Global Agri-Food Export Competitiveness

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The article investigates agri-food export competitiveness of 23 countries on global markets using revealed comparative advantage (B) index in the 2000-2011 periods. Results indicate that main global agri-food exporting countries have revealed comparative advantages. The panel unit root tests suggest convergence in the dynamics of the B indices. Mobility indices indicate relatively low mobility in the B indices at the product level. The Kaplan-Meier survival rates of the B indices on long-term are among the highest for the Netherlands, France, Belgium, the United States, Argentina and New Zealand. The level of economic development, the share of agricultural employment, subsidies to agriculture, and differentiated consumer agri-food products increases the likelihood of failure in comparative advantage, while agricultural land abundance and export diversification reduces.

Keywords: global agri-food export – revealed comparative advantage – panel unit root tests – intra-distribution dynamics – duration analysis – discrete time models

JEL codes: F01, F14, C23, C41, Q17

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1. Introduction

With trade liberalization on global agri-food markets, the crucial factor for long-term business survival is export competitiveness and its long-term duration, which determines opportunities in the business prosperity of agri-food products on global markets. On the global agri-food markets, different countries play the role of global leaders in agri-food export competitiveness. So far, there has been limited attention to the agri-food export competitiveness and long-term export specialisation patterns of global agri-food leaders. On global agri-food markets, can be observed three main stylized empirical facts, which are important for research and practice on global businesses (European Commission, 2012, 2013; WTO, 2013; FAO, 2014). First, during the last two decades of agri-food trade liberalization, global agri-food export has increased rapidly, particularly due to fast growth in processed and final consumer agri-food products. Global agri-food exports tend to increase in response to food demand increases. Some variations with a contraction in global agri-food export have been caused by the impact of the economic crisis in 2009, exchange rate and global price fluctuations by countries and by agri-food products. Second, the increase in global agri-food export has been both from developed and developing countries. Among the global leading agri-food exporters are France, Germany, the Netherlands, and Belgium in the European Union (EU), the United States (US) and Brazil. Developed countries are substantial exporter of final products, which have become the most important in the structure of global agri-food trade. Third, the EU is the global biggest importer of agricultural products from developing countries, followed by China's fast growth in imports, and Japan as the third largest importer. The US, Russia, and China (including Hong Kong) are the top EU's biggest agri-food markets (FAO, 2014).

The aim of the paper is to examine the pattern, stability and determinants of global agri-food export competitiveness of major agri-food exporter and importer countries at the global markets. Considering the global stylized empirical facts, the objective of this paper is to provide empirical evidence and derives explanation on the following four research questions. First, the most recent structures and dynamics of agri-food exports and the magnitude and dynamics of revealed comparative advantage (B) index by major global competitors. Second, the analysis of stability of the B indices using panel unit root tests of the null hypothesis on the existence of the panel unit root (divergence) or the alternative hypothesis of the stationarity of panel datasets (convergence to their equilibrium state) using a variety of panel unit root tests. Third, long-term export specialization patterns, duration analysis and intra-distribution dynamics of B indices using Markov transition probability matrices and nonparametric Kaplan-Meier product limit estimator. Fourth, main driving forces of global agri-food export competiveness using discrete time models. The econometric models test the set hypotheses and explain the determinants of the B index considering structural nature and dynamic aspects of an economy, factor endowments in agriculture and policy support to agriculture.

2. Background

Agri-food export-oriented growth is largely based on processed agri-food products from developed countries and less from non-traditional agricultural exports from developing countries (Patel-Campillo, 2010). Our sample contains 23 countries including the four major agri-food exporting countries in the EU (France, Germany, the Netherlands, and Belgium) (e.g. Bojnec and Fertő, 2015), BRICS-5 countries (Brazil, Russia, India, China and South Africa) as an association of five major emerging fast-growing economies, the North American Free Trade Agreement (NAFTA-3) countries (Canada, Mexico, and the US), the MIST-4 countries (Mexico, Indonesia, South Korea, and Turkey), Tiger Cup-4 countries (Indonesia, Malaysia, the Philippines, and Thailand) as the four newly industrialized countries, and selected global major agri-food trading countries such as Argentina, Australia and New Zealand in global agri-food exports and Japan and Switzerland in global agri-food imports (European Commission, 2013).

The BRICS-5 represents the world largest size of territory and population. They represent one of largest world economies in terms of agri-food production and consumption. The NAFTA-3 is one of the world largest trade blocs according to the economic size or by the size of gross domestic product (GDP). The Tiger Cub-4 countries follow the export-driven model of rapid growth and economic development with a bamboo network of overseas Chinese businesses operating that share common family and cultural ties. When focusing on major global trading groups of countries, there are some overlaps and double counting issues as some countries are members of more than a single trading group of countries such as Mexico in NAFTA-3 and MIST-4, and Indonesia in MIST-4 and Tiger Cup-4. This is the reason that the focus of the analysis and the presentation of the results is on the levels and trends in the B indices as a measure of export specialization by the individual countries and less by main trading groups.

The stylized empirical facts indicate that the EU experienced the largest agricultural trade surplus being the second largest agricultural exporter immediately behind the US in the ranking of global top agricultural exporters (European Commission, 2013). Exports markets particularly in developing economies such as in China and Saudi Arabia are crucial for the growth in demand for EU agri-food exports.

3. Methodology

The country's *i* agri-food export share in total global agri-food exports is calculated as:

$$Xi\% = (Xi \,/ \sum_{i=1}^{n} \mathrm{Xi}\,)\ 100$$

where $X_i\%$ is in the share (in per cent) of the value of agri-food export X_i of the county's *i* in total global value of agri-food exports $\sum_{i=1}^{n}$ Xi, where *n* is the number of countries in the world.

The country's *i* agri-food import share in total global agri-food imports is calculated as:

$$Mi\% = (Mi \,/ \sum_{i=1}^{n} \mathrm{Mi}\,)\ 100$$

where $M_i\%$ is in the share (in per cent) of the value of agri-food import M_i of the county's *i* in total global value of agri-food imports $\sum_{i=1}^{n}$ Mi, where *n* is the number of countries in the world.

The paper employees the concept of 'revealed' comparative advantage introduced by Liesner (1958) and later redefined and popularized by Balassa (1965). Therefore, it is known as the 'Balassa index' to empirically identify a country's weak and strong export sectors. The Revealed Comparative Advantage (B) index is defined (Balassa, 1965) as follows:

B = (Xij / Xit) / (Xnj / Xnt) ,

where X represents exports, i is a country, j is a commodity, t is a set of commodities, and n is a set of countries, which are used as the benchmark export markets for comparisons. B is based on observed export patterns. In this paper, the B index is calculated at the 6-digit level of the World Customs Organization's Harmonized System (HS-6). It measures a country's exports of a commodity relative to its total exports and to the corresponding export performance of a set of countries, e.g., the global agri-food exports. If $B > 1$, then a country's agri-food comparative export advantage on the global market is revealed. In a spite of some critics of the B index as export specialisation index, such as the asymmetric value problem and problem with logarithmic transformation (De Benedictis and Tamberi, 2004) and the importance of simultaneous consideration of the import side (Vollrath, 1991), it can provide useful evidence on the country's agri-food export competitiveness on global markets.

In addition, we focus on the stability of the B indices over time. The first type of stability of the distribution of the B indices is capturing convergence/divergence in revealed comparative export advantage. Time series investigation of the convergence hypothesis in economic literature often relies on unit root tests. The rejection of the null hypothesis is commonly interpreted as evidence that the time series have converged to their equilibrium state, since any shock that causes deviations from equilibrium eventually drops out. To check convergences or divergence in the B indices, three panel unit root tests with and without trend specifications, respectively, as a deterministic component are used: Im *et al.* (2003) method (assuming individual unit root processes), ADF–Fisher Chi–square, and PP–Fisher Chi–square (Maddala and Wu, 1999; Choi, 2001). In addition, the lag length of explanatory variables has been chosen according to the Modified Akaike Information Criterion (MAIC) proposed by Ng and Perron (2001).

The second type of stability of the value of the B indices for particular agri-food product groups is investigated in two steps. First, we employ Markov transition probability matrices to identify the persistence and mobility of B indices. We classify agri-food products into two categories: agri-food products with revealed comparative export disadvantage ($B<1$) and agri-food products with revealed comparative export advantage ($B>1$). Second, the degree of mobility in patterns of revealed comparative export advantage can be summarised using an index of mobility. This formally evaluates the degree of mobility throughout the entire distribution of B indices and facilitates direct cross-country comparisons. The mobility index M_1, following Shorrocks (1978) evaluates the trace (tr) of the Markov transition probability matrix. This M_1 index thus directly captures the relative magnitude of diagonal and off-diagonal terms, and can be shown to equal the inverse of the harmonic mean of the expected duration of remaining in a given cell:

$$M_1 = \frac{K - tr(P)}{K - 1},$$

where K is the number of groups, and P is the Markov transition probability matrix. A higher value of M_1 index indicates greater mobility (the upper limit is two in our case), with a value of zero indicating perfect immobility.

Duration analysis of revealed comparative export advantage (B>1) is estimated by the survival function, S(t), using the nonparametric Kaplan-Meier product limit estimator (Cleves *et al.*, 2004). We assume that a sample contains n independent observations denoted (t_i; c_i), where i = 1, 2,…, n, t_i is the survival time, and c_i is the censoring indicator variable C taking a value of 1 if failure occurred, and 0 otherwise of observation i. It is assumed that there are m < n recorded times of failure. The rank-ordered survival times are denoted as $t_{(1)} < t_{(2)} < \ldots < t_{(m)}$, while n_j denotes the number of subjects at risk of failing at $t_{(j)}$, and d_j denotes the number of observed failures. The Kaplan-Meier estimator of the survival function is then:

$$\hat{S}(t) = \prod_{t(i)<t} \frac{n_j - d_j}{n_j},$$

with the convention that $\hat{S}(t) = 1$ if $t < t_{(1)}$. Given that many observations are censored, it is then noted that the Kaplan-Meier estimator is robust to censoring and uses information from both censored and non-censored observations.

Beyond to descriptive analysis of duration of revealed comparative advantage we are interesting for the factors explaining the survival. Recent literature on the determinants of trade and comparative advantage duration uses Cox proportional hazards models (e.g. Besedeš and Prusa, 2006b; Nitsch, 2009; Brenton et al., 2010; Obashi, 2010; Bojnec and Fertő, 2012b; Cadot et al., 2013). However, recent papers point out three relevant problems inherent in the Cox model that reduce the efficiency of estimators (Brenton et al., 2010; Hess and Persson, 2011, 2012). First, continuous-time models (such as the Cox model) may result in biased coefficients when the database refers to discrete-time intervals (years in our case) and especially in samples with a high number of ties (numerous short spell lengths). Second, Cox models do not control for unobserved heterogeneity (or frailty). Thus, results might not only be biased, but also spurious. The third issue based on the proportional hazards assumption that implies similar effects at different moments of the duration spell. Following Hess and Persson (2011) we estimate different discrete-time models including probit and logit specifications, where product-exporter country random effects are incorporated to control for unobservable heterogeneity.

The challenging issues for firms and countries are to strengthen determinants of the duration of comparative advantages as well as transform disadvantages into advantages in international trade (e.g. Contractor et al., 2007; Cuervo-Cazurra and Genc, 2008). Following the previous research on trade and comparative advantage duration we test the following hypotheses.

Exports can be positively sensitive to level of economic development, which is proxied by per capita gross domestic product (GDP) of exporting countries. Therefore, the duration of comparative advantage is positively associated to the level of economic development. A positive relation between product differentiation and per-capita GDP sensitivity is consistent with hypothesis on preferences of consumers for quality and demand for varieties with higher level of economic development (e.g. Philippidis and Hubbard, 2003; Hallak, 2006; Choi et al. 2009).

H1: Duration of comparative advantage is positively associated with the level of economic development.

The size of the economy can be measured by the size of GDP and/or by the size of population (e.g. Helpman, 1998). The size of the economy is traditional gravity trade model variable with expected positive association between bilateral exports and the size of economy (e.g. Anderson and van Vincoop, 2003). We expect that larger countries tend to have comparative advantage for longer period than smaller ones. The population differential increases between the regions increases exports.

H2: Larger countries tend to have comparative advantage of longer duration than smaller ones.

A large part of agricultural production depends on natural agricultural factor endowments. Among them a crucial role can play availability and quality of land soil potentials and natural climatic conditions. Better endowment in agricultural resources can through more competitive agricultural production also increase competitiveness of food processing industry and thus of agri-food comparative advantages.

H3: Better endowment in agricultural resources increase the probability of survival of comparative advantage.

When modelling export duration for final products within a sector, the assumption of product homogeneity is often quite unrealistic due to different varieties of the product and its considerable heterogeneity (e.g. Helpman and Krugman, 1985). Countries with a generally diversified export structure will have a more chance to have comparative advantage in a given product for long periods of time (Nitsch, 2009; Hess and Persson, 2011). For agri-food products, we assume that more product heterogeneity exists in value chain according to the degree of product processing. Heterogeneity between vertical stages in value chain is related to the processing of primary agricultural products either for further processing or for final human consumption. In addition, the duration of comparative advantage is expected to be of longer duration for differentiated agri-food products than homogeneous ones (Rauch and Watson, 2003; Besedeš and Prusa, 2006).

H4: Export diversification has positive impact on duration of comparative advantage in a given agri-food product and the duration of comparative advantage is longer for differentiated agri-food products than homogeneous ones.

The literature on political economy of agricultural policy and government transfers emphasise the negative relationships between agricultural subsidies and comparative advantage (e.g. Anderson et al., 2013).

H5: Agricultural support has negative impact on survival of comparative advantage.

4. Data

The United Nations (UN) International Trade Statistics UN Comtrade database (UNSD, 2013) at the six-digit harmonized commodity description and coding systems (HS6-1996) level is used for agri-food exports by the leading agri-food exporting and trading groups of countries on global agri-food markets. Agri-food trade defined by the World Trade Organization contains 789 HS-6 level product groups. The UN Comtrade database with the World Integrated Trade Solution (WITS) software developed by the World Bank, in close collaboration and consultation with various international organizations including United Nations Conference on Trade and Development (UNCTAD), International Trade Center (ITC), United Nations Statistical Division (UNSD) and WTO is used. The value of trade is expressed in US dollars.

The proxy for economic development is the log of GDP per capita at purchasing power parity (PPP) at constant 2005 international US dollars based on the World Bank (2013b). The logarithm of the populations of exporter country is used as a proxy for the market size. Population data are also from the World Bank (2013b).

We use two proxies for agricultural factor endowments: first, the share of agricultural land in total land, and second, the share of active agricultural employment in total active employment. Land data is based on the World Bank (2013b), while agricultural employment data taken from the FAO (2014) database.

The agri-food export diversification is measured by natural logarithm of the number of agri-food exported products per year. We define a dummy for the differentiated agri-food products as consumption or final agri-food products based on the UN classification by Broad Economic Categories (BEC). For agri-food items final goods are described by two BEC categories: BEC 112 – primary agricultural products mainly for household consumption and BEC 122 – processed agri-food products mainly for household consumption. The primary source of data for export diversification (the number of exported agri-food products) and consumer (differentiated) agri-food products is UNSD (2013).

We use the Nominal Rate of Assistance (NRA) to measure the agricultural supports based on the World Bank (2013a). Positive values of the NRA indicate protection to agricultural sectors, whilst negative values mean its taxation.

Dependent and all explanatory variables in the panel are capturing each of the EU-27 member states in the twelve year analyzed (2000-2011).

5. Empirical results

5.1. Countries Shares in Global Agri-Food Exports and Imports

According to the agri-food export and import shares in the global markets, the analyzed countries have been net exporters, because their overall share in global agri-food exports was higher than their overall import share in global agri-food imports (Figure 1). The import share has declined from more to less than 60 per cent during the analysed period, while export share has remained close to 70 per cent. The share of gross trade is ranging around 65 per cent.

Figure 2 compares the global market agri-food export and import shares of individual analyzed countries in the years 2000 and 2011. In 2011, the major agri-food exporters are the United States (US), the Netherlands, Germany, Brazil and France. Comparisons between 2000 and 2011 show a rapid increase in agri-food export share for Brazil, and deterioration for France and Belgium. In 2011, the major agri-food importers are the United States, Germany, China, Japan, the Netherlands and France. Comparisons between 2000 and 2011 show a rapid increase in agri-food import share for China. This is consistent with the previous findings in the literature (e.g. Bojnec et al., 2014).

5.2. Changes in Revealed Comparative Advantage (B) Indices

According to the distribution of the mean and median values of the B indices and for the percentage of agri-food products with the B>1, the agri-food B indices suggest that export competitive countries on the global markets are: Argentina, Australia, Belgium, France, the Netherlands, New Zealand, and the US (Figure 3). They experienced: the B mean values greater than 1 (B>1), the higher B median values, and the increasing or stable percentage of agri-food products with the B>1, which is greater than 30%. With lower share of the B>1 are close to this group also Turkey and Canada. The Netherlands has further improved export competitiveness, while it has deteriorated a slightly for Australia and Turkey.

The second group according to the B indices are mostly the BRICS and MIST countries with the revealed comparative advantage or the B mean value greater than 1 (B>1), but with rather diversified median values and the lower percentage of agri-food products with the B>1: Brazil, India, South Africa, Indonesia, Malaysia, Philippines, Thailand, and to a lesser extent China, which experienced deterioration of revealed comparative advantage from advantage B>1 in 2000 to disadvantage B<1 in 2011. Some deterioration in export competitiveness is also for India, while improvements for Philippines.

The third group with revealed comparative disadvantage (B<1) consists of the four countries with the lowest B mean value less than one (B<1), the lowest B median value, and the share with the B>1 less than 10%; these are: Russia, Japan, South Korea, and Switzerland.

Finally, the fourth group consists of Germany and Mexico with revealed comparative disadvantage (B<1), with lower (Mexico) to medium (Germany) value of the B median value, and the share with the B>1 close or more than 19%. Germany has slightly improved export competitiveness.

Except for Russia and China with annual variation, the BRICS countries have experienced the B>1 for agri-food exports on the global markets. Among the NAFTA countries, only the USA is clearly performed with revealed comparative advantage (B>1) for agri-food products. The MIST countries in general experienced revealed comparative advantage (B>1). Among the Tiger Cup countries, Philippines have the highest values for the B>1 indices.

Except for the Netherlands, France, Belgium, the US and to a lesser extent for Argentina, the median values are lower suggesting the greater number of agri-food products with revealed comparative disadvantages (B<1) vis-à-vis revealed comparative advantages (B>1) on the global markets. This implies that the global agri-food exports by competitiveness are clearly dispersed among different countries' players by different agri-food products, which can be explained by different sources of revealed comparative advantages and export specialisation patterns from natural factor endowments and climatic conditions to development of agri-food processing industries and international agri-food marketing as well as some other countries specific factors.

5.3. Dynamics of the B Indices

To investigate convergence vis-à-vis divergence in the dynamics of the B indices, panel unit root tests with time-trend and without time-trend specifications, respectively, as a deterministic component are used (Table 1). The empirical results of the three different panel unit root tests without time-trend clearly reject the existence of the panel unit root hypothesis for all countries. This implies that the B indices are stationary confirming the hypothesis of convergence in the dynamics of the B indices.

5.4. Mobility of the Revealed Comparative Advantage

The degree of mobility in patterns throughout the entire distribution of the B indices is estimated using the mobility index, M_1, based on the Markov transition probability matrices using a one year lag. The empirical results in Figure 4 indicate relatively low mobility in the B indices at the HS-6 product level by the analysed countries. Except for India, Russia, and South Africa, the M1 indices on average for agri-food products by the analysed countries are less than 0.2 indicating rather high stability with relatively low mobility in patterns of the B indices for agri-food products. Except for Malaysia and to a lesser extent for Mexico, the degree of mobility in the B indices is a slightly higher for non-consumer agri-food products than for consumer agri-food products. This finding indicates a relatively low degree of mobility and thus relatively high stability in patterns throughout the entire distribution of the B indices at the HS-6 agri-food product level by the analyzed countries.

5.5. Duration of the Revealed Comparative Advantage (B>1) Indices

The duration of the B>1 indices is investigated in two steps: first, the duration of B>1 in the years during the analyzed period, and second, the description of the periods of time as a continuous process (or 'spells') of B>1. The former indicates for how many years B>1 at the HS-6 agri-food product levels, ranging from 1 to 12 years during the 12-years analyzed period. The latter indicates whether the B>1 is a continuous process during the analysed period as a whole with a single spell or with multiple spells up to six with switches year-to-year ins and outs from B>1 to B<1 during the 12-years analyzed period.

Figure 5 presents the results of the duration analysis of the B>1 indices for the HS-6 number of agri-food products. The highest average number of years with the B>1 duration are for France, New Zealand, Japan, the US, Australia and Argentina. The number of the HS-6 agri-food products with B>1 over the 12-years duration is the largest for the Netherlands, whilst the mean and median values of the B>1 duration are the highest for France. In general, the average number of years with the B>1 duration is greater for the consumer HS-6 agri-food products than for the non-consumer HS-6 agri-food products, which is consistent with the set H 4.

A single agri-food product can change its B>1 position to B<1 year-to-year, e.g. six times within the 12-years analyzed period. Six is the maximum possible number of spells when an agri-food product has changed its B>1 status year-to-year. The analyzed number of spells for the HS-6 agri-food products B>1 indices by the analysed spell length years show the number of relationships that are characterized by the single and multiple spells for the HS-6 agri-food products B>1 indices by the analysed countries on the global markets. Around three-quarters of the spells are concentrated in the single spell (Figure 6). This finding indicates that most of the HS-6 agri-food products export competitiveness failed after the first or shorter number of years. The distribution of the number of spells for the HS-6 agri-food products with B>1 indices that survived continuously at least a single year up to twelve years vary from one single spell up to five multiple spells. Japan has the greatest percentage of agri-food products with B>1 as the single spell and India has the lowest percentage.

5.6. Survival of the Revealed Comparative Advantage (B>1) Indices

The duration of the mean values of the B>1 indices for agri-food exports by the analysed countries on the global market is tested by examining nonparametric Kaplan-Meier estimates of a survival function over the 12-year analyzed periods. The mean values for countries with higher B>1 indices for the HS-6 agri-food products exports are expected to be of longer duration. The Kaplan-Meier survival rates for the mean values of the B>1 indices by each of the analysed country have declined over time (Figure 7).

The duration of the mean values of the B>1 indices over the 12-year periods differs between the analyzed countries and can be divided in three groups. First, the highest survival rates are found for the Netherlands, France, Belgium, Argentina, the US, and New Zealand. The higher survival rates over time imply their relatively higher ability to maintain the B>1 indices with revealed comparative advantages on long-term.

Second, the modest Kaplan-Meier survival rates around 5% over the 12-year period are found for the following countries: Germany, Turkey, Canada, and Australia. In addition, in this group of countries to a lesser extent can be included the following analyzed countries with the Kaplan-Meier survival rates more than 3% over the 12-year period: India, Brazil, South Africa, Indonesia, Philippines, and Thailand.

Third, the Kaplan-Meier survival rates are relatively low (less than 3% after 12 years analysed period) for the following countries: China, Russia, Mexico, Japan, South Korea, Switzerland, and Malaysia. The results for this group of the analysed countries imply that the duration of their agri-food exports on the global markets is shorter and their probability of survival is lower. These countries can have some specific agri-food products, which can have higher B>1 indices with longer duration and higher survival rate such as for some niche agri-food products. However, they are less likely to maintain competitive their agri-food exports for a larger number of agri-food products on the global markets on long-term.

The results of the duration of the mean values of the B>indices over the 12-year periods are mixed between consumer and non-consumer agri-food products. First, no substantial differences in the Kaplan-Meier survival rates can be seen for Japan, South Korea, Switzerland, China, South Africa, and Thailand. Most of these countries belong to a group of countries with relatively low survival rates. Second, the Kaplan-Meier survival rates are higher for consumer agri-food products than non-consumer agri-food products: the Netherlands, France, Bulgaria, New Zealand, Turkey, and Mexico. This finding is consistent with the set H4. Third, the Kaplan-Meier survival rates are higher for non-consumer agri-food products than consumer agri-food products: Argentina, the US, Germany, Canada, Australia, India, Brazil, Indonesia, Philippines, Malaysia, and Russia. These mixed findings suggest specificities of determinants explaining the duration of export competitiveness in different global agri-food net exporting/importing countries.

5.7. Explanation of the Duration of Revealed Comparative Advantage (B>1) Indices

We estimate the baseline specification using discrete-time probit and logit models, which are then additionally specified with consumer agri-food products dummy variable (Table 2). All models include random effects for every exporter-product combination.

In general, the sign of coefficients are similar for the various estimation procedures. We find the larger log-likelihood value for the logit models comparing to probit models. The values of rho mean that random effect explains around 95 per cent of unobserved heterogeneity in all specifications. The likelihood-ratio tests strongly reject the null hypothesis of no latent heterogeneity for all model specifications, confirming that unobserved heterogeneity plays a significant role in all model specifications.

The GDP per capita has a positive and significant coefficients, suggesting that comparative advantage involving economically developed economy increases the likelihood of failure in the B>1 indices. The market size in terms of the size population has no significant impacts on the likelihood of failure in the B>1 indices. The two factor endowment variables have opposite effects on the likelihood of failure in the B>1 indices. The B>1 indices in land abundant countries have more chance to survive as this decreases the probability of failure in the B>1 indices, whilst more agricultural employment increases the likelihood of failure in the B>1 indices. The significant negative regression coefficients on the number of agri-food exported products indicate that exporting many products decreases the likelihood of failure in the B>1 indices. We find that agricultural supports increases the probability of failure in the B>1 indices. Contrary to the theoretical predictions by Rauch and Watson (2003), we find that the B>1 indices in differentiated consumer agri-food products will have a larger likelihood of failure.

To sum up the findings regarding the set hypotheses on the likelihood of failure in the B>1 indices, we reject the H1, because the higher level of economic development is not confirmed to reduces the probability of failure in the B>1 indices. The results for the set H2 are not found statistically significant. The results for the set H3 are mixed: we cannot reject the association with the land abundant variable, while the association with agricultural population is rejected. The results for the set H4 are also mixed: we cannot reject the association with the export diversification, while the association with the differentiated consumer agri-food products is rejected. Finally, we cannot reject the set H5 as agricultural support increases the likelihood of failure in the B>1 indices.

6. Conclusions

The article investigates agri-food export competitiveness on global markets for 23 major countries accounting more than 60 percent of global agri-food trade. Most of the analyzed countries have been competitive in agri-food exports with revealed comparative advantage (B>1) on global markets. Export specialisation by countries is on a smaller number of the HS-6 agri-food products with revealed comparative advantage (B>1).

The convergences in the dynamics of the B indices further reinforced findings on similar global competitive pressures on long-term specialisation patterns and survival rates of competitive agri-food products. The switches in revealed comparative advantages between agri-food products over time are found relatively low, which implies that the focus in agri-food export specialisation patterns is on existing established or niche agri-food products, which are able to survive global competition on long-term.

The number of the HS-6 agri-food products with revealed comparative advantages (B>1) and their survival rates make the major differences between the global players in agri-food export competitiveness. Higher B>1 indices, larger number of the HS-6 agri-food products with B>1 with the longer duration and higher survival rates are found for the Netherlands, France, Belgium and some overseas countries from different parts of the world, particularly Argentina, the US, and New Zealand.

The regression results of probit and logit models are mixed. As expected, agricultural land abundance and export diversification reduces the likelihood of failure in the B>1 indices, while agricultural subsidies increases. Unlike to our expectation, the level of economic development, the share of agricultural employment, and differentiated consumer agri-food products increases and not reduces the likelihood of failure in the B>1 indices. Yet, the regression coefficient for the population size is not found statistically significant. These results suggest substantial heterogeneity between agri-food competitors on global markets. Finally, the empirical findings suggest that there are also numerous other non-analyzed countries, particularly developing ones, which can have greater difficulties in agri-food export competitiveness, particularly for non-primary raw agricultural and low processed food products. These are issues for future research in order to widen and deepen our knowledge and better understanding of global agri-food export competitiveness by different products and countries on global agri-food markets.

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Tables and Figures

Table 1. Panel Unit Root Tests for the B Indices, 2000-2011 (p-values)

	without trend			with trend		
	IPS	ADF	PP	IPS	ADF	PP
Argentina	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Australia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Belgium	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Brazil	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Canada	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
China	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
France	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Germany	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
India	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Indonesia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Japan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Malaysia	0.0000	0.0000	0.0000	0.0476	0.0000	0.0000
Mexico	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Netherlands	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
New Zealand	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
Philippines	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000
Russia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
South Africa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
South Korea	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Switzerland	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Thailand	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Turkey	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
United States	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

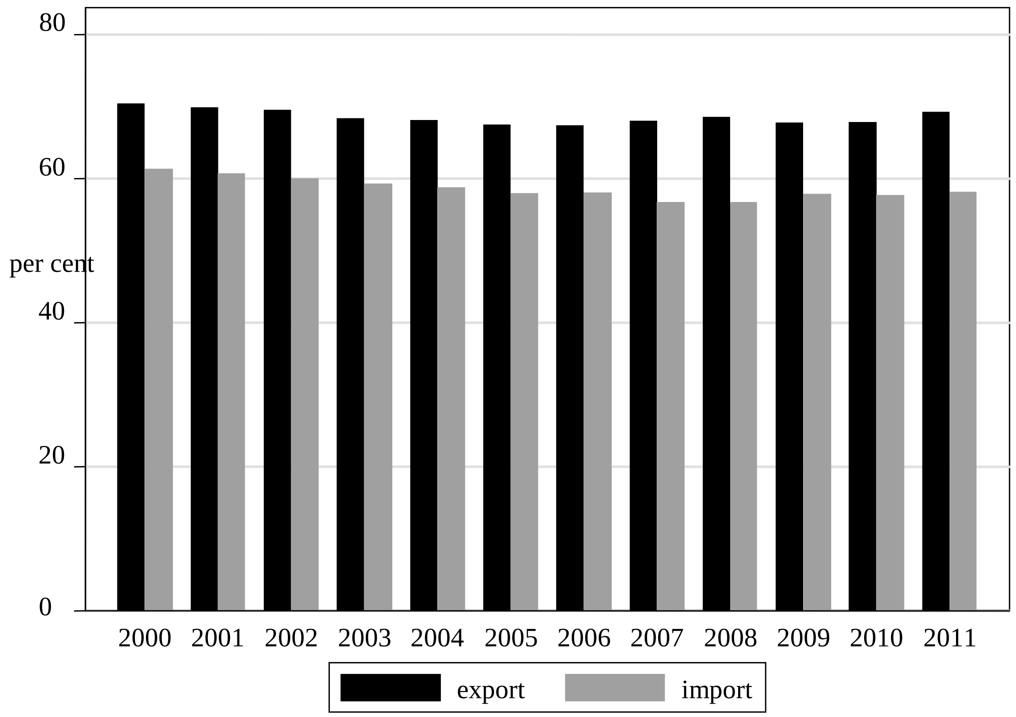
Note: IPS (Im, Pesaran and Shin W-stat), ADF (ADF - Fisher Chi-square), PP (PP - Fisher Chi-square).
Source: Own calculations based on Comtrade database (UNSD 2013) with WITS (World Trade Integration Solution) software.

Table 2. Regression Results of Determinants of the Revealed Comparative Advantage (B>1) Indices

Dependent variable: B>1	probit	logit	probit	logit
lnGDP/capita	0.102***	0.160***	0.102***	0.160***
lnPopulation	0.025	0.066	0.022	0.064
lnAgricultural land	-0.880***	-2.028***	-0.855***	-2.027***
lnAgricultural employment	0.387***	0.727***	0.378***	0.726***
ln number of products	-1.556***	-3.362***	-1.529***	-3.360***
NRA	0.443***	0.894***	0.439***	0.898***
Consumer goods			0.216***	0.384***
Constant	14.347***	30.533***	14.250***	30.366***
Wald chi^2	954.799	995.602	853.786	1012.601
N	150158	150158	150158	150158
Log likelihood	-33600.771	-33600.861	-33623.985	-33596.482
rho	0.948	0.947	0.952	0.947
LR test of rho=0	0.000	0.000	0.000	0.000

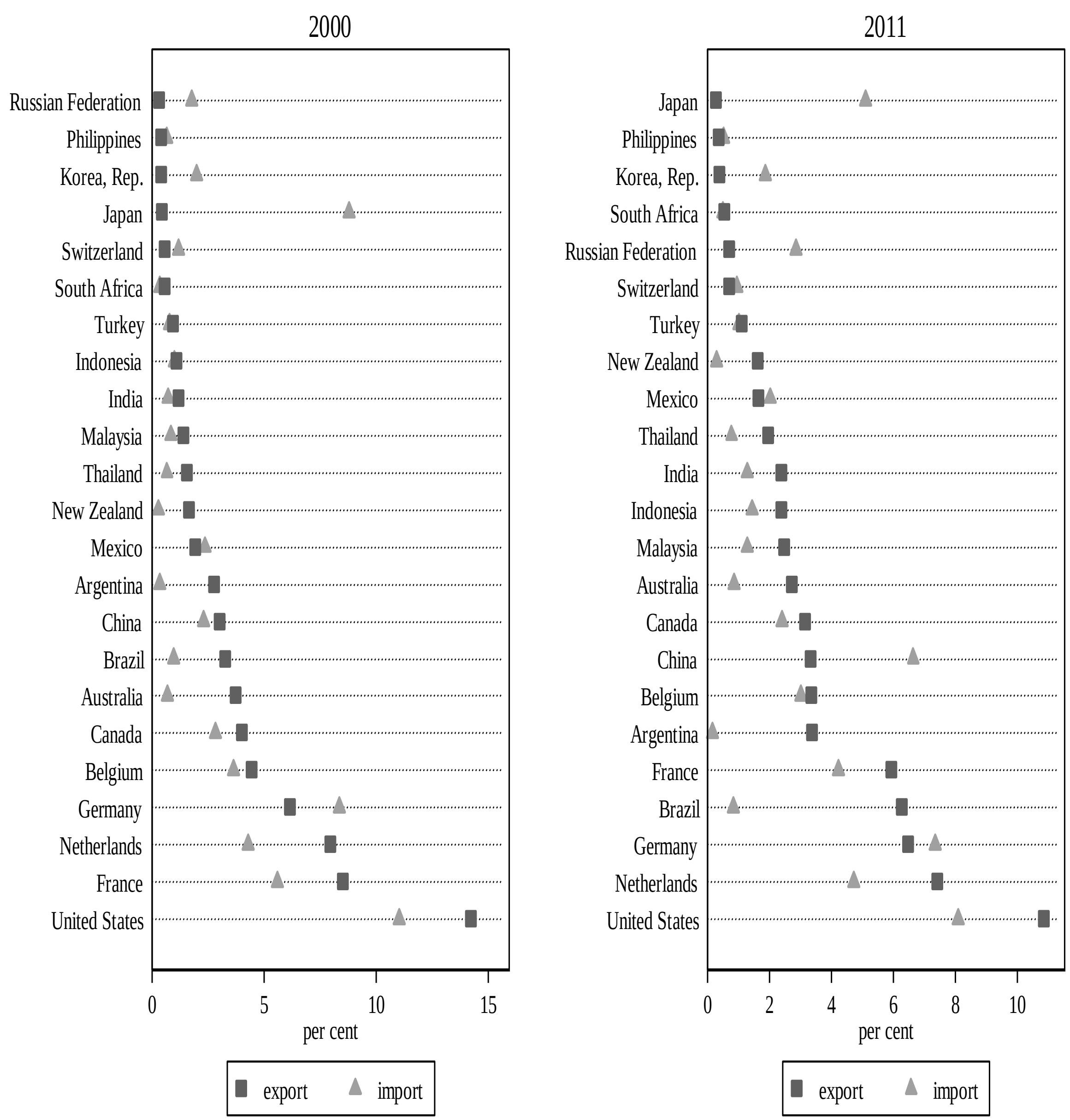
Source: Own calculations. Note: * p<0.1, ** p<0.05, *** p<0.01.

Figure 1. Agri-Food Export and Import Shares for the Sample of Countries in the Global Agri-Food Exports and Imports, respectively, in the 2000-2011 period



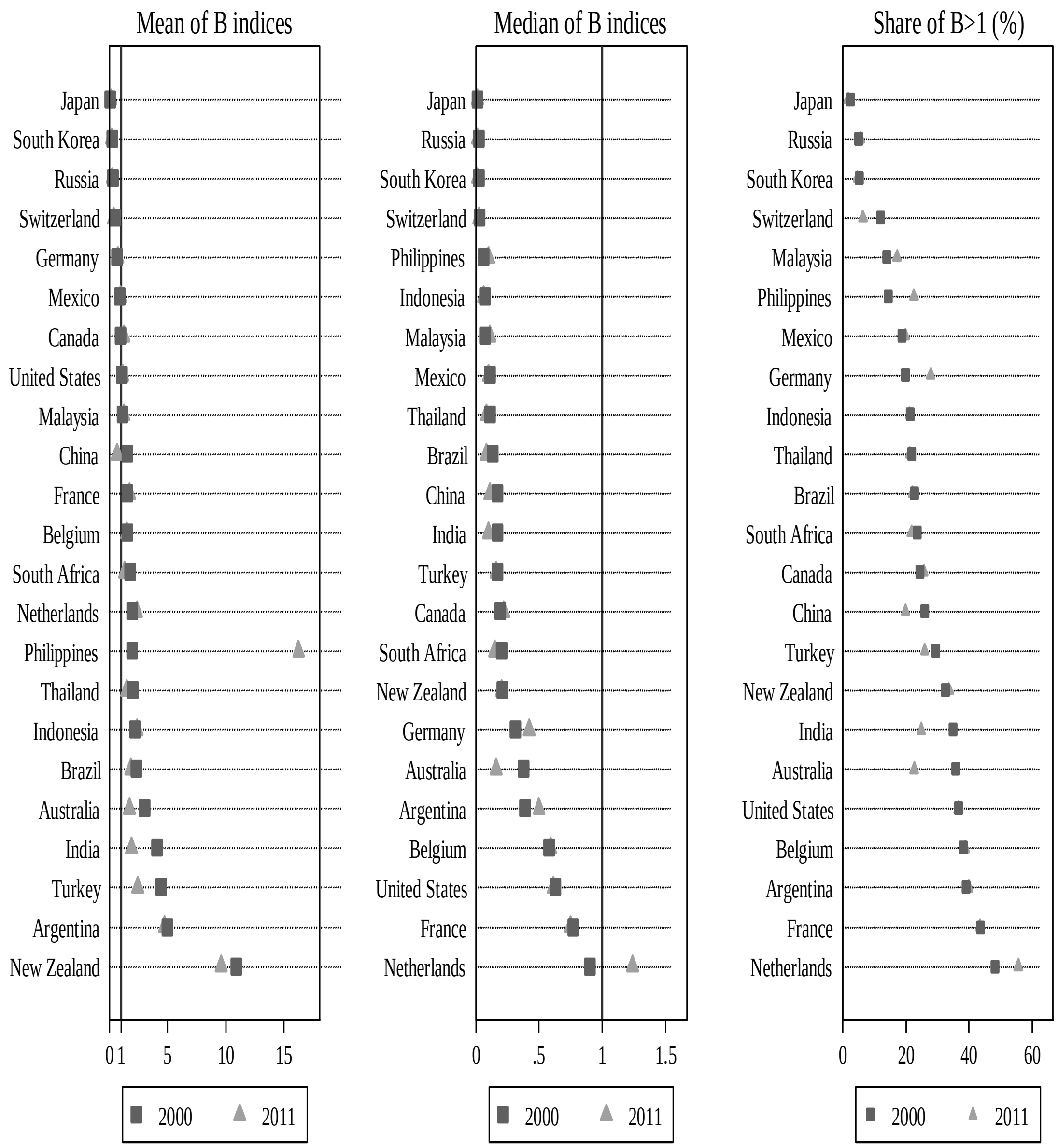
Source: Own calculations based on Comtrade database (UNSD 2013) with WITS (World Trade Integration Solution) software.

Figure 2. Agri-Food Export and Import Shares by Countries in the Global Agri-Food Exports and Imports in the Years 2000 and 2011



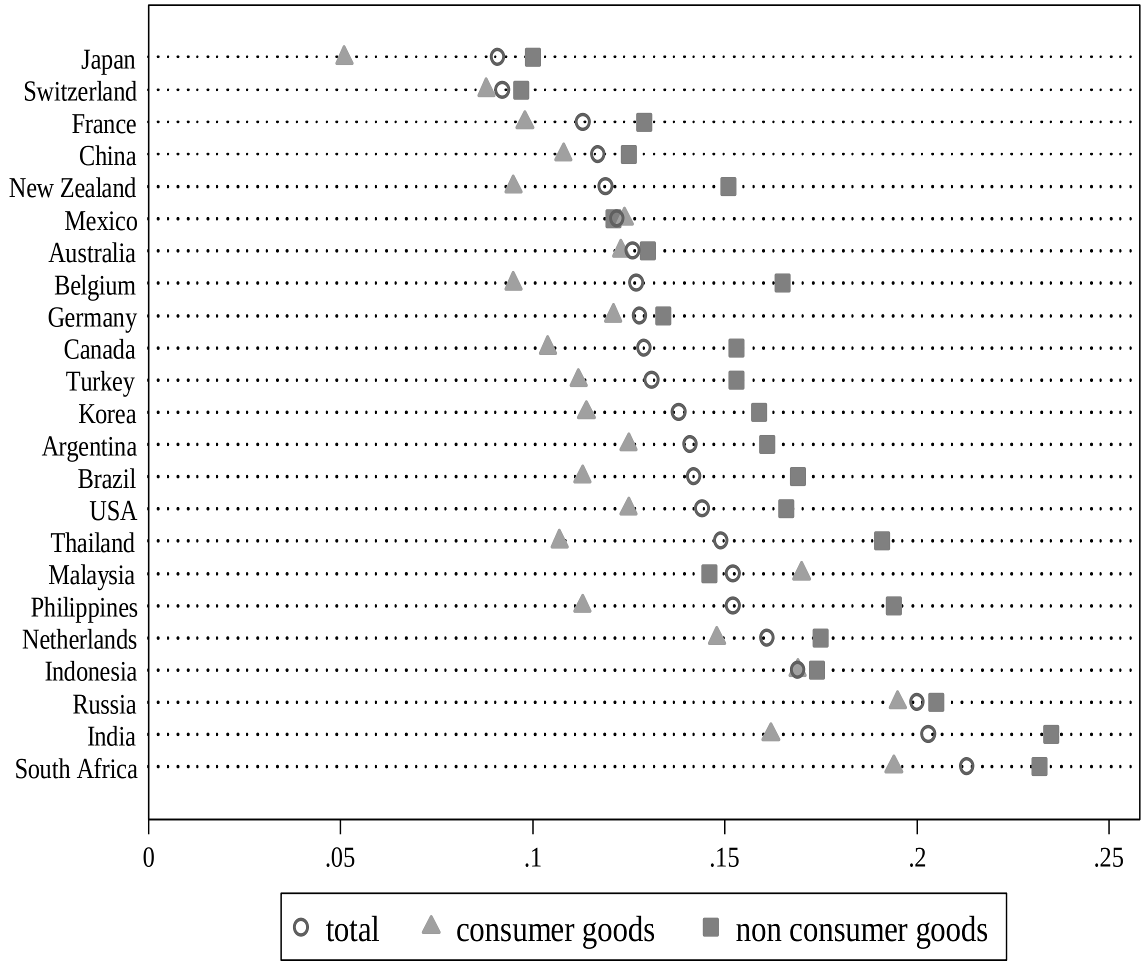
Source: Own calculations based on Comtrade database (UNSD 2013) with WITS (World Trade Integration Solution) software.

Figure 3. Changes in B Indices between 2000 and 2011



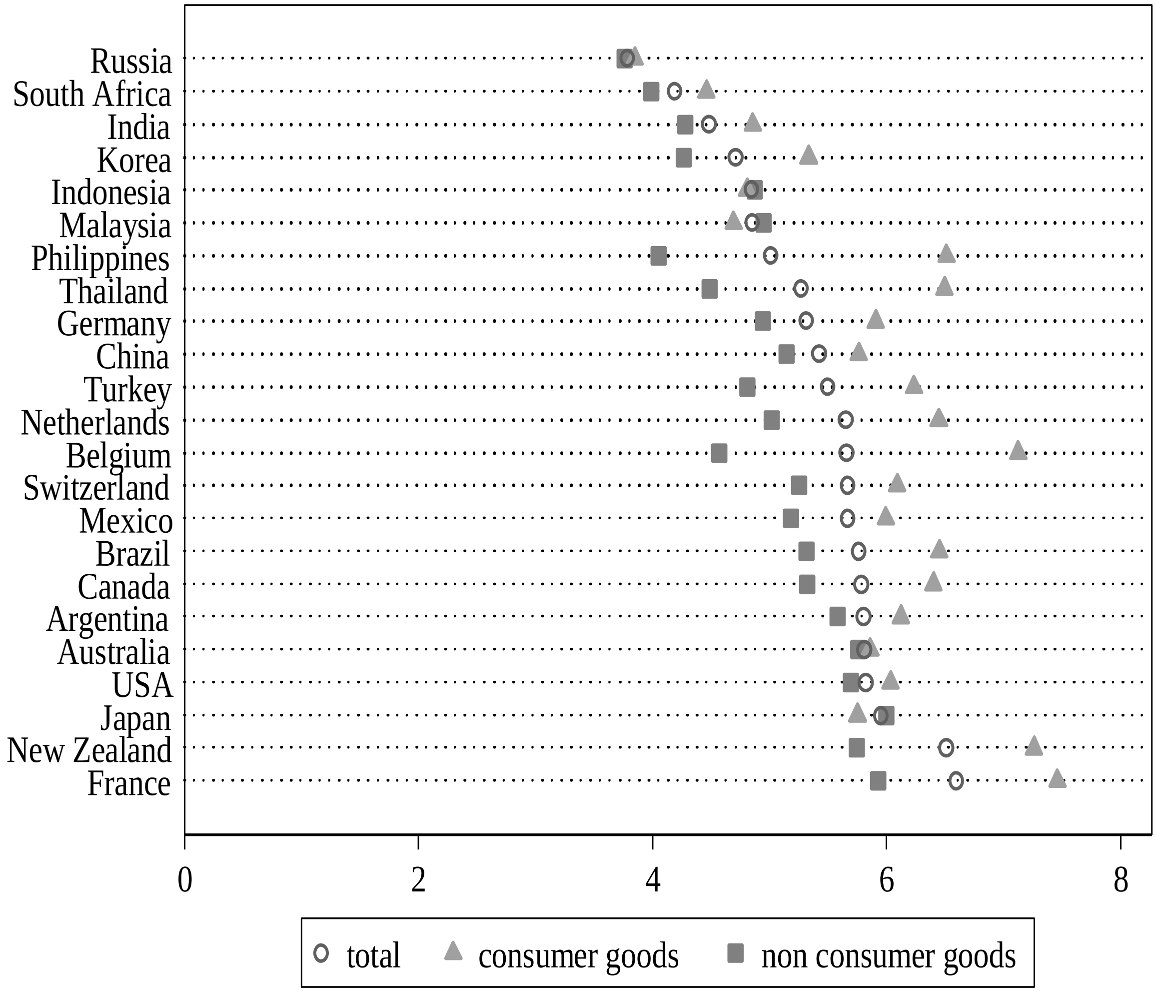
Source: Own calculations based on Comtrade database (UNSD 2013) with WITS (World Trade Integration Solution) software.

Figure 4. Mobility of B Indices, 2000-2011



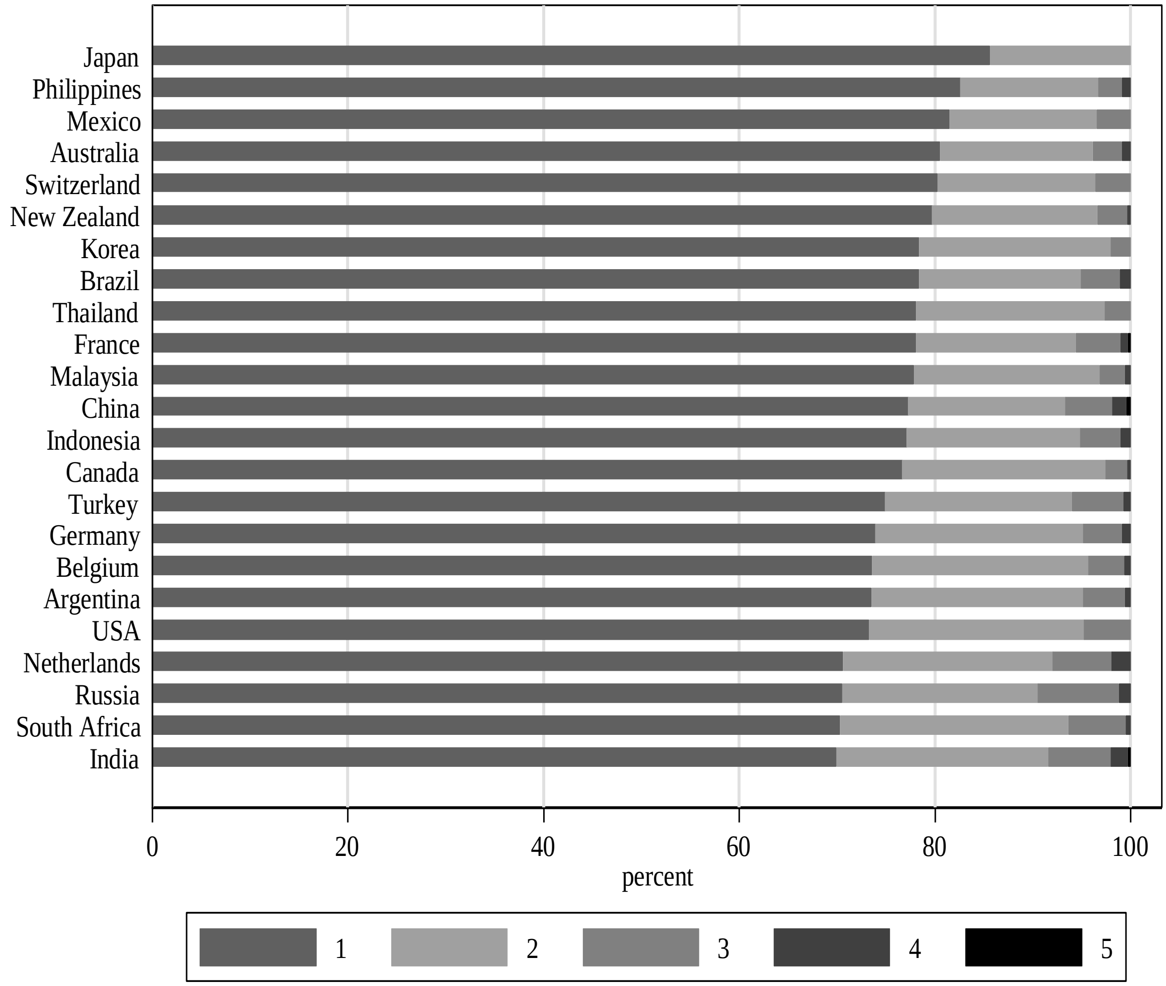
Note: M1 can take values: 0<M1<2.
Source: Own calculations based on Comtrade database (UNSD 2013) with WITS (World Trade Integration Solution) software.

Figure 5. Mean Duration of the B>1 Indices by Countries



Note: The average number of years that survived the HS-6 agri-food products during the twelve years analyzed.
Source: Own calculations based on Comtrade database (UNSD 2013) with WITS (World Trade Integration Solution) software.

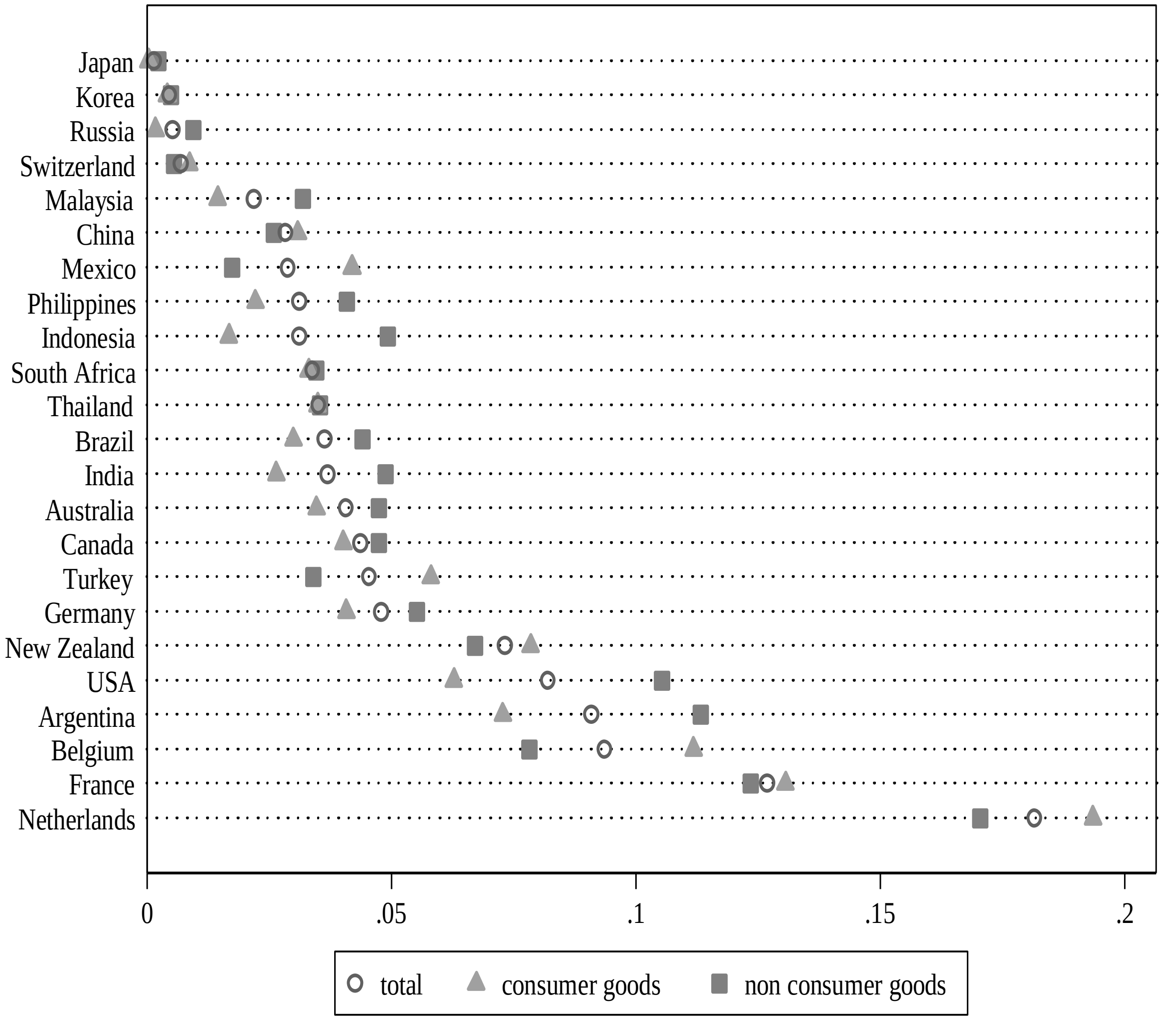
Figure 6. Distribution of spells by country



Note: The percentage of the number of the HS-6 agri-food products that survived a certain number of years 2000-11

Source: Own calculations based on Comtrade database (UNSD 2013) with WITS (World Trade Integration Solution) software.

Figure 7. Kaplan-Meier survival rates for the mean values of the B>1 indices (probability of continues survival of the last 12 year)



Note: The figures indicate a probability of the B>1 indices continuous survival during the twelve years analyzed.
Source: Own calculations based on Comtrade database (UNSD 2013) with WITS (World Trade Integration Solution) software.