Duration of global agri-food export competitiveness

Abstract

Purpose – The article examines the pattern, duration and country-level determinants of global agri-food export competitiveness of 23 major global agri-food trading countries.

Design/methodology/approach – The large panel dataset is compiled to assess the pattern, duration and country-level determinants of global agri-food export competitiveness, using a revealed comparative advantage index.

Findings – Our results suggest that duration of revealed comparative advantage is heterogeneous at the agri-food product level. Survival rates of the revealed comparative advantage indices on the 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 increase the likelihood of failure in the duration of comparative advantage, while agricultural land abundance and export diversification reduce that likelihood.

Originality/value – The framework developed is conceptually innovative for modelling the likelihood of failure in the duration of comparative advantage with implications. Export competitiveness is a crucial factor for long-term global farm business survival, as it fosters opportunities in business prosperity on global markets.

Keywords: Global agri-food market, revealed comparative advantage, duration analysis

Article type: Research paper

1. Introduction

Different theoretical frameworks and empirical approaches of competitiveness have been developed in the literature (Latruffe, 2010; Bojnec and Fertő, 2012a; 2016). Theory suggests that a nation's competitiveness is based on the concept of comparative advantages. Lafay (1992) explains two significant differences between comparative advantage and competitiveness. Firstly, competitiveness usually involves a cross-country comparison for a particular product, whilst comparative advantage is measured between products within a country. Secondly, competitiveness is subject to changes in macroeconomic variables, whereas comparative advantage is structural in nature. Thus empirical analyses that focus on comparative advantage and competitiveness measures may lead to different results and findings (e.g., Krugman, 1994; Hay, 2011; Bojnec and Fertő, 2012a). Furthermore, considering comparative advantage and competitiveness Porter's (1998) concept of competitive advantage using a "diamond" model considers supply and demand aspects of competitiveness, microeconomic and management factors at the level of the economic entities.

One of important implication of trade theories is that comparative advantage evolves usually slowly over time. However, recent studies provide evidence that both trade relationships (e.g., Besedeš and Prusa, 2006; Brenton *et al.*, 2010; Bojnec and Fertő, 2012b; Cadot *et al.*, 2013) and comparative advantages (Bojnec and Fertő, 2015, 2016) are surprisingly short lived. While factors of trade duration are relatively well explored, research explaining the duration of comparative advantage is still scarce.With trade liberalisation and regional integration on global agri-food markets, export competitiveness and its long-term duration are crucial for prosperity of agri-food products on global markets. On the global agri-food markets, different countries play the roles of global leaders in agri-food export competitiveness. Thus 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, three main stylised empirical facts that are significant for research and practice on global businesses can be observed (Reardon and Barrett, 2000; EU Commission, 2012, 2013; WTO, 2013; FAO, 2016). First, during the last two decades of agri-food trade liberalisation and agro-industrialization of the global agri-food economy, global agri-food exports have increased rapidly, particularly due to rapid growth in processed and final consumer agri-food products. Global agri-food exports tend to increase in response to increases in food demand. 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 exporters of final products, which have become the most important group of products in the structure of global agri-food trade. Third, the EU is the biggest global importer of agricultural products from developing countries, followed by China's rapid growth in imports, and Japan is the third largest importer. The US, Russia, and China (including Hong Kong) are the EU's biggest agri-food markets (FAO, 2014).

Considering the global stylised empirical facts, the aim of the article is to provide empirical evidence on the duration of global agri-food export competitiveness using the concept of revealed comparative advantage developed by Balassa (1965). First, we present on overview on the duration of global agri-food export competitiveness using the non-parametric Kaplan–Meier estimator of survival function.

Second, we apply discrete time proportional hazard model to evaluate main country-specific factors of global agri-food export competiveness. Finally, we pay special attention on the possible impacts of the economic crisis on the duration of global agri-food export competitiveness.

The article is organised as follows. In the next section, the paper's theoretical base is integrated, hypotheses about determinants and their impacts on global agri-food export competitiveness are developed, and methods used in empirical testing are explained. In Section 3, a discussion of the set of countries and time period on which the analyses focuses on is presented, and data and variables are described. In Section 4, the results of revealed comparative advantage and the regression results are presented and interpreted. In the final section, theoretical and empirical contributions, and implications of the results are discussed.

2. Research hypotheses and methods

2.1 Theory and hypotheses

A body of theoretical, conceptual frameworks and empirical literature has been developed on the comparative advantage of competition in regional and global trade. The challenging issues for countries are to strengthen the determinants of the duration of comparative advantages as well as to transform disadvantages into advantages in international trade (e.g., Curzi and Olper, 2012). To achieve comparative advantages, countries and firms can use different export strategies (e.g., Ritthaisong *et al.*, 2014; Lehtinen *et al.*, 2016). Following the previous research on the duration of trade and comparative advantage we set the following hypotheses.

Agri-food exports can be positively associated to the level of economic development, which is proxied by the per capita gross domestic product (GDP) of exporting countries.

While wealthier countries tend to be less specialized in agri-food products and export relatively less from these declining industries, they are more likely to remain competitive for longer in export of final higher value-added agri-food products, which are the most important in the structure of global agri-food export. Therefore, competitiveness of longer duration can be due to their profound terms of trade, because more economically developed countries have stronger overall chain value creation and export market capacity. Therefore, the duration of comparative advantage is expected to be positively associated to the level of economic development of a country, as market potential (e.g., Head and Mayer, 2011). A positive relation between exports and per-capita GDP is consistent with a supply-side hypothesis on impact of level of economic develoment on export growth. On demand side, higher level of economic develoment induces preferences of consumers for quality and a demand for varieties, which correlates with higher levels of economic development (e.g., Philippidis and Hubbard, 2003; Hallak, 2010; Choi *et al.*, 2009). The stronger is domestic demand for a product, the weaker a country's comparative advantage in it, other things equal (Markusen, 2013). This study thus hypothesizes the following:

H1. The 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 variable in gravity trade model with expected positive association between exports and the size of the economy (e.g., Anderson and van Wincoop, 2004). We expect that at similar level of economic development larger countries tend to have a comparative advantage for a longer period than smaller ones. The population differential increases between the regions increases exports. This study thus hypothesizes the following:

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

A body of literature has been developed about resource determinants of export performance across industries and countries (e.g., Beleska-Spasova *et al.*, 2012; Lehtinen *et al.*, 2016). A large part of agricultural production depends on endowments with natural agricultural resources (e.g., Anderson 1998; Huo 2014). Among them, a crucial role can be played by the availability and quality of land soil potentials and natural climatic conditions. Better endowments in agricultural resources can, through more competitive agricultural production, also increase the competitiveness of the food processing industry and thus of agri-food comparative advantages. Standard comparative cost theory of international trade has relative, not absolute, factor endowments as drivers such as agricultural land per worker. This study thus hypothesizes the following:

H3. Better endowments in agricultural resources increase the probability of the duration of comparative advantage.

When modelling the export duration for final products within a sector, the assumption of product homogeneity is often quite unrealistic due to the presence of different varieties of the same product and its considerable heterogeneity (e.g., Helpman and Krugman, 1985). For agri-food products, we assume that greater product heterogeneity exists in the value chain according to the degree of product processing. Heterogeneity between vertical stages in the value chain is related to the processing of primary agricultural products either for further processing or for final human consumption. 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). On the basis of this exploration, we set the following hypothesis:

H4. The duration of comparative advantage is longer for differentiated agri-food products than homogeneous ones.

Literature provides empirical support that those countries with a diversified export structure that refers to the presence of different sectors among a country's export set and thus with greater number of exported products will have a greater chance to have a comparative advantage in a given product for longer periods of time (Hess and Persson, 2011). This study thus hypothesizes the following:

H5. Export diversification has positive impact on the duration of comparative advantage in a given agri-food product.

The literature on political economy of agricultural policy and government transfers emphasises distortions to agriculture and food markets. The ambiguous relation between agricultural support and comparative advantage depends of the actual kind and level of support and on which products are supported. The complexity of the topic and the abundant literature suggest mixed results. Barkema *et al.* (1991) emphasized the role of distortion in agricultural markets and the competitiveness is changing in the short-run under impacts of different sector-specific, macroeconomic and other influences, such as from the use of agricultural subsidies. Anderson *et al.* (2013) argue on the negative relationships between agricultural subsidies and comparative advantage on long-term. This study thus hypothesizes the following:

H6. Agricultural support has a negative impact on the duration of comparative advantage.

Finally, economic crisis had negative effects on global agri-food trade (FAO, 2016). Therefore, we expect that economic crisis in the 2009-2011 period has also negative impacts on comparative advantage. This study thus hypothesizes the following:

H7. Economic crisis has a negative impact on the duration of comparative advantage.

2.2 Revealed comparative advantage

Different approaches have been developed and applied in literature to measures trade and export competitiveness (e.g., Mavrogiannis *et al.*, 2008; Bojnec and Fertő, 2008; 2012a). Our paper applies the concept of 'revealed' comparative advantage introduced by Liesner (1958) and later redefined and popularised by Balassa (1965). Therefore, it is known as the 'Balassa index', used to empirically identify a country's weak and strong export sectors. The Revealed Comparative Advantage (B) index is defined (Balassa, 1965) as follows:

$$B = (Xij / Xig) / (Xwj / Xwg) \quad (1)$$

where *X* represents exports, *i* is a country, *j* is a commodity, g is a set of commodities, and w 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 Organisation's Harmonised 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 spite of some criticisms of the B index as export specialisation index, such as the asymmetric value problem, the problem with logarithmic transformation (De Benedictis and Tamberi, 2004) and the importance of simultaneous consideration of the import side, the main advantage against alternative trade indices is its theoretical foundation that changes in the B index are consistent with changes in countries' relative factor-endowments (e.g., Hinloopen and van Marrewijk, 2008; Bojnec and Fertő, 2008). The B index can provide useful evidence on the country's agri-food export competitiveness on global markets.

2.3 Survival analysis

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:

$$\hat{S}(t) = \prod_{t(i)<t} \frac{n_j - d_j}{n_j} \qquad (2)$$

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.

2.4 Discrete time models

Beyond to descriptive analysis of duration of revealed comparative advantage, we are interested in 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, 2006; 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 (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 is 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.

3. Regional setting of countries, data and measurement of variables

3.1 Regional setting of the analysed countries

Agri-food export-oriented growth is largely based on processed agri-food products from developed countries and less so on non-traditional agricultural exports from developing countries (Oro and Pritchard, 2011). 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 industrialised countries, and selected global major agri-food trading countries, e.g., Argentina, Australia and New Zealand in global agri-food exports and Japan and Switzerland in global agri-food imports (EU Commission, 2013; FAO, 2014).

The BRICS-5 is the largest in terms of territory and population, and is among the largest world economies in terms of agri-food production and consumption. The NAFTA-3 is one of the world largest trade blocs according to economic size or by the size of 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, e.g., Mexico in NAFTA-3 and MIST-4, and Indonesia in MIST-4 and Tiger Cup-4. As a result, 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 specialisation by global agri-food market leaders according to the individual countries and less so by the main trading groups.

3.2 Data and measurement of variables

The B index is used as dependent variable. The United Nations (UN) International Trade Statistics UN Comtrade database (UNSD, 2013) at the six-digit harmonised 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 as defined by the World Trade Organisation contains 789 HS-6 level product groups. The UN Comtrade database with the World Integrated Trade Solution (WITS) software developed by the World Bank (2013a), in close collaboration and consultation with various international organisations 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 logarithm of the populations of the exporter countries is used as a proxy for the market size. Population data are from the World Bank (2013c).

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 (2013c). In addition, the share of agricultural labour force is used as a proxy of economic development. The share of active agricultural employment in total active employment data is taken from the FAO (2014) database.

The share of agricultural land in total land is used as a proxy for agricultural factor endowments. Land data is based on the World Bank (2013c).

The agri-food export diversification is measured by the 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).

The Nominal Rate of Assistance (NRA) is used to measure the agricultural supports based on the World Bank (2013b). Positive values of the NRA indicate protection to agricultural sectors, while negative values mean its taxation.

Economic crisis is a dummy, which takes value one in the years 2009-2011, and zero otherwise.

The dependent variable for the B index and all explanatory variables are capturing each of the analysed countries in the twelve years analysed. The analysis embraces the 2000–2011 period. The rationale for using this specific period of time, which contains a major structural break related to global food, economic and financial crises, is not only in data availability, but also in capturing structural and policy changes in global agri-food exports with useful implications.

4. Empirical results

4.1 Global agri-food market leadership

According to agri-food export and import shares in the global markets, the analyzed countries have been net exporters. Their overall share in global agri-food exports was higher than their overall import share in global agri-food imports. The import share has declined from more than 60 per cent to less than 60 per cent during the 2000–2011 period, while the export share has remained close to 70 per cent. The share of gross trade ranges around 65 per cent.

In 2011, among the analyzed countries the major agri-food exporters are the US, the Netherlands, Germany, Brazil and France. Comparisons between 2000 and 2011 show a rapid increase in the agri-food export share for Brazil, and deterioration for France and Belgium. In 2011, the major agri-food importers are the US, Germany, China, Japan, the Netherlands and France. Comparisons between 2000 and 2011 show a rapid increase in agri-food import share for China, which is consistent with the previous findings in the literature (e.g., Bojnec *et al.*, 2014).

4.2 Changes in revealed comparative advantage (B) indices

Comparing 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 between 2000 and 2011 suggest that the export competitive countries on the global markets are Argentina, Australia, Belgium, France, the Netherlands, New Zealand, and the US (Figure 1). They experienced B mean values greater than 1 (B>1), higher B median values, and an increasing or stable percentage of agri-food products with B>1, which is greater than 30 per cent. With a lower share of B>1, Turkey and Canada are also close to this group. The Netherlands has further improved its export competitiveness, while it has deteriorated slightly for Australia and Turkey.

Insert Figure 1 about here

According to the B indices, the second group 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 a lower percentage of agri-food products with B>1: Brazil, India, South Africa, Indonesia, Malaysia, Philippines, and Thailand. To a lesser extent this also holds for China, which experienced deterioration of revealed comparative advantage from the advantage of B>1 in 2000 to the disadvantage of B<1 in 2011. Some deterioration in export competitiveness is also seen for India, while improvements are observed for the 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 B>1 less than 10 per cent; 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) values of the B median value, and the share with B>1 close or more than 19 per cent. Germany has slightly improved its export competitiveness.

Except for Russia and China with annual variation, the other BRICS countries have experienced B>1 for agri-food exports on the global markets. Among the NAFTA countries, only the US has clearly performed with revealed comparative advantage (B>1) for agri-food products. In general, the MIST countries experienced revealed comparative advantage (B>1). Among the Tiger Cup countries, the Philippines have the highest values for the B>1 indices. The high value of the Philippines in 2011 can be explained by extreme values of some products including for essential oils of citrus fruit and of non citrus fruit, rice flour and thyme.

Except for the Netherlands, France, Belgium, the US and to a lesser extent for Argentina, the median values are lower, suggesting a 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, according to competitiveness, are clearly dispersed among different countries' players according to 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 the development of agri-food processing industries and international agri-food marketing as well as some other country-specific factors.

4.3 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.

Insert Figure 2 about here

The highest average number of years with the B>1 duration are for France, New Zealand, Japan, the US, Australia and Argentina (Figure 2). 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 H4.

Insert Figure 3 about here

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 3). 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. Japan has few agri-food products with strong competitiveness of longer duration, while India does not have competitive agri-food products of longer duration.

The duration of the B>1 indices for agri-food exports by the 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.

Insert Figure 4 about here

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 (Figure 4). 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 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 on long-term. Second, the Kaplan-Meier survival rates are higher for consumer agri-food products than non-consumer agri-food products for the following countries: 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.

4.4 Regression results

We estimate the baseline specification using discrete-time probit and logit models, which are then additionally specified with a consumer agri-food products dummy variable (Table 1). All models include random effects for every exporter-product combination.

Insert Table 1 about here

In general, the signs of coefficients in regression models are similar for the various estimation procedures. Wald Chi^2 test show that we can reject the hypothesis that coefficients are equal to zero. We find the larger log-likelihood value for the logit models comparing to probit models. The values for Akaike and Bayesian information criteria are similar and suggest that probit is better than logit for baseline model, and the opposite logit is better than probit for augmented model with included consumer goods variable. The high values of rho mean that the random effect panel model explains around 95 per cent of unobserved heterogeneity in all specifications. The likelihood-ratio tests strongly rejected 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 and the share of agricultural labour force have positive and significant coefficients, suggesting that comparative advantage involving economically developed economies increases the likelihood of failure in the B>1 indices. In terms of the size of the population, the market size has only significant impacts on the likelihood of failure in the B>1 indices at 10% significance level. The factor endowment variable has expected effect on the likelihood of failure in the B>1 indices. The B>1 indices in land-abundant countries have a better chance of survivial as this decreases the probability 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 increase the probability of failure in the B>1 indices. Economic crisis has no significant impacts on the likelihood 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 summarise the findings regarding the set hypotheses on the likelihood of failure in the B>1 indices, we reject the hypothesis 1, because the higher level of economic development is not confirmed to reduce the probability of failure in the B>1 indices. The results for the hypothesis 2 are found to be statistically significant at only 10% level. The result for the hypothesis 3 is that we cannot reject the association with the abundant land variable. The results reject the hypothesis 4 as the association with the differentiated consumer agri-food products is not confirmed to reduce the probabilty of failure in the B>1 indices. We cannot reject the hypothesis 5 as the association with the export diversification towards greater number of agri-food export products reduces the probability of failure in the B>1 indices. We cannot reject the hypothesis 6 as agricultural support increases the likelihood of failure in the B>1 indices. Finally, we can reject the hypothesis 7 as the results for the economic crisis are not found to be statistically significant.

5. Conclusion

The article investigates agri-food export competitiveness on global markets for 23 major countries accounting more than 60 per cent 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 found in a smaller number of the HS-6 agri-food products with revealed comparative advantage (B>1).

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 and larger numbers of the HS-6 agri-food products with B>1 with longer durations due to their 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 highest survival rates on the revealed comparative advantage indices and thus competitiveness over the long term could be also explained by developed logistic and port infrastructure.

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 increase. This is consistent with the set hypotheses 3, 5 and 6, which cannot be rejected.

Contrary to our expectations, the level of economic development, the share of agricultural employment, and differentiated consumer agri-food products increase and does not reduce the likelihood of failure in the B>1 indices. This is inconsistent with the set hypothesis 1 and 4, which can be rejected. The findings for the level of economic development and differentiated consumer agri-food products suggest that both supply-side and demand-side factors are important for agri-food export competitiveness. A stronger domestic demand for a product can weaker its country's comparative advantage as consumers with higher and rising incomes desire higher quality and more variety of foods. As limitation, measuring export diversification by counting active export lines may result in neglecting diversification within a given level of product disaggregation. The ambiguous finding for the share of agricultural employment can be explained by its double role for agri-food export competitiveness as it can serve as agricultural factor endowment and as a proxy for level of economic development with an inverse relation between the share of agricultural employment and the level of economic development. A greater share of agricultural employment indicates lower level of economic development, which increases the likelihood of failure in agri-food revealed comparative advantages.

The regression coefficient for the population size is found to be statistically significant only at 10% significance level. The population size is only partly a sensible index of country size as the analyzed countries are heterogeneous by the level of economic development measured by GDP per capita. However, the set H2 cannot be rejected.

In contrast to our expectation, the regression coefficient for the economic crisis is not found to be statistically significant. Therefore, the set H7 can be rejected as there is no significant evidence that the global economic crisis had negative impacts on comparative advantage in long-term.

The econometric results also suggest substantial heterogeneity between agri-food competitors on global markets. Among policy implications, agricultural natural factor endowment with land abundance and export diversification with greater number of exported products are important driving forces of agri-food export competitiveness of longer duration. The latter can be improved with investments and innovations activities. On the other hand, government subsidies might create a temporary competitive advantage on short-term, but on their basis agri-food export cannot remain competitive of longer duration.

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 less-processed food products. These are issues for future research in order to widen and deepen our knowledge and better understanding of the duration of agri-food export competitiveness by different products and countries on global agri-food markets. Agri-food export competitiveness of longer duration is a crucial factor for long-term farm business survival, as it fosters opportunities in business prosperity on changing global agri-food markets.

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Table 1. Regression results of determinants of the revealed comparative advantage (B>1) indices, 2000–2011.

	Dependent variable: B>1 indices			
	(1) probit	(2) probit	(3) logit	(4) logit
ln GDP per capita	0.117***	0.188***	0.118***	0.188***
ln Population	0.035*	0.084*	0.032	0.082*
ln Agricultural land	-0.881***	-2.018***	-0.854***	-2.017***
ln Agricultural employment	0.387***	0.723***	0.379***	0.722***
ln Number of products	-1.623***	-3.488***	-1.598***	-3.486***
NRA	0.427***	0.866***	0.422***	0.869***
Economic crisis	-0.032	-0.058	-0.033	-0.058
Consumer goods			0.215***	0.384***
Constant	14.452***	30.752***	14.361***	30.585***
N	150158	150158	150158	150158
Log likelihood	-33596.119	-33599.641	-33619.437	-33595.261
rho	0.949	0.947	0.952	0.947
Wald chi^2	971.00	869.24	997.18	1014.26
LR test of rho=0	0.000	0.000	0.000	0.000
Akaike information criteria (AIC)	67210.24	67217.28	67258.87	67210.52
Bayesian information criteria (BIC)	67299.51	67306.56	67358.07	67309.72

Source: Authors' own calculations.
* p<0.1.
** p<0.05.
*** p<0.01.

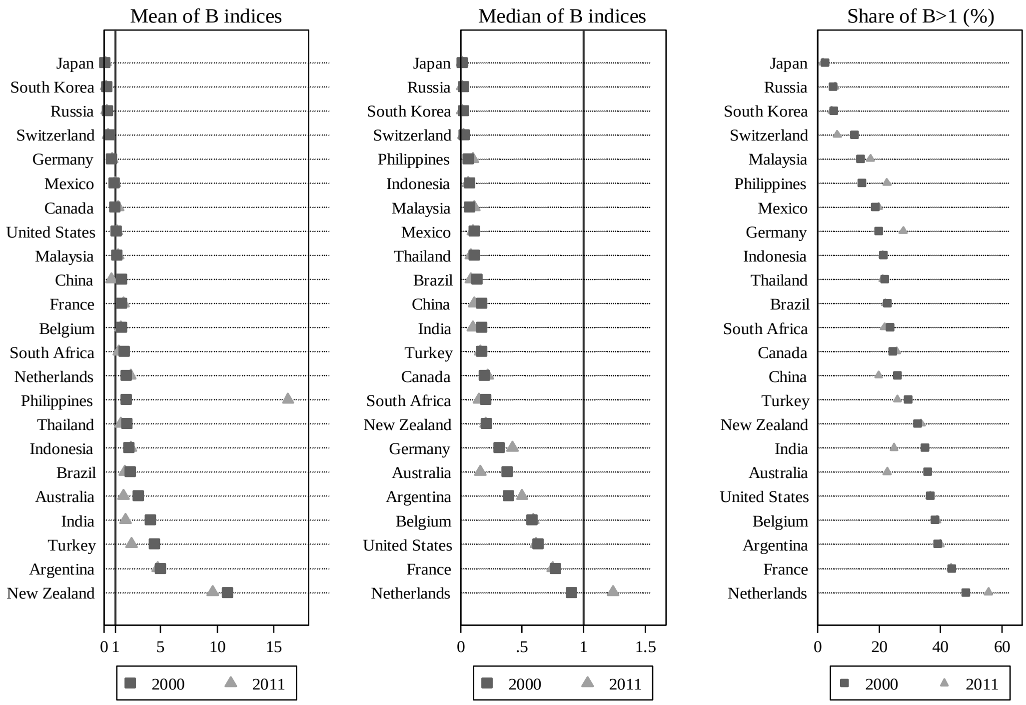

Figure 1. Changes in B indices by countries between 2000 and 2011.
Source: Authors' own calculations based on Comtrade database (UNSD, 2013) with WITS (World Trade Integration Solution) software (World Bank, 2013a).

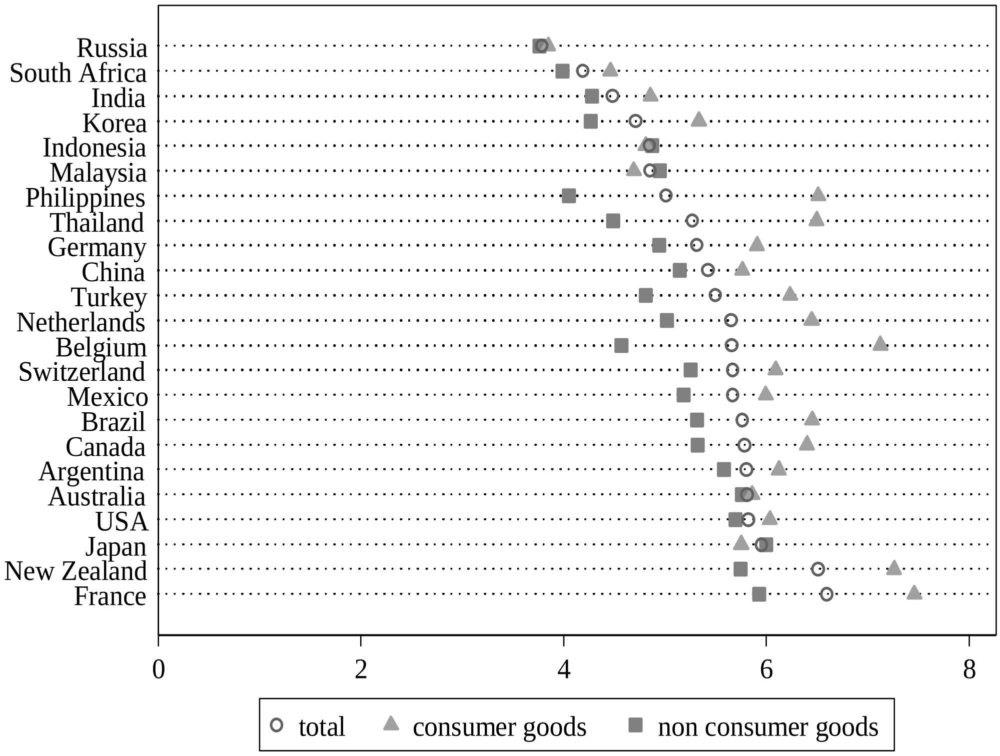

Figure 2. Mean duration of the B>1 indices by countries, 2000–2011.
Note: The average number of years that survived the HS-6 agri-food products during the twelve years analyzed.
Source: Authors' own calculations based on Comtrade database (UNSD, 2013) with WITS (World Trade Integration Solution) software (World Bank, 2013a).

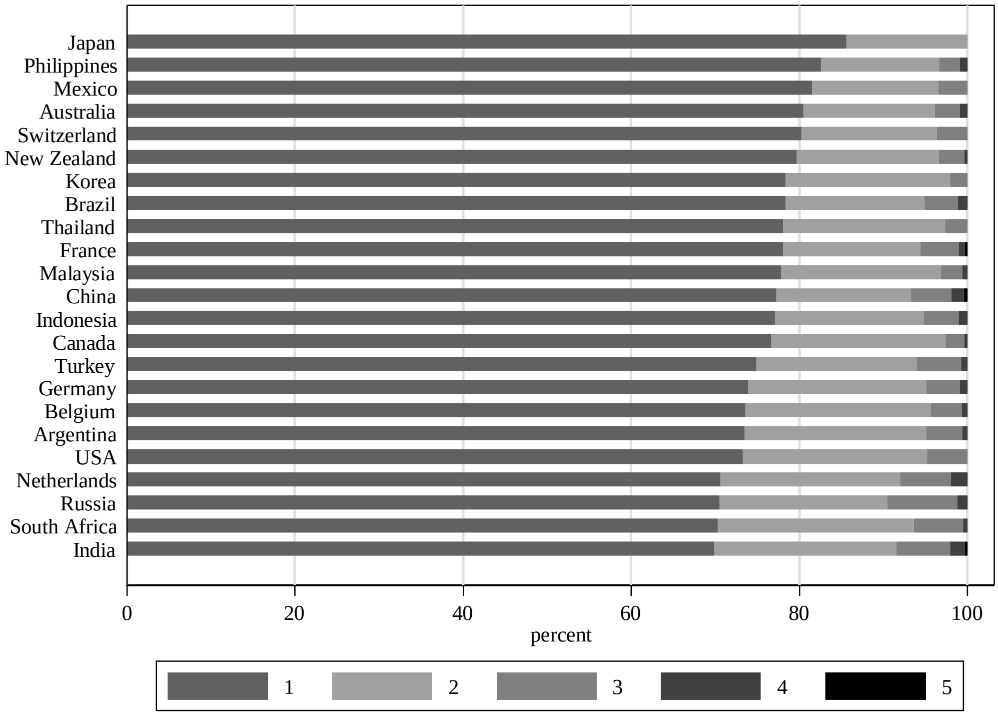

Figure 3. Distribution of spells by country.
Note: The percentage of the number of the HS-6 agri-food products that survived a certain number of years 2000–2011.
Source: Authors' own calculations based on Comtrade database (UNSD, 2013) with WITS (World Trade Integration Solution) software (World Bank, 2013a).

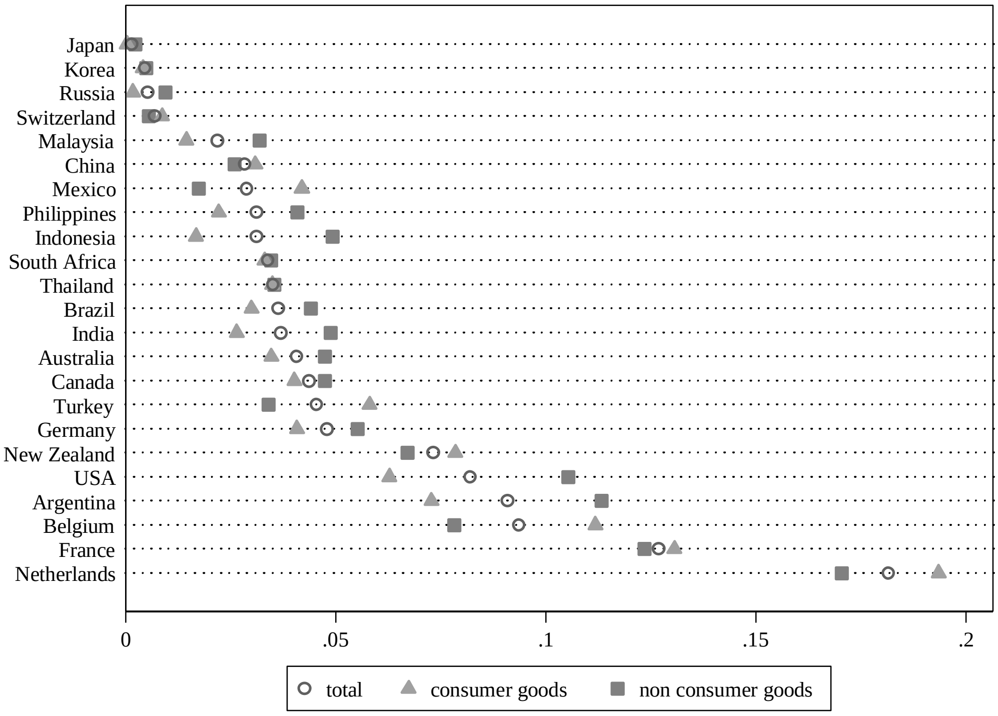

Figure 4. Kaplan-Meier survival rates for the B>1 indices (probability of continues survival in the last 12 year=2011), 2000–2011.
Source: Authors' own calculations based on Comtrade database (UNSD, 2013) with WITS (World Trade Integration Solution) software (World Bank, 2013a).