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Patterns and Drivers of the Agri-Food Intra-Industry Trade of European Union Countries

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Abstract

This paper investigates the drivers of agri-food intra-industry trade (IIT) indices in the European Union (EU-27) member states during the period from 2000–2011. The increased proportion of IIT in matched two-way agri-food trade of the EU-27 member states is consistent with economic integration and economic growth. When export prices were at least 15% higher than the import prices, high-vertical IIT, increased for most member states. This finding suggests that quality improvements occurred when comparing agri-food exports to similar imports of agri-food products. The IIT indices for both horizontal and vertical IIT are positively associated with higher economic development levels, new EU membership and EU enlargement. Additionally, as higher levels of economic development decreases, the size of the economy and marginal IIT increases the effects of agri-food trade liberalization on the costs of the labor market adjustment. Understanding how improvements in agri-food trade quality impact agribusiness and managerial competitiveness reveal significant policy implications.

Keywords: agri-food trade, intra-industry trade, trade quality, European Union

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Introduction

This paper investigates drivers of agri-food intra-industry trade (IIT) and marginal IIT (MIIT) to assess the potential determinants of product quality differentiation and the effects of agri-food trade liberalization on agricultural labor factor market adjustment costs. The economic dimension of agri-food trade is an issue relevant to both research and policy issues with agribusiness and managerial implications.

International food supply chains face several trade and competitiveness challenges (Folkerts and Koehorst 1997; Neves et al. 2013). One of them concerns quality and similarity, which is important on the supply-side for exploiting economies of scale to increase export competitiveness, and on the demand-side for differentiating products to satisfy different consumer quality preferences. The need to better understand the increasing role of agri-food product quality differentiation and agri-food trade segmentation based on product quality, along with its determinants and labor factor market adjustment costs, motivated this research.

Different measures of international trade, comparative advantage and competitiveness have been developed in the literature (UNCTAD/WTO 2012; Bojnec and Fertő 2012; Carraresi and Banterle 2015). From the body of international trade literature, this paper employs the theory and empirical bases of IIT and MIIT. IIT has become a widespread phenomenon and plays an increasing role in international trade (Fontagné et al. 2006; Brühlhart 2009). The formation of stronger economic ties between European countries due to the creation and expansion of the European Union (EU) has contributed to an increase in IIT among EU member states. The previous two decades of transition and adjustment to EU membership in Central and Eastern European (CEE) countries have also reoriented trade from within former communist bloc states to EU member states, while the share of IIT with the EU has also increased.

There is evidence of a growing role for IIT in manufacturing industries in EU member states (e.g. Jensen and Lüthje 2009). However, a significant proportion of the preexisting research has focused on examining trade in industrial products, while agri-food products are usually neglected in empirical studies (Bojnec 2001a, 2001b; Bojnec and Fertő 2008). In addition, studies suggest that the role of IIT has increased in agri-food trade in EU member states (Fertő 2005; 2015; Leitão and Faustino 2008; Jám bor 2014).

In contrast to recent research which has focused on examining intra-EU IIT (Fertő 2015; Fertő and Jám bor 2015; Jám bor 2014), the aim of this paper is to analyze the agri-food IIT of EU-27 member states on global markets.¹ Creating a simple description of IIT and MIIT patterns is the subject of interest for two main reasons: it can be employed as an indicator of the similarity of the agri-food sectors of different EU-27 member states, and also as a proxy for the intensity of factor-market adjustment pressures that are associated with the expansion of trade during the

¹ The EU-27 member states include the old EU-15 (OMS-15) member states (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom) and the new EU-12 member states (NMS-12). The NMS-12 group was created through two enlargements: 1st May 2004 (NMS-10: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia) and 1st January 2007 (NMS-2: Bulgaria and Romania).

enlargement period. Accordingly, the paper focuses on examining comparisons of IIT and MIIT indices between the EU-27 member states over time. Agri-food product differentiation in matched two-way trade is investigated through a separation of IIT into horizontal IIT (HIIT) and vertical IIT (VIIT). An MIIT index is applied to investigate how this factor is linked with labor factor market adjustment costs. Finally, drivers of agri-food IIT and the intensity of labor factor market adjustment costs are investigated using an econometric regression framework.

The remainder of this paper is structured as follows: the following section provides a literature review of theory and empirical studies which have applied models of drivers of IIT and examined the causal relationships between MIIT and labor factor market adjustment costs. The methods and data used in the research are then described, followed by a presentation and discussion of the results. The final section contains concluding remarks.

Literature Review

New trade theory offers several models for explaining IIT based on different assumptions about product differentiation. In the case of horizontal product differentiation, the usual conclusions relate to the role of factor endowments and scale economies that stem from the framework of monopolistic competition. This framework, summarized in Helpman and Krugman (1985), and often referred to as the Chamberlin-Heckscher-Ohlin (C-H-O) model, allows for inter-industry specialization in homogeneous goods and IIT in horizontally differentiated goods. This model suggests that a negative relationship exists between the differences in relative factor endowment. Alternatively, the vertical IIT models developed by Falvey (1981), Falvey and Kierzkowski (1987) and Flam and Helpman (1987) predict a positive relationship between IIT and differences in relative factor endowment.

Although the importance of IIT was already well documented for agri-food sectors by the late nineties (Fertő, 2005), research from the last decade about European agri-food IIT remains limited. Fertő (2007) investigated Hungarian IIT agri-food patterns in EU-15 member states and confirmed the existence of different drivers of HIIT and VIIT. HIIT was negatively associated with differences in gross domestic product (GDP) per capita, average GDP, distance and distribution of income, while income and distance were positively related to VIIT. Leitão and Faustino (2008) investigated the determinants of IIT in the Portuguese food processing sector and found that IIT was positively influenced by GDP per capita differences and energy consumption, and negatively associated to physical factor endowments, relative size effects and geographical distance. Jám bor (2014) analyzed the determinants of HIIT and VIIT in agri-food trade between New Member States (NMS) and the EU-27 member states, finding that agri-food trade is mainly of a vertical nature in the NMS, although the majority of NMS export low quality agri-food products to EU-27 markets. Factor endowments are negatively related to HIIT for agri-food products, but positively to VIIT. Economic size is positively and significantly associated to both types of IIT, while distance and IIT are found to be negatively associated in both cases. Results also suggest that HIIT and VIIT are greater if a NMS exports agri-food products to another NMS, and that EU accession has had positive and significant impacts on both HIIT and VIIT, indicating that economic integration fosters IIT. Fertő and Jám bor (2015) investigated the drivers of VIIT in Hungarian agri-food trade with the EU member states. Their findings suggest that factor endowments are negatively, and economic size positively and significantly, associated

to VIIT. Distance and VIIT were found to be negatively associated, as is commonly confirmed from use of the standard gravity model. Also discovered was the fact that VIIT is greater if an NMS exports agri-food produce to another NMS, while EU accession has ambiguously influenced the share of VIIT. Fertő (2015) analyzed the patterns and drivers of HIIT within the EU employing a new empirical strategy developed by Cieřlik (2005) to test the predictions of Helpman and Krugman's (1985) model, concluding that a low level of HIIT occurs within the enlarged EU for agri-food products during the period of analysis. Empirical evidence suggests that standard IIT theory is at least partially supported by the data when the sum of capital–labor ratios in the estimating equations is controlled for, instead of relative country-size variables. In conclusion, the literature highlights an increase in the role played by IIT in agri-food trade in the EU. In addition, and in line with recent empirical evidence, studies confirm that HIIT and VIIT are influenced by different factors.

Another strand of literature focuses on the dynamics of IIT. The proposition that IIT is affected by lower factor market adjustment costs than inter-industry trade has become known as the “smooth adjustment hypothesis” (SAH). The SAH, originally proposed by Balassa (1966) and further developed in the influential monographs on IIT by Grubel and Lloyd (1975) and Greenaway and Milner (1986), has become widely used. Discussion of the effects of trade liberalization on labor markets motivated a number of studies that followed the development of MIIT indices (Brühlhart 2002). Direct empirical support for the SAH in a European context is not extensive and focuses almost exclusively on manufacturing-intensive Western European countries. Fertő (2008, 2009) examined the structure of Hungary's food trade expansion over the period 1995-2003 and its implications for labor-market adjustment, finding some support for the SAH.

Intra-Industry Trade Indices

The basis for the various measures of IIT that are used in the present study is the Grubel–Lloyd (GL) index (Grubel and Lloyd 1975), which is formally expressed as follows:

$$(1) \quad GL_i = 1 - \frac{|X_i - M_i|}{(X_i + M_i)}$$

where X_i and M_i are the values of exports and imports of product category i in a particular country. The GL index varies between 0 (complete inter-industry trade) and 1 (complete IIT) and can be aggregated to country and industry level as follows:

$$(2) \quad GL = \sum_{i=1}^n GL_i w_i \quad \text{where} \quad w_i = \frac{(X_i + M_i)}{\sum_{i=1}^n (X_i + M_i)}$$

where w_i denotes the share of industry i in total trade of a country for a particular product group.

Literature offers several options for disentangling HIIT and VIIT. For example, Greenaway et al. (1995) developed the following approach: a product is horizontally differentiated if the unit value of export compared to the unit value of import is within 15%, otherwise the existence of

vertically differentiated products is indicated. Formally, this is expressed for the bilateral trade of horizontally differentiated products as follows:

$$(3) \quad 1 - \alpha \leq \frac{UV_i^X}{UV_i^M} \leq 1 + \alpha$$

where UV refers to unit values and X and M to exports and imports for goods i and $\alpha=0.15$. The choice of a 15% range is rather arbitrary; Greenaway et al. (GHM) (1994) have proposed widening the spread to 25%. Interestingly, studies which have investigated the potential impact of various unit value-weighting procedures (Liao 2011) and result thresholds confirm that results derived by selecting from the 15% range do not change significantly when the spread is widened to 25% (Jensen and Lüthje 2009). Based on the above-described logic, the GHM index may be formally written as follows:

$$(4) \quad GHM_k^p = \frac{\sum_j [(X_{j,k}^p + M_{j,k}^p) - |X_{j,k}^p - M_{j,k}^p|]}{\sum_j (X_{j,k} + M_{j,k})}$$

where X and M denote exports and imports, respectively, while p distinguishes HIIT from VIIT, j stands for the number of product groups and k for the number of trading partners ($j, k = 1, \dots, n$). Blanes and Martin (2000) emphasize the distinction between high and low VIIT and define a low VIIT as one which occurs when a relative unit value of a good is below 0.85, while a unit value above 1.15 indicates high VIIT.

Another strand of IIT literature focuses on the relationships between IIT and the adjustment costs associated with changes in trade patterns. The effects of trade liberalization depend, *inter alia*, on whether trade is inter-industry or IIT. Whereas the former is associated with the reallocation of resources between industries, the latter suggests reallocation *within* industries. The belief that IIT leads to lower costs for factor market adjustment, particularly for labor, gives rise to the SAH. However, adjustment costs reflect dynamic phenomena, suggesting that use of the static GL index is in this case not appropriate. During the last few decades several MIIT indices have been developed, but the measure used in most recent empirical studies remains that proposed by Brühlhart (1994), which is a transposition of the GL index to trade changes:

$$(5) \quad MIIT_i = 1 - \frac{|\Delta X_i - \Delta M_i|}{|\Delta X_i| + |\Delta M_i|}$$

where X_i and M_i have the same meaning as in the GL index, and Δ indicates the change in trade flows between two years (or two periods). The MIIT index varies between 0 and 1: extreme values correspond to changes in trade flows that are specifically inter-industry (0) or intra-industry (1). The MIIT index is defined in all cases and can be aggregated over a number of product groups using appropriate weights.

Regression Models

To complement descriptive statistics about IIT indices, a regression analysis is applied to quantify the impact of country-specific factors and policy variables on the IIT indices in EU-27

member states' agri-food trade. Following Fertő and Jám bor (2015), the following model for each type of IIT indices' driver is estimated:

$$(6a) \text{HIIT}_{ijt} = \alpha_0 + \alpha_1 \ln \text{GDP/capita}_{it} + \alpha_2 \ln \text{GDP}_{it} + \alpha_3 \ln \text{Gini}_{it} + \alpha_4 \text{NMS}_{it} + \alpha_5 \text{EU}_{it} + \varepsilon_{ijt}$$

$$(6b) \text{VIIT}_{ijt} = \alpha_0 + \alpha_1 \ln \text{GDP/capita}_{it} + \alpha_2 \ln \text{GDP}_{it} + \alpha_3 \ln \text{Gini}_{it} + \alpha_4 \text{NMS}_{it} + \alpha_5 \text{EU}_{it} + \varepsilon_{ijt}$$

where HIIT and VIIT indicate horizontal and vertical IIT, respectively. $\ln \text{GDP/capita}$ and $\ln \text{GDP}$ are the natural logarithms of GDP per capita and the size of GDP, $\ln \text{Gini}$ is the natural logarithm of the Gini index, NMS is a dummy variable equal to 1 for the NMS and zero otherwise, and EU is a dummy for the EU accession years (and zero otherwise), subscript i denotes the country, j the product, and t time. According to IIT theory we expect GDP/capita to positively impact HIIT and negatively influence VIIT, and anticipate the existence of a positive association between HIIT/VIIT and other variables.

In addition, a test of the SAH is conducted to identify the importance of MIIT on labor market adjustment costs. Trade theory does not provide a fully specified model of labor market adjustments or strong prior indications about which control variables should be included in model testing of the validity of the SAH. However, former theoretical and empirical research provides a useful guide (Fertő, 2009). The absolute value of agricultural employment changes ($|\Delta \text{Empl}|$) is used as a proxy for labor factor adjustment costs. According to the SAH, the relationship between the absolute value of total employment changes and the MIIT index should be negative. In addition, we employ several country-specific variables, including GDP per capita, size of GDP and a dummy for the NMS. We focus on the changes that occurred between 2000 and 2011, and estimate the following regression model:

$$(7) |\Delta \text{Empl}|_{ijt} = \alpha_0 + \alpha_1 \ln \text{GDP/capita}_{it} + \alpha_2 \ln \text{GDP}_{it} + \alpha_3 \text{MIIT}_{it} + \alpha_4 \text{NMS}_{it} + \varepsilon_{ijt}$$

Regression models (6a), (6b) and (7) are estimated using random effect panel models with heteroscedastic robust standard errors.

Data

Different data sources have been employed in empirical analyses of IIT and MIIT indices. In addition to national trade data sources, the most popular international trade databases for the EU-27 member states are Eurostat (2015), FAOSTAT (2015), OECD (2015) and UNSD (2015). As most of these databases can be freely accessed, their use largely depends on the aim and objectives of the analysis.

The empirical analysis of the IIT and MIIT indices for the EU-27 member states was conducted using detailed trade data at the six-digit World Customs Organization's Harmonized System (HS-6) level for the years 2000-2011. Results are compared according to the four-digit International Standard Industrial Classification of all Economic Activities (ISIC-4) agri-food product groups, which as agri-food products includes eighteen 4-digit ISIC codes (Table A1 in Appendix).

Trade data is sourced from the UN Comtrade database (UNSD, 2015) using **World Integrated Trade Solution** (WITS) software. UN Comtrade was preferred to the Eurostat Comext database because of the availability of WITS software, and the fact that the issue of interest is the total value of agri-food trade in the EU-27 member states which in UN Comtrade database is reported in US dollars (the Eurostat Comext database denominates values in euros).

Data for the explanatory variables in the regression equations (6) and (7) for testing the drivers of IIT and the SAH hypothesis are based on the following data sources: GDP per capita, GDP and agricultural employment data were obtained from the World Bank (2014) database, while Gini indices were obtained from UNU-WIDER (2014) database.

Results

Structure and Evolution of the Development of IIT Indices by EU-27 Member State

Figure 1 clearly illustrates that the share of IIT in EU-27 agri-food trade has increased. This increase is consistent with the effects of the 2004 and 2007 EU enlargements and with the evolution in economic growth patterns (not including the economic recession and slowdown in the years 2008-2009).

Two-way matched IIT is divided up into HIIT, high VIIT and low VIIT. HIIT is the most important component of IIT structure, followed by high VIIT. This indicates that the EU-27 countries to a greater extent exported agri-food products of either a similar or higher quality than imports (the proportion of low VIIT accounts for a smaller percentage of IIT).

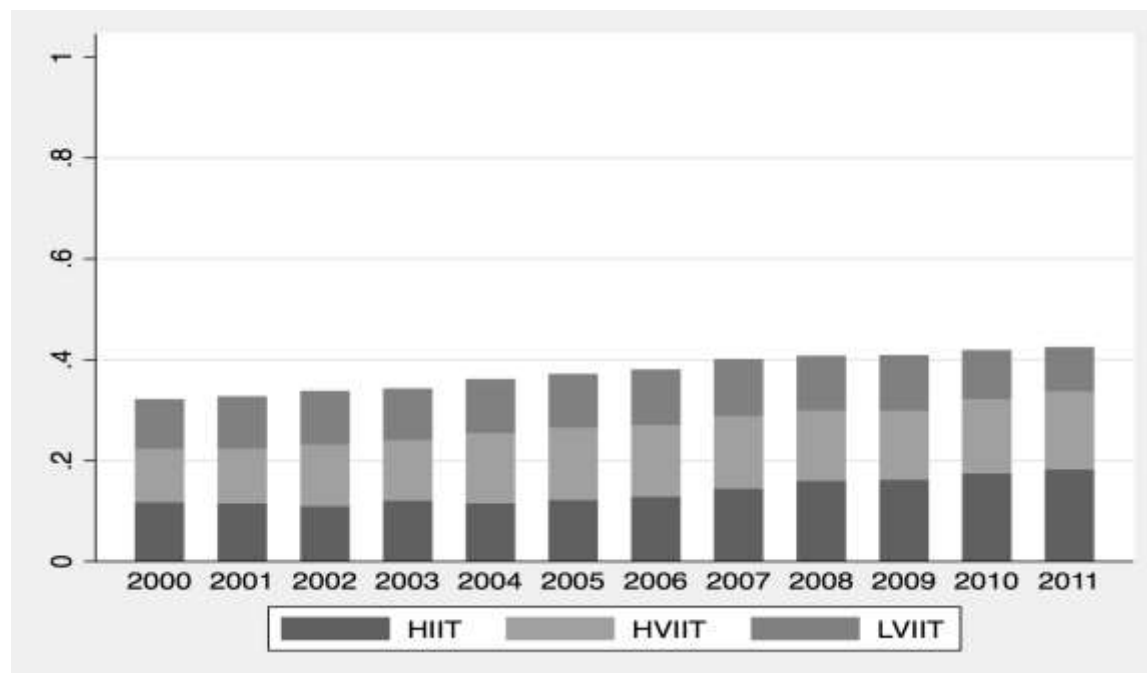


Figure 1. Development of intra-industry trade (IIT) in the EU-27 member states from 2000–2011.

Note. HIIT: Horizontal IIT, HVIIT: High Vertical IIT, and LVIIT: Low Vertical IIT.

Source. Authors' calculations based on Comtrade database using WITS (World Trade Integration Solution) software.

The percentage of IIT in matched two-way agri-food trade for the EU-27 member states increased more consistently for NMS-12 than for old member states OMS-15.² This finding is consistent with the greater economic integration and economic growth these countries experienced due to EU enlargement. Belgium was the only country to experience a continuation of growth in IIT in agri-food two-way matched trade flows. The share of HIIT for NMS-12 grew more rapidly than for OMS-15. HIIT levels were highest for Lithuania, Belgium, Estonia, Germany and Austria. These countries had a relatively higher share of matched agri-food trade, experiencing smaller differences between export and import unit values.

High VIIT increased in total and for most of the EU-27 member states, although NMS-12 gained more significantly than OMS-15 over the period of analysis. High VIIT levels were most typical of Slovakia, followed (in descending order) by the Netherlands, Belgium, Italy, Denmark, France, Austria, the Czech Republic and Portugal.

Regarding the EU-27 as a whole, low VIIT declined. This trend was similar for the OMS-15 and the NMS-12. Nevertheless, specific low VIIT levels and patterns were mixed across the EU-27 member states. EU-27 member states with low VIIT exported lower quality than they imported in terms of export to import unit values in matched agri-food trade.

Figure 2 illustrates the evolution in the development of IIT indices according to the EU-27 member states over the period under analysis, clearly indicating that the percentage of IIT in agri-food trade of the EU-27 member states increased between 2000 and 2011. The percentage of IIT is highest for Belgium, whilst the increase in the share of IIT was particularly large for most of the NMS from CEE countries. Estonia can be grouped with Germany, Austria, the Netherlands and Luxembourg, while a large increase in the share of IIT occurred with Lithuania, the Czech Republic, Slovakia, Slovenia, Latvia, Hungary and Poland, as well as with Bulgaria and Romania.

Moreover, two main groups of EU-27 member states can be identified as concerns the increase (decline) in the percentage of HIIT: a small group (low number) of EU-27 member states which witnessed a reduction in the percentage of HIIT, and a larger group (higher number) of EU-27 member states which increased HIIT. However, from the latter group the greatest increases in HIIT were achieved by the following countries of the CEE NMS-10: Lithuania, the Czech Republic, Latvia, Slovenia, Hungary, Poland, Bulgaria, Romania, and Estonia. The latter initially already had a relatively high percentage of HIIT. A slight increase in HIIT occurred with most of the OMS-15, except for Finland, Ireland, and to a lesser extent, with France. Among the NMS-12, a decline in the proportion of HIIT occurred with Malta and Slovakia. The importance of HIIT is particularly low for Cyprus.

Except for Lithuania and Belgium (and to a lesser extent, France) which experienced relatively high shares of high VIIT, the other EU-27 member states increased their share of high VIIT. This favorable trade specialization pattern (which can be identified by an increase in the percentage of agri-food products with substantially higher export unit values than import unit values) indicates a quality advantage. Each of the NMS-12 increased their share of high VIIT. Slovakia is a

² IIT indices for each of the EU-27 member states for the period under analysis (2000–2011) are available from the authors upon request.

notable outlier among the NMS-12, having substantially increased its percentage of high VIIT. On the other hand, the Netherlands – from among the OMS-15 – increased an already high VIIT (among the highest of all the EU-27 member states).

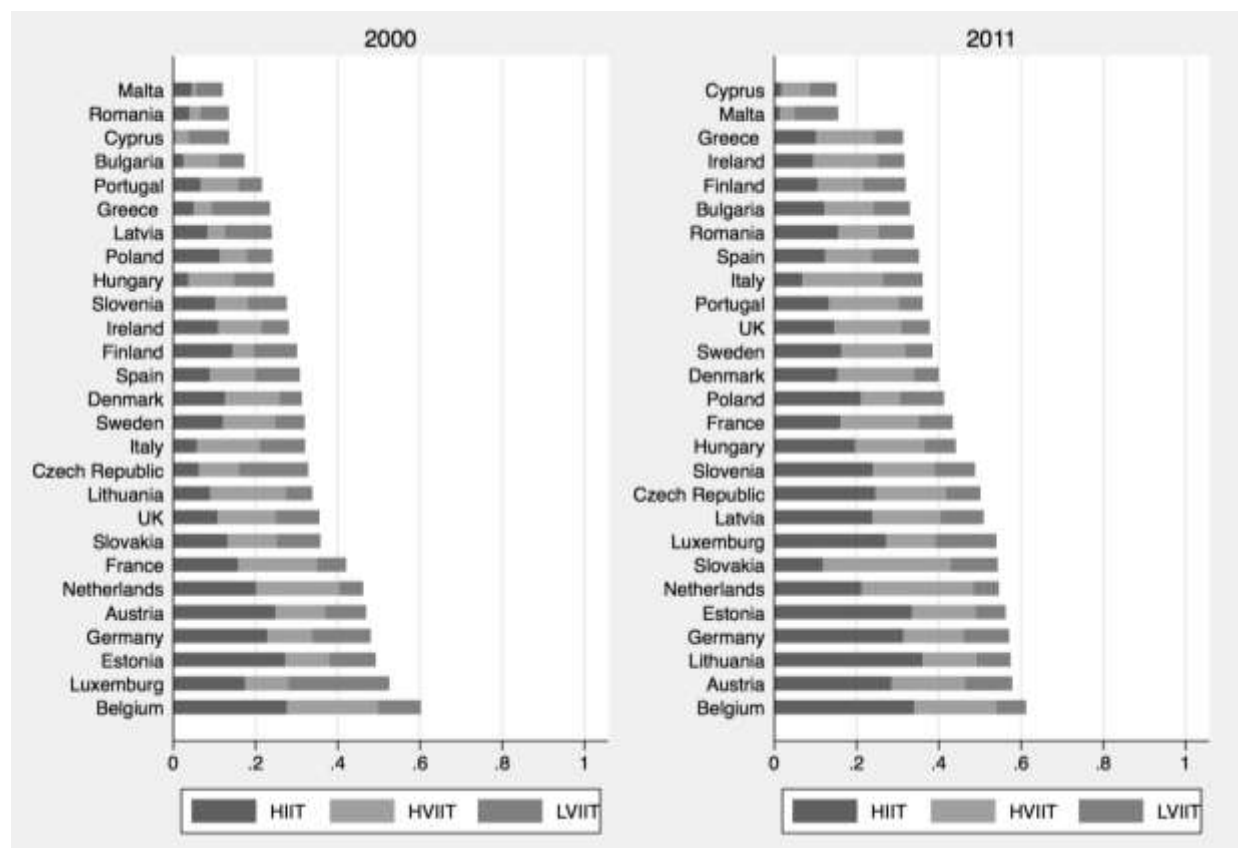


Figure 2. Intra-industry trade (IIT) according to EU-27 member states, 2000 and 2011.

Note. HIIT: Horizontal IIT, HVIIT: High Vertical IIT, and LVIIT: Low Vertical IIT.

Source. Authors' calculations based on Comtrade database using WITS (World Trade Integration Solution) software.

The share of low VIIT in the IIT structure is on average lower than the share of high VIIT, which is on average lower than the share of HIIT. Low VIIT can be considered to be a less desirable pattern of trade specialization in terms of the quality of agri-food exports *vis-à-vis* the quality of agri-food imports of similar products. Therefore, a reduction in the percentage of low VIIT can be considered an improvement in the quality of agri-food exports as concerns the quality of agri-food imports of similar products: this phenomenon was particularly evident with both the OMS-15 (notably Luxembourg and Greece) and the NMS-12 (particularly with the Czech Republic). On the other hand, one group from the OMS-15 and one from the NMS-12 maintained their similar share of low VIIT, or even increased it. Among the OMS-15, Austria and France increased in terms of low VIIT, whilst among the NMS-12 the proportion of low VIIT increased, for example, with Poland, Malta, Bulgaria and Romania.

Between 2000 and 2011, the percentage of IIT increased for both the OMS-15 and particularly the NMS-12 (Figure 3). In 2011, a few years after the EU enlargement process, the OMS-15 and

the NMS-12 are, in agri-food trade terms, much more similar than before (i.e. prior to 2000) (Bojnec and Fertő 2015a, 2015b). The NMS-12 increased their share of high VIIT and particularly HIIT, whilst the OMS-15 increased HIIT and particularly VIIT. The reduction in the proportion of low VIIT was greater for the OMS-15 than for the NMS-12.

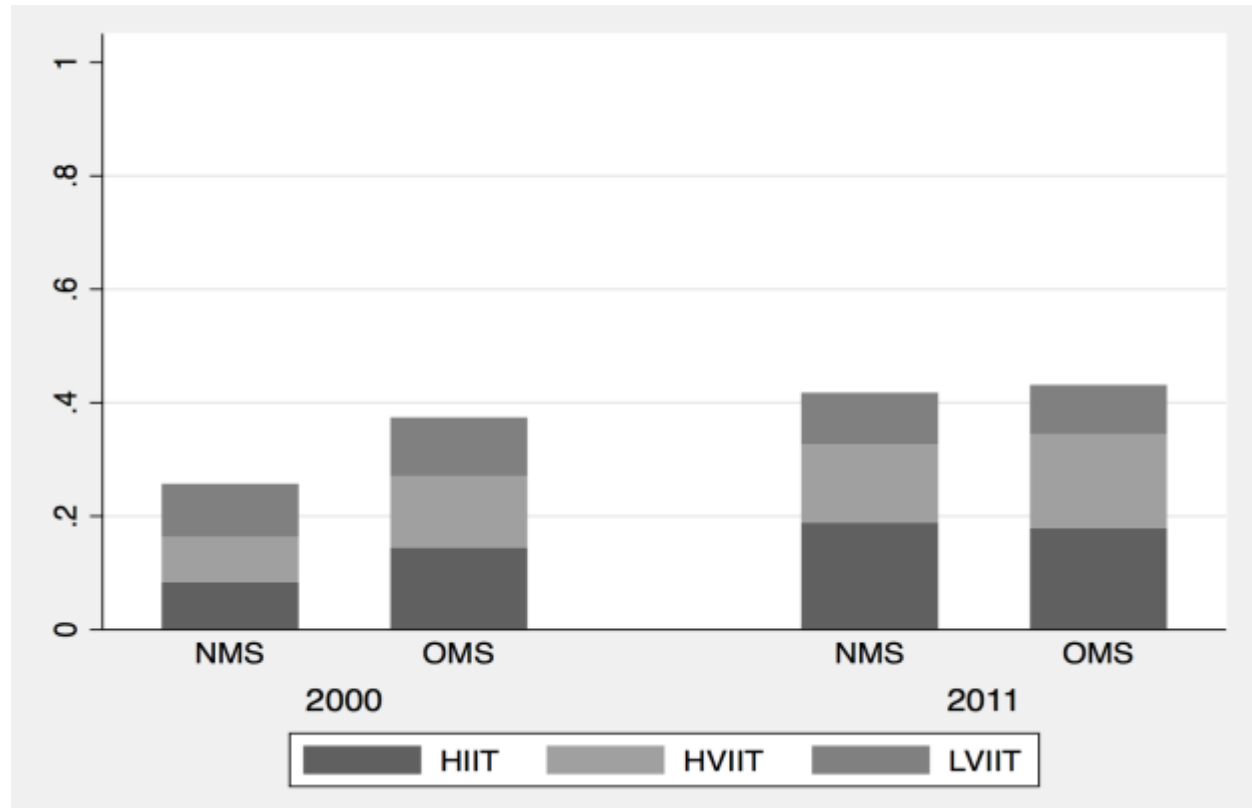


Figure 3. Mean values of various intra-industry trade (IIT) indices according to OMS-15 and NMS-12 member state groups, 2000 and 2011.

Note. HIIT: Horizontal IIT, HVIIT: High Vertical IIT, and LVIIT: Low Vertical IIT.

Source. Author's calculations based on Comtrade database using WITS (World Trade Integration Solution) software.

To conclude, the importance of IIT in agri-food trade varies considerably between the EU-27 member states. Two-way matched IIT can be distinguished in terms of HIIT, high VIIT and low VIIT. For most EU-27 member states, inter-industry trade is more important than IIT. Belgium has the greatest share of IIT in agri-food trade (more than 60%) with a significant share of HIIT and high VIIT, whilst Cyprus and Malta have the lowest share of IIT in the agri-food trade. Moreover, only Belgium has experienced continued and sustained IIT in their agri-food two-way matched trade flows. The greatest share of IIT in two-way matched agri-food trade flows are found for Austria, Estonia, Germany, Latvia, Lithuania, Luxembourg, the Netherlands, Slovakia and the Czech Republic (data relate to 2011). The Netherlands has a high share of VIIT. High VIIT has increased for most of the EU-27 member states, while the levels and patterns of low VIIT vary according to EU-27 member state.

Evolution in the Development of IIT Indices by ISIC-4 Product Group

Shares of IIT vary considerably across the ISIC-4 agri-food product groups (Figure 4). The share of IIT is lowest for 3131 – distilling, rectifying and blending spirit, close to 50% for 3121 – manufacture of food products not elsewhere, and more than 50% for 3119–manufacture of cocoa, chocolate and sugar, and 3117 – manufacture of bakery products. In addition, the structure of IIT varies considerably by ISIC industry. HIIT is most significant for 3119–manufacture of cocoa, chocolate and sugar, and least important for 3131 – distilling, rectifying and blending spirit. High VIIT is most prominent with 1130 – hunting, trapping and game propagation, and least important for 3118 – sugar factories and refineries. Low VIIT, meanwhile, is most important for 3121 – manufacture of food products not elsewhere classified and least important for 3115 – manufacture of vegetable and animal oils. These results confirm the different relationships between the unit values of exports and unit values of imports for products with similar ISIC-4 industry codes.

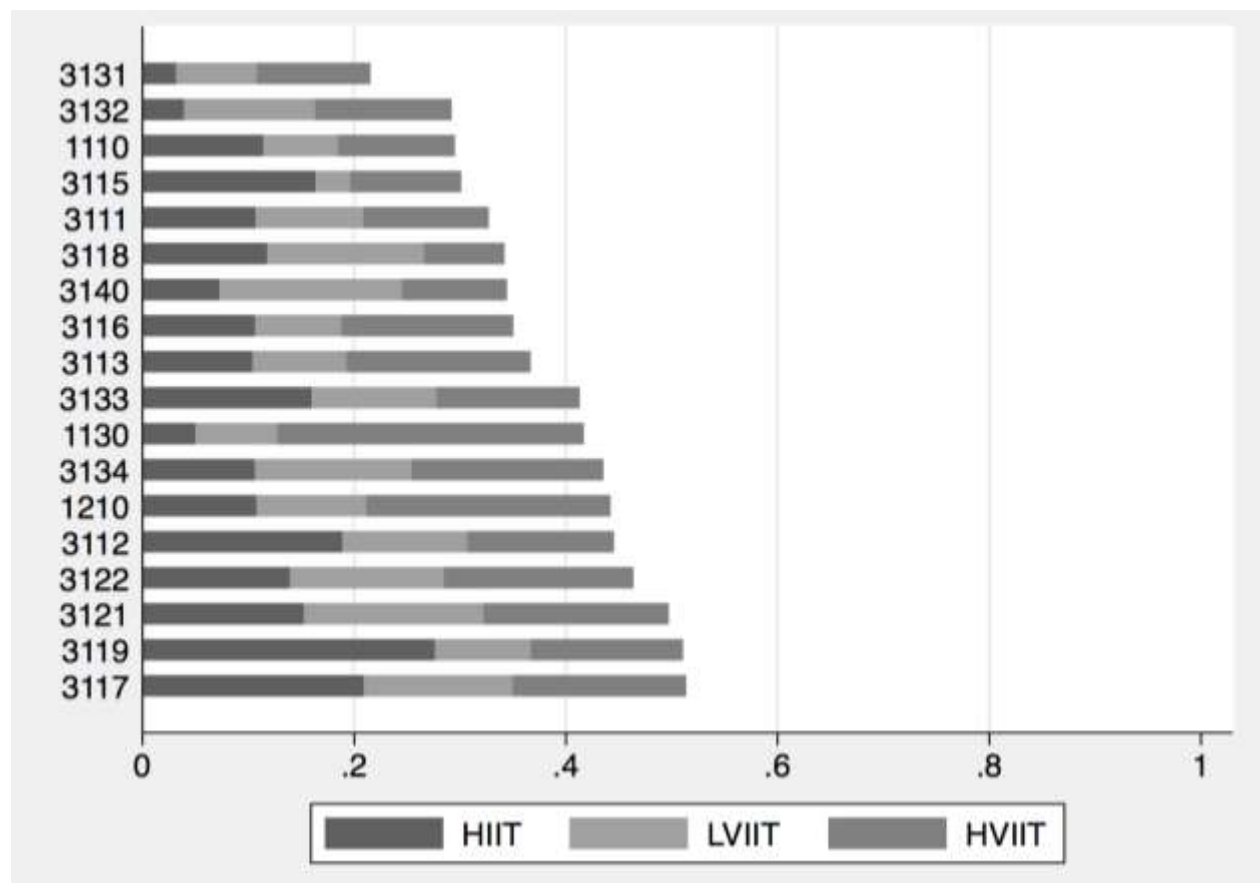


Figure 4. Mean values of intra-industry trade (IIT) indices by ISIC industry from 2000–2011.

Note. HIIT: Horizontal IIT, HVIIT: High Vertical IIT, and LVIIT: Low Vertical IIT.

Source. Author's calculations based on Comtrade database using WITS (World Trade Integration Solution) software.

On average, the proportion of IIT in the agri-food trade of the OMS-15 was higher than the proportion of IIT in NMS-12 agri-food trade. As can be seen from Figure 5, this statement is also

valid for ISIC agri-food product groups. In the OMS-12, the percentage of IIT is highest for 3117 – manufacture of bakery products, and lowest for product group 3131. In the NMS-12, the percentage of IIT is highest for 3134 – the soft drinks and carbonated waters industry, and lowest for 3131. In both the OMS-15 and the NMS-12, the proportion of HIIT is highest for 3119, whilst the proportion of high VIIT is highest for 1130. This suggests that there are some similarities between the importance of HIIT and high VIIT for the OMS-15 and the NMS-12. On the other hand, the percentage of low VIIT is highest for 3140 in the OMS-15 and for 3134 in the NMS-12.

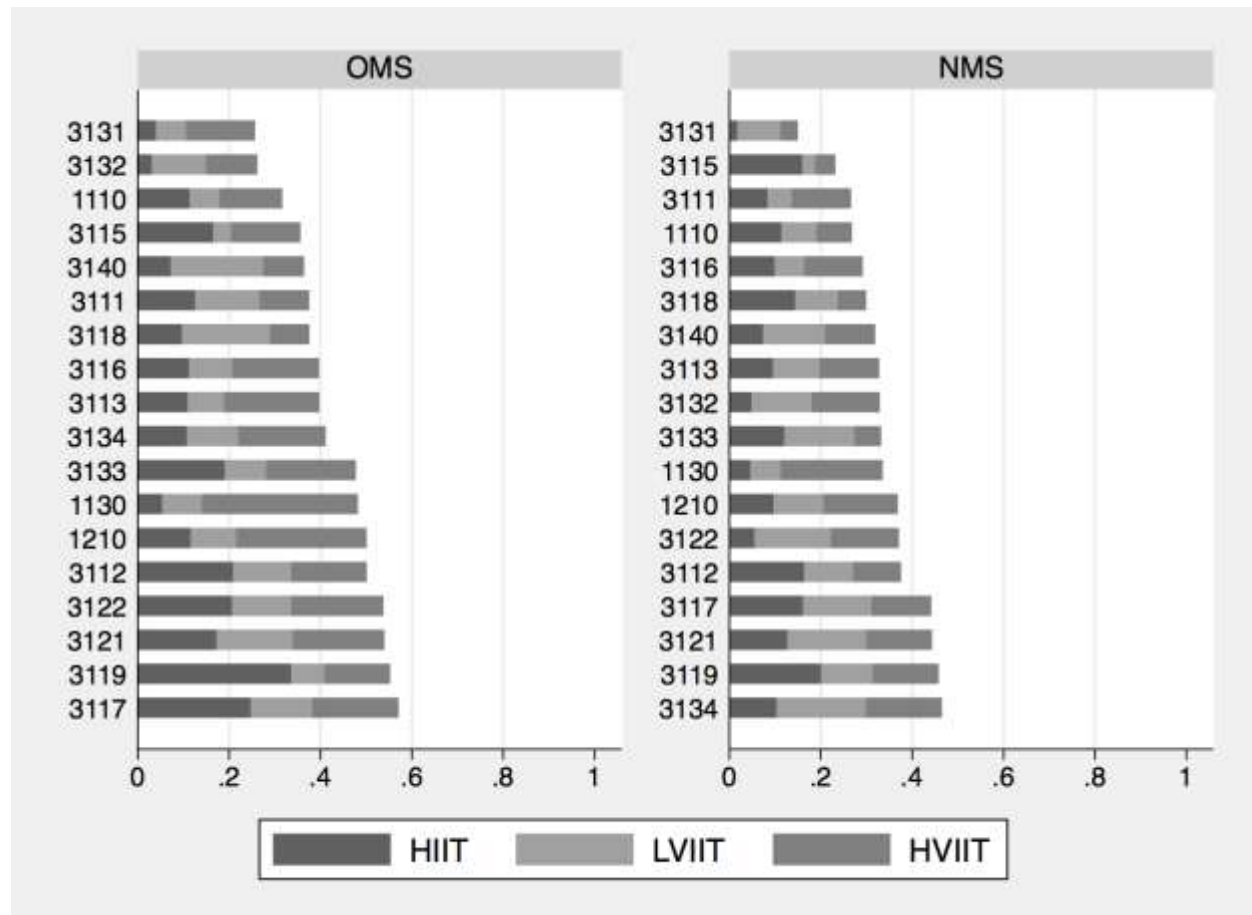


Figure 5. Mean values of intra-industry trade (IIT) indices by ISIC agri-food product group between the OMS-15 and the NMS-12 from 2000–2011.

Note. HIIT: Horizontal IIT, HVIIT: High Vertical IIT, and LVIIT: Low Vertical IIT.

Source. Author's calculations based on Comtrade database using WITS (World Trade Integration Solution) software.

Marginal IIT

MIIT remained relatively low between 2000 and 2011. On average, about 10% of trade expansion originated from bilaterally matched import and export changes in HS-6 or ISIC-4 agri-food product groups. Consequently, the majority of changes in trade involved inter-industry

adjustments. The visible increase in IIT (Figure 1) was therefore not accompanied by a similar rise in MIIT (Figure 6). In agreement with observations made by Brülhart (2009), we confirm that an increase in IIT does not necessarily imply lower adjustment costs for trade expansion. MIIT is significantly lower than IIT. While static IIT increased continuously, the pressures of intersectoral factor reallocations implied by this expansion of trade do not appear to have proportionally lessened during the period under analysis (2000-2011). The highest proportion of MIIT is found for Germany, the Netherlands, Poland and Bulgaria, whilst the smallest proportion of MIIT is found with Cyprus and Malta.

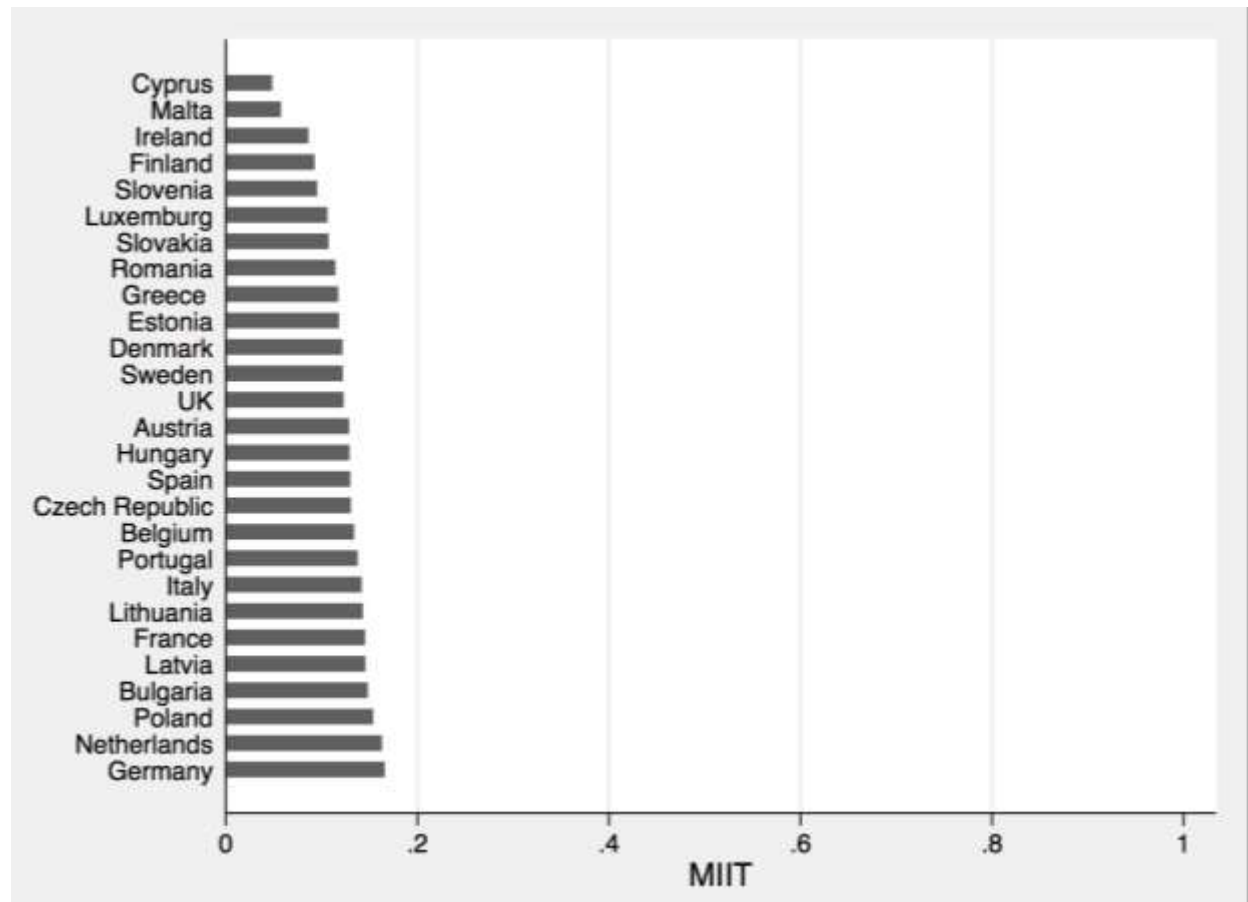


Figure 6. Marginal intra-industry trade (MIIT) indices according to EU-27 member states between 2000 and 2011.

Source. Authors' calculations based on Comtrade database using WITS (World Trade Integration Solution) software.

The Kruskal-Wallis test confirms that MIIT is significantly higher in the OMS-15 than in the NMS-12. In addition, Figure 7 demonstrates the similarities/differences in the MIIT indices between the OMS-15 and NMS-12 across the ISIC-4 agri-food product groups. For both the OMS-15 and the NMS-12 the MIIT index is highest for ISIC 3122, while there are some differences regarding the lowest MIIT index along the ISIC-4 agri-food product groups. However, our research indicates the existence of a weak negative association between the OMS-15 and the NMS-12 country groups.

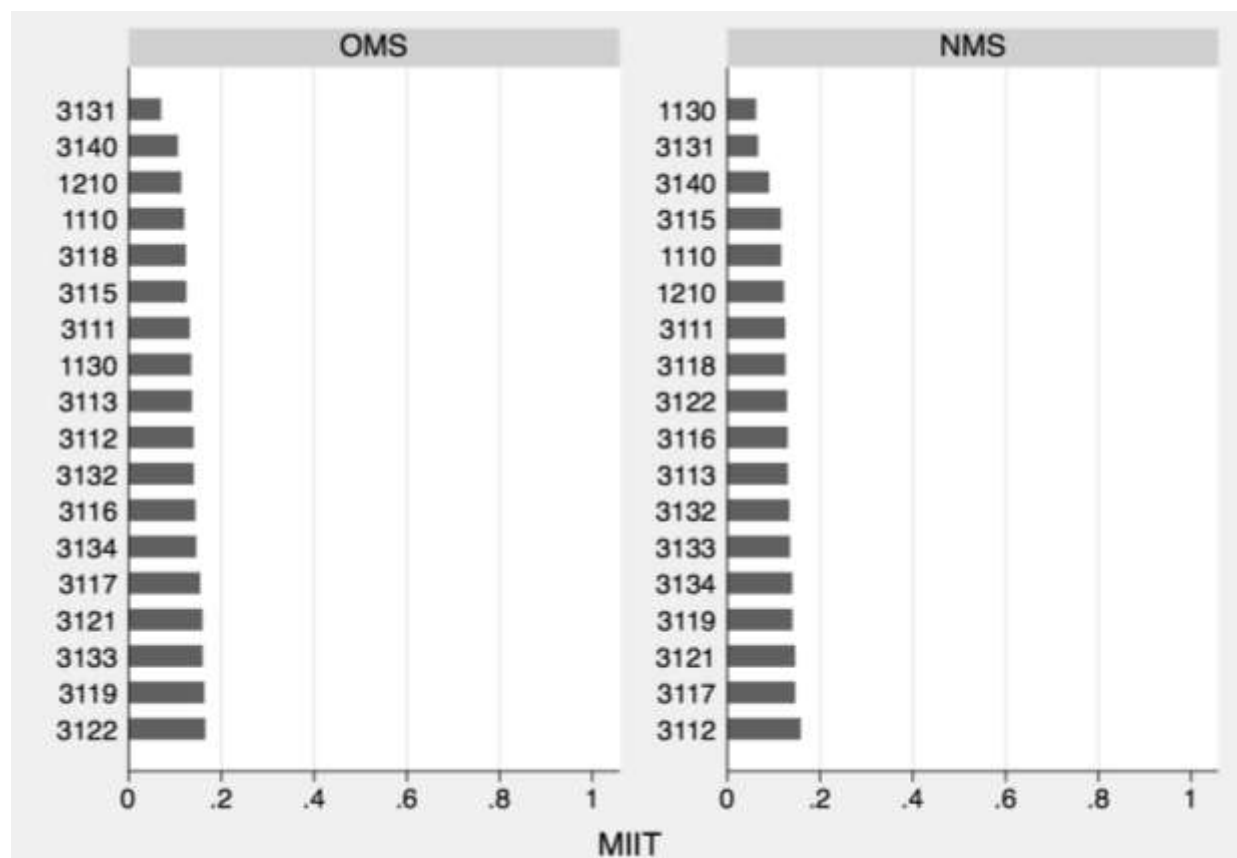


Figure 7. Marginal intra-industry trade (MIIT) indices between the OMS-15 and NMS-12 country groups and the ISIC-4 agri-food product groups between 2000 and 2011.

Source. Authors' calculations based on Comtrade database using WITS (World Trade Integration Solution) software.

IIT Regression Results

Our calculations of the IIT regression indicate that the level of economic development measured by GDP per capita has a positive impact on IIT (both HIIT and VIIT (Table 1)). Market size measured by size of GDP and income distribution measured by the Gini index do not influence the type of IIT indices. The factors a) being a NMS, and b) EU accession are positively associated with both types of IIT.

Table 1. Drivers of intra-industry trade (IIT) indices

	HIIT	VIIT
lnGDP/capita	0.0139***	0.0130***
lnGDP	0.0015	0.0002
lnGini	-0.0048	0.0046
NMS	0.0224***	0.0184***
EU	0.0045***	0.0043***
constant	-0.1487***	-0.1200**
N	148615	148615
R ²	0.0007	0.0009

Note. HIIT: Horizontal IIT and VIIT: Vertical IIT. * p<0.1; ** p<0.05; *** p<0.01.

Source. Authors' calculations.

SAH Regression Results

Calculations suggest that economically richer countries with a higher GDP per capita face lower labor factor adjustment costs, while the total economic size of the country (GDP) has the opposite impact (Table 2). The MIIT index is negatively associated with changes in employment, confirming the prediction of the SAH. The status NMS does not have a significant effect on labor factor adjustment costs.

Table 2. Drivers of Labor Factor Adjustment Costs

	$ \Delta \text{Empl} _{ijt}$
lnGDP/capita	-1.191***
lnGDP	0.126***
Marginal intra-industry trade (MIIT) index	-0.539***
New member states (NMSs)	-0.097
Constant	19.468***
Number of observations	7791
R ²	0.0833

Note: * p<0.1; ** p<0.05; *** p<0.01.

Source: Authors' calculations.

Conclusion

Our analysis of the overall interpretation of the IIT and MIIT indices and their drivers and causalities for the agri-food trade of the EU-27 member states during the period 2000-2011 generates five concluding findings and associated remarks. First, the percentage of IIT in the matched two-way agri-food trade of EU-27 member states has increased; this is consistent with economic integration and the EU enlargements in 2004 and 2007 and the corresponding economic growth that occurred during the period under analysis, with accompanying cyclical developments in economic growth, the recession and recovery in most EU-27 member states.

Second, the IIT indices in agri-food trade vary considerably between the EU-27 member states. The greater significance of inter-industry trade for most EU-27 member states suggests that the prevailing pattern of specialization between agri-food products remains. Belgium, France, the Netherlands and Germany experienced the highest level of IIT among the EU-27 member states. These are economically developed EU-27 member states with a relatively high GDP per capita whose intense IIT is of significant importance and can be further strengthened by increasing the competitiveness of port infrastructure and developing logistical centers for agri-food trade.

Third, the EU enlargements have contributed to some NMS (particularly those from CEE region) catching up in terms of the similarity of agri-food IIT patterns. The EU enlargement with the adoption in the EU of a borderless single market has likely contributed to the restructuring of the agri-food sectors in CEE countries, which in turn has resulted in increases in the competitiveness of agri-food sectors with a greater focus on product quality and product quality differentiation. However, the mixed results concerning how rapidly the NMS-12 are catching up to the OMS-15 suggest the need to deepen integration on both sides because IIT is positively associated with the policy-related processes of EU enlargement.

Fourth, the EU-27 member states have improved in terms of export-to-import unit value, which suggests quality improvements in their matched two-way agri-food trade. A greater focus on agri-food product quality and quality differentiation is determined by the level of economic development (GDP per capita), which on the supply-side with a greater abundance of factor endowments fosters the production of higher added value agri-food products, and on the demand-side with higher purchasing power drives consumer preferences toward more expensive and (in quality terms) more highly differentiated added value agri-food.

Finally, empirical findings about the drivers of the SAH confirm that labor factor adjustment costs during the process of economic integration and agri-food trade liberalization are lower for the economically more integrated and developed EU-27 member states with higher GDP per capita, particularly most of the OMS-15.

One of the more obvious policy implications is that liberalization and thus greater trade openness and market access provide more opportunities for trade. Bilateral and multilateral trade agreements, EU enlargement and market integration with the associated adjustment of food trade legislation and the harmonization of food quality standards, creation of an environment for good quality institutions and the simplification of the implementation of food safety systems and traceability, along with better functioning of international markets, all act to reduce trade barriers and trade costs, which can boost trade and improve quality. Specific recommendations to policy makers are that trade negotiation and trade liberalization activities can contribute to improving access to global markets in developed and emerging market economies. In addition, in a more liberalized trade environment, promoting fair trade practices and promotional activities can incentivize the export of agri-food products on global markets.

Among the implications for agri-business are that maintaining the importance of competitiveness in high VIIT and continuously adjusting to competitive market pressures in agri-food supply markets at different stages of the value chain should be a priority. There is a need to use economies of scale to increase the specialization of existing low VIIT and HIIT products, for research, development and innovation (RDI) activities to create new, higher quality and niche high VIIT agri-food products with higher export prices, and for better labeling, branding and geographical information about products at different scales of IIT. Such priorities can create incentives for businesses to improve their RDI with new products and create higher value-added varieties of agri-food products with a reputation for quality, which are demanded by consumers in countries with high GDP per capita. Both diversification of the export structure of agri-foods using new agri-food products created through the collaboration of different sectors of a country's export set *and* differentiation of preexisting products through the creation of new and different varieties of the same product within one sector and higher value-added products are required.

In terms of managerial implications there is a need for greater specialization to meet demand and consumer preferences at different scales of IIT with a focus on price competition in low VIIT and HIIT and quality competition in high VIIT agri-food value chains. Increasing economies of scale to reduce fixed costs and increase price competitiveness may be important for low VIIT and HIIT agri-food value chains that focus on creating agri-food commodities to meet diverse consumer demands, while high quality competition with brand name development can have as its focus the promotion of specific market niche for high VIIT agri-food products in value chains to

increase product value-added. In terms of managerial practices, a combination of competition-related activities is recommended for the purpose of strengthening market positions through utilizing economies of scale (for preexisting products) and creating niche products with brand names. Implementing the latter suggestion is rational from a managerial perspective as it would create potential market outlets for smaller suppliers of specific agri-food products. A greater role can also be played by producer/supplier associations and different networks in agri-food value chains in terms of increasing economies of scale in production, marketing and the promotion of good practices as regards agri-food international competitiveness.

The different causes and consequences of IIT and its dynamics on different markets are issues for agri-food trade research, businesses and international marketing. The evolution in the patterns of development of IIT indices can be explained by the most important determinants, from the level of economic development and natural agricultural factor endowments to the most recent innovation-related theoretical empirical developments (e.g. Dethier and Effenberger 2012). Consequently, one issue for further research is to identify the additional determinants (explanatory variables) of IIT and the factors involved in agri-food sector quality improvements and global competitiveness for different countries and regional markets (such as intra-EU markets, non-EU markets and other individual countries) using data samples and different periods of analysis. While analysis of country-level analysis and agri-food trade exchanges among countries can generate useful comparisons across space and time, micro-firm level data analysis is also recommended.

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Appendix

Table A1. Description of Four-Digit ISIC-2 Code for Agri-Food Trade

	Four-digit ISIC code
Agricultural and livestock production	1110
Hunting, trapping and game propagation	1130
Forestry	1210
Slaughtering, preparing and preserving m	3111
Manufacture of dairy products	3112
Canning and preserving of fruits and vegetables	3113
Manufacture of vegetable and animal oils	3115
Grain mill products	3116
Manufacture of bakery products	3117
Sugar factories and refineries	3118
Manufacture of cocoa, chocolate and sugar	3119
Manufacture of food products not elsewhere	3121
Manufacture of prepared animal feeds	3122
Distilling, rectifying and blending spirit	3131
Wine industries	3132
Malt liquors and malt	3133
Soft drinks and carbonated waters industry	3134
Tobacco manufactures	3140

Source. http://wits.worldbank.org/product_concordance.html

