Intra-industry trade is one of the most important subjects in the discourse of international economics. Undoubtedly, there is still a need for studies aimed to systematically analyse changes in the composition and directions of trade. The reviewed book is a meaningful voice in the discussion on the significance of such developments for the economic development of the new EU Member States, including Poland.

(An excerpt from the review by Professor Katarzyna Śledziewska)

The analysis was based on the basic Grubel-Lloyd indices and on measures of vertical trade taking account of unit values of products, important for distinguishing goods differentiated in terms of quality (…) correlated with varying consumer income levels. Such a broad analysis is the value added of the publication, with a very detailed insight into the intensity and structure of the intra-industry trade of the whole group of the 10 countries that joined the EU in 2004 and 2007.

(An excerpt from the review by Professor Anna Zielińska-Głębocka)
Intra-Industry Trade
of the New EU Member States
Intra-Industry Trade of the New EU Member States

Theory and Empirical Evidence

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Łukasz Ambroziak
Edward Molendowski
Wojciech Polan
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Abbreviations

BAFTA – Baltic Free Trade Area
CEECS – Central & Eastern European countries
CEFTA – Central European Free Trade Agreement
Comecon – Council for Mutual Economic Assistance
CU – customs union
GDP – gross domestic product
EEC – European Economic Community
EFTA – European Free Trade Association
EMU – Economic and Monetary Union
EU – European Union
FDI – foreign direct investment
FTA – free trade agreement
GATS – General Agreement on Trade in Services
GL index – Grubel-Lloyd index, measure of intra-industry trade intensity
HIIT – horizontal intra-industry trade
HS – Harmonized Commodity Description and Coding System
IIT – intra-industry trade
NMS – new Member States of the European Union
OCA – optimum currency area
PPML – Poisson pseudo-maximum-likelihood model
PPP – purchasing power parity
PTAs – preferential trade agreements
RE – the random effects panel data
SITC – Standard International Trade Classification
UE-10 – the ten Central and Eastern European countries that entered the European Union in 2004 and 2007 (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia)
UE-15 – the fifteen European Union Member States that constituted the EU before the eastern enlargement in 2004 (Austria, Belgium, Denmark, Finland, France, Germany, Great Britain, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden)

UE-25 – all EU Member States after the enlargement in 2007 (UE-15 + UE-10)

VIIT – vertical intra-industry trade

WTO – World Trade Organization
Background and research objectives of the analysis

Since the beginning of the transition, trade has been growing rapidly in Central and Eastern European countries (Poland’s 10 years, 2014, pp. 73-80), which became European Union Member States during the 2004 or 2007 (Eastern) enlargement. They are referred to interchangeably as the ‘EU-10’ or the ‘new Member States’. Trade has been an important mechanism of the integration of those countries into the European Union’s internal market, the main economic pillar of the EU. It first occurred under the association agreements, followed by preparations for accession and, finally, after accession, through a full participation of the countries concerned in the single market of the EU and in other areas included in European treaties.

This analysis aims to verify whether the impressive quantitative changes of EU-10 trade observed since the beginning of their transition have been accompanied by developments in the pattern of trade specialisation of those countries and to identify the determinants of such changes. We intend to achieve this objective using the concept of intra-industry trade (IIT, also referred to as two-way trade), showing the extent to which simultaneous exports and imports of products within the same industry occur.

The analysis excludes Cyprus and Malta due to the fact that they had been market economies for many years and did not experience the radical transformations that significantly affected the development of the countries discussed. Furthermore, the countries in question are very small and average changes identified for the EU-10 as a whole could be entirely irrelevant to the situation of the two countries. Croatia is excluded as it joined the EU much later (in 2013) and its trade changes are not comparable with those of the EU-10. For the purpose of maintaining data comparability, with regard to Bulgaria and Romania the analysis also covers the period from 2004. Furthermore, the ‘non-EU-25’ countries are understood, throughout the period covered (also before the EU enlargement), as countries other than the EU-15 or the EU-10.
Theory indicates that a study of the trade changes in terms of intra-industry trade is useful for at least the following reasons (Dautovic et al., 2014; Fontagné et al., 1998):

1) In the literature, intra-industry trade is considered to be more beneficial than inter-industry specialisation. It increases the variety of products of the same industry, which is beneficial to consumers. This type of trade also allows producers to benefit from economies of scale and to use their comparative advantages. Specialisation within an industry may also stimulate innovation. Producing varieties of a product increases general knowledge about technology and facilitates the implementation of innovation (Ruffin, 1999).

2) It is also believed that changes in directions of intra-industry specialisation are easier and faster as they take place within the same industries rather than between them. This significantly reduces adjustment costs (particularly the costs of employment reallocation) in comparison with inter-industry trade where factor mobility is lower (Faustino, Leitão, 2009).

3) Theoretically, it is assumed that a rising share in vertical intra-industry trade in products of a relatively higher quality in exports than in imports (hereinafter referred to as high-quality VIIT) suggests an increasing role of quality competition (at the expense of diminishing price competition). Thus, VIIT (when varieties of products are of different qualities) informs us about an improving nature of the international specialisation of production and trade.

4) At the same time, a growing share of horizontal intra-industry trade (different varieties of a product of similar quality, abbreviated as HIIT) implies a structural convergence of economies. According to theory, the higher the HIIT, the more similar and the more developed the trading partners are. This, in turn, is an important consideration in terms of the process of convergence of the trading partners and in terms of a successful catching-up process. Thus, the level of and growth in horizontal IIT can be treated as one of the indicators of the degree to which the EU-10 countries are ‘similar’ to the EU-15 (in terms of their incomes and development levels).

5) The IIT approach also allows us to evaluate the preparedness of applicant countries to join the euro area (to assess the stability of the euro zone). The reason is that, according to theory, the higher the share of intra-industry trade, the greater the synchronisation of business cycles, which is considered to be one of the key conditions for successful monetary integration. For this reason, IIT intensity is an important indicator of a country’s stability within a monetary union. This aspect of IIT is of particular importance to the EU Member States still outside the euro area, in order to assess where they are on the path to convergence with the euro-area countries.

In the light of the above remarks, the detailed research objectives of the present analysis are as follows:
(1) examination of the changes in the intensity of EU-10 IIT in their total trade, in trade with groups of major trading partners as well as in bilateral and sectoral terms;
(2) identification of the changes in the structure of EU-10 IIT by type of IIT;
(3) estimation of the impact of macroeconomic factors – with the use of a regression model – on changes in the intensity of EU-10 intra-industry trade.

The analysis will enable an assessment of the changes in the nature of trade specialisation as well as of the degree of economic convergence of individual EU-10 countries and of the whole group with the incomes for more developed partners in 1995-2014. In the context of relations between the EU-10 and the old EU Member States we can say that IIT is a measure of real adjustments taking place in the internal market.

In turn, the identification of the main determinants of development trends and the present pattern of EU-10 IIT will allow to draw conclusions regarding the possible impact of such factors in the future. The conclusions may also prove useful to the EU membership candidate countries.

Structure of the book

Chapter 1 briefly presents the nature of intra-industry trade, its theoretical foundations, methods and problems involved in measurement, major determinants of IIT, the role of IIT in successive stages of economic integration as well as a review of the literature on IIT developments in the EU-10. The chapter provides a framework that is necessary to interpret the results of the empirical studies presented further in the book.

Since there are a significant number of English-language works on the theoretical foundations of IIT, Chapter 1 concentrates on the aspects of the IIT theory that are necessary to explain the research problems presented. Similarly, in the literature review we only take into consideration studies concerning the IIT of the countries under analysis. Therefore, we exclude a great many very important contributions to the IIT theoretical framework and to the empirical evidence that are widely known in the original versions or extensively discussed in other works. Basically, we take account of English-language publications (although with minor exceptions) being unable to fully and objectively compare and assess papers presented in the native languages of the EU-10, very valuable at times. To ensure an equal treatment of the literature, we have also excluded from the review the vast majority of works in Polish.

Chapter 2 offers empirical evidence on the main trends in the patterns of IIT in the EU-10 by groups of major trading partners (intra-EU-10 trade, trade with the EU-15 and with the rest of the world) as well as by main sectors. The intensity of total IIT as well as of its main types (vertical versus horizontal IIT) is calculated. The
standard Grubel-Lloyd indices measuring IIT were used to compare the changes in
the nature of specialisation and the structures of the EU-10 economies before and
after EU accession.

Chapter 3 estimates the impact of macroeconomic determinants – identified on
the basis of theory – on the changes in the intensity of EU-10 vertical and horizontal
intra-industry trade. The IIT factors suggested in the literature were verified with the
use of a regression model on panel data. Those determinants include: the economic
size of the trading partners, differences in economic size between the countries con-
cerned, differences in per capita income, geographical proximity (the distance and
the existence of a common border), foreign direct investment, the economic crisis,
trade liberalisation arrangements (different free trade agreements concluded by the
EU-10), the adoption (or the lack) of the euro. The results of our empirical study
covering the determinants of EU-10 intra-industry trade were compared with the
findings of other studies available in the literature.

The final remarks contain the conclusions as well as policy-oriented reflections.

Methodological remarks

The study was carried out with the use of a number of research methods: from an
overview of the literature (both theoretical and empirical studies) through statistical
and descriptive methods to econometric techniques. Statistical methods were applied
to calculate the changes in the dynamics and pattern of intra-industry trade. In order
to establish the direction of the effects of specific determinants on intra-industry
trade, a regression equation was applied. Its parameters were estimated using the
random effects panel data Tobit model. The robustness of results was tested by
estimating the regression equation parameters with the use of the PPML (Poisson
pseudo-maximum-likelihood) log-linear regression model.

The analysis covers the period 1995-2014, i.e. a total of twenty years (nine years
before and eleven years after the countries concerned acceded to the European
Union). The choice of 1995 as the initial year of analysis was not coincidental, it was
made for two reasons. First, in 1995 three new countries joined the EU (Austria,
Finland and Sweden). From the year in question until the 2004 ‘Eastern enlargement’,
there were fifteen European Union Member States, which ensured the comparability
of the EU-15 statistics. Second, comparable statistical data (the Comtrade database)
was available only from 1995 (cf. sub-chapter 2.1).

For the purpose of analysing the intensity of intra-industry trade, the period
under study was broken down into two stages, i.e. the years 1995-2003 (the period
before the accession of the countries concerned to the EU) and 2004-2014 (the post-
accession period). The stage 2004-2014 was further divided into the years 2004-2008
(before the crisis) and 2009-2014 (after the outbreak of the world crisis).
Contribution to the literature

This book extends earlier works in several ways. A review of the empirical studies on IIT reveals that the authors have not found any study in English covering all of the EU-10 countries. Most of the available papers address IIT trends and/or determinants of IIT in selected Central and Eastern European countries, quite often focussing on the Visegrad countries.

None of the previous works covered such a long period as our study (i.e. 20 years, from 1995 to 2014). The majority of other researchers concentrated on IIT in the period before or immediately after EU accession. Our study used more recent data (until 2014), which allowed to capture the effects of EU membership of the EU-10 in the econometric model.

The PPML (Poisson pseudo-maximum-likelihood) log-linear regression model used in our study is a relatively new method. It has only been employed for several years to estimate parameters in the gravity model of trade, constituting the basis for the regression model allowing to estimate the determinants of intra-industry trade.

Another important merit of our research is that – in comparison with other analyses – the sample used in this study was large as it comprised more than 8,100 observations.

The analysis of the impact of particular determinants on IIT also included their influence on horizontal and vertical IIT (both as overall VIIT and broken down into high- and low-quality VIIT). The IIT indices were computed on the basis of bilateral trade (using a uniform methodology). Moreover, the analysis covered factors relatively seldom addressed in previous studies – inward FDI, outward FDI and membership of the euro area. In the literature on the subject we have found no study on EU-10 intra-industry trade that would be as comprehensive in scope.

Hopefully, with this book the reader is offered an in-depth analysis of the major changes in the nature of production and trade specialisation and of the underlying factors in the 10 new EU Member States.

The authors are very grateful to Professor Elżbieta Czarny for her truly helpful suggestions and discussions on the concept and interpretation of intra-industry trade indices. We also wish to thank Professor Bartosz Witkowski for his very valuable advice regarding the econometric model used and its interpretation.

Our thanks are also addressed to the reviewers, Professor Anna Zielińska-Głębocka and Professor Katarzyna Śledziewska, for their useful suggestions and comments.

The authors are solely responsible for any shortcomings or flaws in the text.
Introduction

Chapter 1 discusses the theoretical framework and tools for the analysis of intra-industry trade, abbreviated as IIT, as well as the results of previous studies on the intensity and determinants of IIT in the 10 Central and Eastern European countries that joined the EU at the beginning of the 21st century (EU-10). It constitutes a point of reference for assessments of the direction and nature of changes in intra-industry specialisation in the EU-10.

Chapter 1 begins with a brief presentation of the essence of IIT and its theoretical foundations. The latter served as the basis for the assessment (contained in Chapter 2) whether the developments observed in the trade of the EU-10 countries under study were consistent or inconsistent with the theoretical indications. Next, the methods of IIT measurement are described. The literature on IIT measurement is rich and in this study we present the most frequently applied concepts and indices, stressing their merits and weaknesses. Only selected measures of IIT intensity are used in Chapter 2 to analyse and assess the direction and nature of changes in the trade specialisation of the EU-10. Another sub-chapter discusses the main macro-economic determinants of IIT. Although the set of determinants of this type of trade is basically unlimited, we only focus on factors that are most frequently identified in the literature. Those include the size of the trading economies, differences in size between the economies concerned, the level of income per capita, differences in income per capita, trade liberalisation (including the creation of free trade areas), geographical proximity, the economic crisis, foreign direct investment (FDI) and the adoption of a common currency: the euro. The above determinants are used in the model presented in Chapter 3 to verify the hypotheses concerning the factors and
mechanisms shaping IIT. Further, the role of IIT in successive stages of economic integration (with a focus on monetary integration) is discussed. Chapter 1 concludes with the findings of other studies (published in English) on IIT developments in the EU-10. Those are compared in Chapter 3 with the estimation results obtained in this analysis for the EU-10.

1.1. The concept and categories of intra-industry trade

(Łukasz Ambroziak, Elżbieta Kawecka-Wyrzykowska)

The phrase ‘intra-industry trade’ was coined by Balassa (1966) to name a phenomenon that had been described for the first time by Verdoorn (1960) in a study about the Benelux countries (Ecochard et al., 2005). The concept was disseminated through a major 1975 publication by Grubel and Lloyd, who described the character of that trade, its different types, measurement methods and related problems as well as the implications for theories on foreign trade and economic policy. The authors proposed a definition, rather widely used at present, of intra-industry trade understood as ‘(...) the value of exports of an “industry” which is exactly matched by the imports of the same industry’ (Grubel, Lloyd, 1975, p. 20). Owing to this specific characteristic, intra-industry trade is also referred to as two-way trade, as opposed to one-way (inter-industry) trade.

Furthermore, they were the first to break down intra-industry trade flows by category of the products involved. They pointed out that IIT was mainly about differentiated products, divided by them into four types (Table 1). Some IIT also concerns homogeneous goods, but their share in intra-industry trade is minor.

### Table 1.1. Categories of products involved in intra-industry trade

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Differentiated</strong></td>
<td>(1) Commodities with rather similar input requirements but low substitutability in use (e.g. petroleum products: petrol and tar; iron products: bars and sheets).</td>
</tr>
<tr>
<td></td>
<td>(2) Commodities with high degrees of substitutability in use (e.g. wood and steel furniture; nylon and wool yarn).</td>
</tr>
<tr>
<td></td>
<td>(3) Commodities with similar input requirements and high substitutability in their respective uses (e.g. cars: Renault and Volkswagen; cigarettes: Players and Gauloises).</td>
</tr>
<tr>
<td></td>
<td>(4) Parts, components and final products are classified in the same statistical category.</td>
</tr>
<tr>
<td><strong>Homogeneous</strong></td>
<td>Functionally homogeneous products traded in specific conditions such as:</td>
</tr>
<tr>
<td></td>
<td>• re-export (mostly driven by the minimisation of transport costs);</td>
</tr>
<tr>
<td></td>
<td>• border trade (trade in products which are functionally homogeneous but differentiated by location);</td>
</tr>
<tr>
<td></td>
<td>• periodic trade (trade is based on predictable, periodic fluctuations in nations’ production of or demand for commodities such as agricultural products, electricity or similar goods);</td>
</tr>
<tr>
<td></td>
<td>• trade in strategic goods (trade in homogeneous commodities due to government regulations).</td>
</tr>
</tbody>
</table>

Source: Own study based on: Grubel and Lloyd (1975, pp. 71-88, 114-118).
Thus, any measure of IIT must be based on a classification of products precise enough so that commodities within one category can be assumed to be substitutes. The important publication of Grubel and Lloyd (1975) on the concept and measurement of intra-industry trade stimulated an enormous interest in this type of trade specialisation and was followed by many theoretical and empirical studies on IIT.

1.2. Theoretical framework

(Łukasz Ambroziak, Elżbieta Kawecka-Wyrzykowska, Edward Molendowski)

Due to the fact that the nature and determinants of intra-industry trade are widely discussed in the literature, in this study we only focus on the selected theoretical elements that seem important for the attainment of the research objectives adopted².

Intra-industry trade (IIT) received scholarly attention in the 1960s in connection with the integration processes in Europe. Several empirical studies found that a substantial share of trade among members of the integration blocs (the Benelux and, especially, the EEC) consisted of similar products, in particular between developed countries. That phenomenon seemed to be at odds with the traditional theories basing on different factor endowments and comparative advantages which explained the specialisation of countries in different types of products. However, IIT in the Benelux and in the EEC concerned similar products of the same industries, also semi-finished products characterised by varying degrees of processing rather than final goods. Trade took place despite the lack of significant differences in factor endowments. The trading countries were at comparable and relatively high levels of development.

The first empirical papers covering the issue of parallel export and import of products that belonged to the same industry were presented by Verdoorn (1960, pp. 291-329), Drèze (1961, pp. 717-738) and Balassa (1966). Later research revealed IIT in relations between various other countries.

The first explanations of IIT suggested that it stemmed from an erroneous aggregation of trade data. In other words, the question was raised whether the observed IIT was a real phenomenon or a result of the aggregation of unrelated products into one group (industry)³. The problem was resolved by the above-mentioned empirical studies which stimulated the development of theoretical models that separated intra-industry and inter-industry trade.

Grubel and Lloyd (1975, pp. 6-9) were the first to pay attention to increasing economies of scale in production and product markets in conditions of imperfect

---

² The theoretical and empirical aspects of IIT were broadly discussed in the Polish language by Czarny, 2002.
³ Finger (1975) famously described IIT as a ‘statistical artefact, a mirage created by the vagaries of statistical classification’.
Graph 1.1. Market structure, differentiation of products and the determinants of trade

- Homogeneous products
  - Oligopoly
  - Reciprocal dumping
- Monopolistic competition
- Perfect competition
  - Demand for variety
  - Diversity of tastes
- Fixed cost in R&D
- External economies of scale
- Comparative advantage
- Intra-industry trade

competition as the causes of the development of two-way trade. The existence of rising economies of scale allows enterprises to reduce unit costs as output grows. This may lead to the monopolisation of an economy where one undertaking only specialises in certain types of product, refraining from producing any other types of goods demanded by consumers.

The following years witnessed the emergence of a large group of theories (concepts) explaining certain aspects of IIT. Owing to the complex nature of intra-industry trade, no single model presenting the mechanism and causes of the existence of all types of IIT flows has been developed so far. The existing models, usually explaining specific types of IIT, can be grouped in various ways. This was done in a clear manner by Fontagné, Freudenberg (1997), see Graph 1.1.

From the point of view of this analysis, the models explaining individual types of IIT (vertical and horizontal intra-industry trade) are of crucial importance. Therefore, we elaborate on those models and omit the inter-industry trade models. We also exclude models taking account of homogeneous products (as presented in Table 1.1, sub-chapter 1.1), due to their very modest share in international trade.

The first models of IIT were based on the Dixit and Stiglitz (1977) concept of monopolistic competition. They assumed that goods were horizontally differentiated. Vertically differentiated products were not addressed by theorists until a few years later.

**Box 1.1. Horizontal intra-industry trade (HIIT) versus vertical intra-industry trade (VIIT)**

The breakdown into vertically and horizontally differentiated products (HIIT and VIIT, respectively) was suggested by Greenaway et al. (1994, 1995). The authors identified those two groups of products taking as a criterion the relative unit prices in exports and imports (the so-called unit value) – for more, see sub-chapter 1.3. They adopted the assumption that unit prices reflected differences in quality.

**Horizontal IIT**

Theory explains that horizontal intra-industry trade (HIIT) consists in the exchange of varieties of goods with similar qualities and various other features that are important to consumers, i.e. taste or colour. This group also includes products identical in terms of production technology but perceived as different by buyers (e.g. types of aspirin sold under different brands).

Horizontal intra-industry trade (HIIT) cannot be explained by the traditional theory of comparative advantages. HIIT is usually analysed in the framework of monopolistic competition. On the supply side, HIIT is driven by increasing returns to scale, whereas on the demand side, it is fuelled by diverse consumer preferences (e.g. cars of a similar class and price range). Consumer preferences for variety induce producers to increase production (and thus to reduce the average production costs).
and specialise in separate varieties of products. In this way, consumers obtain access to cheaper products.

There are two approaches to HIIT based on monopolistic competition and product differentiation: the concept of ‘demand for variety’ (‘love of variety’; the neo-Chamberlinian model) and the concept of an ‘ideal product’ (also known in the literature as the ‘diversity of tastes’ or ‘favourite variety’; the neo-Hotelling model).

The concept of love of variety was introduced by Krugman (1979, 1980) and developed by Dixit, Norman (1980). It consists in the idea that consumers want to buy many varieties of products and gain welfare from the amount of variety. The concept of diversity of tastes was introduced by Lancaster (1980) and developed by Helpman (1981). It assumes that different consumers have different preferences for alternative varieties of a given commodity and each consumer prefers one variety to all others. If all goods from a group are accessible and at the same unit price, the consumer will seek to purchase the one favourite variety which is the closest to the ‘ideal product’. In other words, consumers want to buy the good which has the most ‘ideal’ characteristics to them.

In both models each variety is produced under decreasing costs and when countries are open to trade, the similarity of the demands leads to intra-industry trade.

Eaton and Kierzkowski (1982) also analyse intra-industry trade in horizontally differentiated products in conditions of oligopolistic competition. According to the above-mentioned authors, the creation of an oligopoly is determined, on the one hand, by limiting the number of varieties regarded by consumers as ideal (to a maximum of two) and, on the other hand, by the way in which the industry concerned develops (non-simultaneous output decisions made by firms). Intra-industry trade will occur in a situation where each country comes to specialise in the production of a single variety of the commodity in question. The scale of intra-industry trade will depend on factors such as the distribution of customer preferences in both countries.

HIIT is typical of countries with similar and highly developed patterns of economic structures and with similar factor endowments. Such countries are able to produce differentiated goods, usually offered by well-developed manufacturing sectors. Also, developed countries create the greatest demand for such products. As HIIT is usually correlated with economic similarities, increasing HIIT implies the structural convergence of economies.

4 ‘Neo-Chamberlinian models, such as Krugman models, consider the assumption that all varieties enter the utility function symmetrically. By contrast, the neo-Hotelling model, for example the Lancaster model, assumes asymmetry. In the former, the consumers are assumed to endeavour to consume as many different varieties of a given product as possible (‘love of variety approach’). In the latter, different consumers have different preferences for alternative varieties of a given commodity and each consumer prefers one variety to all others (‘favourite variety approach’). In these models each variety is produced under decreasing costs and when the countries open to the trade the similarity of the demands leads to intra-industry trade’ (Faustino, 2008).
Vertical IIT

Theory explains that vertical IIT is an exchange of similar final goods with different qualities and prices (e.g. Italy exports high-quality clothing and imports low-quality clothing) or an exchange of final and intermediate goods produced in the same industry (e.g. exchange of car seats for engines). Thus, it is assumed that consumers rank alternative varieties according to product quality.

Vertically differentiated products mean that one variety as compared with another shows greater intensity of a certain characteristic or has additional properties. Vertical product differentiation results from supply-side factors since an improvement in product quality involves additional inputs, pushing up the unit price of the product. In contrast to horizontal product differentiation, consumer tastes are identical. However, due to the fact that the price increases with quality and everyone seeks a product characterised by the best quality available, the choice of a particular variety of the product is determined by the buyer’s income level. Therefore, it results from income disparities rather than from the love of variety.

Intra-industry trade in vertically differentiated products is analysed in conditions of perfect competition and oligopolistic competition (Graph 1.1).

The theoretical model of IIT in vertically differentiated products (in the framework of perfect competition) was mainly developed by Falvey (1981), Falvey and Kierzkowski (1987). The authors explained VIIT flows by the same factors that explain inter-industry trade, i.e. by the differences between the countries in factor endowment, technology and the pattern of income distribution (Caetano, Galego, 2007). The common elements in the concepts of VIIT by the above-mentioned authors are the relationship between production factor prices and relative factor abundances (the relative abundance of a factor in a country is accompanied by a relatively low price of the factor), and the existence of constant returns to scale (the unit cost of a commodity does not depend on the output). In Falvey’s model, consumer demand for vertically differentiated products is determined by relative income. Quality depends on relative capital intensity, products with a higher capital-labour ratio being of a higher quality. If countries have different factor endowments, the relatively capital-abundant country will export high-quality products, whilst the relatively labour-abundant country exports lower-quality products. Important contributions to the theory of IIT were made by authors such as Jones and Kierzkowski (1990), Arndt and Kierzkowski (2001) and Cheng and Kierzkowski (2001).

The model of vertical intra-industry trade taking account of oligopolistic competition was created and developed by Gabszewicz and Thisse (1979), Gabszewicz et al. (1981), Shaked and Sutton (1984). According to Shaked and Sutton (1984), the reason for engaging in intra-industry trade is to benefit from market expansion
and the related possibilities to cut the average cost and price\(^5\). Market expansion driven by intra-industry trade leads to a reduction in the number of firms operating in the market concerned, consequently to production concentration. The products traded are varieties characterised by a higher quality and lower prices than before such trade took place. In the long run, firms’ survival depends on the improvement of product quality and on economies of scale, which can lead to the emergence of ‘natural’ oligopolies. Likewise, Flam and Helpman (1987) emphasised the importance of technological and income differences between countries in explaining IIT flows.

To sum up, differences in factor endowment, technology and income distribution may explain VIIT. The results of concrete models explaining VIIT can be interpreted as a ‘quality ladder’ approach, since more advanced countries export higher-quality varieties, while lower income countries export lower-quality ones (Caetano, Galego, 2007).

Based on the theoretical explanations, we expect vertical IIT to be more pronounced between countries at different levels of economic development, i.e. developing and developed economies, than between developed countries. Less developed countries usually specialise in those stages of production in which they have comparative advantages, e.g. cheap, unskilled labour. Thus, they export labour-intensive varieties of goods, while importing capital-intensive varieties of products from developed countries.

**Intra-industry trade and production fragmentation**

The division of the above-discussed intra-industry trade theories excludes issues related to multi-stage production, the so-called fragmentation of production, i.e. the splitting of a production process ‘into separate parts which can be done in different locations’ (Deardorff, 2005). Splitting a production process into particular steps offers great opportunities for the development of vertical intra-industry trade since the products traded include not only final goods but also intermediates (parallel export and import of parts and final goods) within the same industry\(^6\). Thus, IIT comprises parallel export and import of parts and accessories, parallel export and import of final

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\(^5\) For comparison, the Brander model (1981) and the Brander–Krugman model (1983), i.e. models explaining horizontal intra-industry trade in conditions of oligopolistic competition, considered market segmentation to be the reason for engaging in intra-industry trade.

\(^6\) Not all examples of international fragmentation of production represent IIT: some fragments (usually parts) may be used in other industries than the majority of production categories (fragments) classified in the same industrial category (Jones et al., 2002, p. 69). Much depends on the level of the aggregation of trade resulting from the international fragmentation of production. At a highly disaggregated product level, different intermediate and final goods are usually classified in distinct product categories and their trade flows are considered inter-industry trade. However, at a more aggregate level, intermediate and final goods tend to be classified in the same category (as IIT) – see: Jones et al., 2002.
goods as well as parallel export and import of parts and final goods. Fragmentation explains some of the increases in world trade, as more intermediate goods circulate between countries and sometimes cross the borders several times. The phenomenon intensified with the elimination of a number of barriers to international trade in goods and the deregulation of capital flows. It was also fuelled by the development of information technology, substantially pushing down costs of communications, as well as by reduced transport costs (Baldwin, 2012).

A theoretical framework for analysing fragmentation was first introduced by Jones and Kierzkowski (1990, pp. 31-48) and further developed by Jones and Kierzkowski (2000). The authors explained the fragmentation processes using the concept of increasing returns, as had been done in the earlier models of IIT, but in a different way. Also, they incorporated into their concept the basic elements of the Ricardian trade theory and of the Heckscher-Ohlin theory. In explaining the fragmentation process, Jones et al. distinguish between production blocks and service links (Jones et al., 2002, pp. 67-72). A commodity can be produced in a single place and time (in a ‘production block’), in a way characterised by the typical ‘constant-returns-to-scale production function’. However, due to the possibility of achieving additional benefits (increasing returns) resulting from specialisation (as suggested by Adam Smith), production can be divided into several production blocks. Those blocks can be placed close to each other or in different countries. In any case, they must be coordinated by ‘service links’, including transportation, communication, etc. Such coordination involves additional costs but also introduces increasing returns. An increasingly fragmented production structure offers lower marginal costs (due to outsourcing production blocks to new, lower cost places). The price is a higher cost of service links (to coordinate production blocks located in different countries). As already mentioned, reduced communication and transport costs as well as technical progress in other areas have substantially decreased the costs of service links and have fostered the degree of international fragmentation of production.

As the authors put it: ‘Fragmentation works in many ways like technological progress, lowering the costs of obtaining the final good, and in turn may stimulate technical progress as fragments of one industry might be used in other industries as well once certain modifications allow “one size to fit all”. In the latter case, fragmentation can stimulate inter-industry trade as well as intra-industry trade’ (Jones et al., 2002, p. 72).

In general, the conclusion is that ‘a third type of intra-industry trade is gaining increasing importance. This trade is encouraged by technological improvements that lower the costs of the service links that bind the various fragments of a production process. These fragments may be located initially in a vertically connected form in one location, but with service links becoming less costly and formal regulatory barriers disappearing, increasingly it is possible that various fragments are outsourced among a number of countries’ (Jones et al., 2002, p. 83).
Intra-industry trade in services

A new research element is IIT in services. Few studies have addressed this issue so far. The first study on the subject is likely to have been one on transportation services (Kierzkowski, 1989, pp. 92-120), followed by that of Lee, Lloyd (2002, pp. 159-179). The latter authors computed indices of the intensity of IIT in services (using unadjusted GL indices) for 20 OECD countries in 1992-1996. They concluded that IIT in the analysed countries had been relatively high and stable over time.

The modest interest of researchers in various aspects of intra-industry trade in services primarily stems from the lack of a uniform approach in the literature to the definition of trade in services, from problems with the availability of statistical data on trade in services (particularly as broken down into disaggregated service categories) and their comparability between countries. Lee and Lloyd (2002, pp. 159-179) argue that, in view of a very important and fast increasing role of services in international trade, there is a great need for the development of models of IIT in this particular area of trade. Such models should first of all explain the determinants of IIT in services and ‘be able to shed light on its welfare implication’ (Lee, Lloyd, 2002, p. 175). Better knowledge on IIT in services could also be used to predict the gains from the liberalisation of trade in services and the resulting adjustment costs.

A later study in the field of intra-industry trade in services covers the issue of such trade in banking services (Moshirian et al., 2005). It adopts key elements of the new trade theories of IIT in order to measure the determinants of IIT in the banking sector. The empirical results show that the following determinants play a crucial role in the growth of IIT in banking services: factor endowments, average per capita income, FDI, economies of scale, trade intensity between the countries analysed and market openness. Thus, the determinants are the same as in the case of trade in goods, although their weights may be different.

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7 Two definitions of trade in services are most commonly used. The oldest one is that suggested by the IMF Balance of Payments Manual (IMF, 1993). It includes transactions on trade in services recorded in the current account balance that are neither goods transactions nor income payments. This approach to services is, of course, very broad. The other definition is contained in Article I of the GATS. Trade in services is defined as the supply of a service across national borders by one of the four modes: (a) from the territory of one Member into the territory of another Member (‘cross-border’ or Mode 1); (b) supply to the service consumer who moves to the country of the service supplier (‘consumption abroad’ or Mode 2); (c) supply by a service supplier who moves to the country of the consumer (‘commercial presence’ or Mode 3); (d) supply through temporary movement of natural persons (‘presence of natural persons’ or Mode 4). The IMF definition roughly corresponds to Modes 1 and 2 only.

It is not clear which of the two definitions should be preferred in practice. The problem is also that some types of trade in services are not recorded by the present statistics (e.g. supplies of services by Mode 3). In general, no statistics of service trade by the GATS modes are available (Lee, Lloyd, 2002, pp.159-179).
Leitão (2012) studied the determinants of intra-industry trade (IIT) in tourism services between Portugal and 17 countries in 2002-2009. He found that relative factor endowments (measured by differences in GDP per capita) and geographical distance influenced IIT in tourism services negatively, while the economic dimension (measured by an average GDP of trading partners) and common border promoted IIT.

Tang et al. (2013) analysed bilateral trade in services between China and its main trading partners in 1982-2009. They concluded that ‘liberalisation of trade in services, trade in goods, and China’s large home market drive the growth and lead to a high level of intra-industry trade in services’.

1.3. Measurement of the intensity of intra-industry trade

(Łukasz Ambroziak, Wojciech Polan)

The concept of an industry and the criteria for its separation

A correct division of products classified into specific industries is extremely important for reliable estimations of the intensity of intra-industry trade. Basing on the criterion for aggregating goods into industries proposed by Grubel and Lloyd (1975, pp. 85-101), there are two approaches in the literature:

(a) the supply-side approach (similarity of products in terms of production processes);

(b) the demand-side approach (substitutes from the point of view of the consumer).

Such commodity groupings should contain similar goods. It means that products grouped in an aggregate will be close substitutes, at the same time being significantly different from goods excluded from the said aggregate. It is also important that close substitutes must not be included in various groups of products. In practice, the correct definition of an industry comes down to the selection of a particular classification used in foreign trade (usually the HS or the SITC) and a specified level of data disaggregation. That, in turn, gives rise to problems with the adoption of an appropriate level of product aggregation in an industry (the so-called sectoral bias – cf. sub-chapter 1.3.).

Box 1.2. Selection of a trade classification for the purpose of defining an industry

International trade analyses usually use one of the two classifications: the SITC (Standard International Trade Classification) or the HS (Harmonised System). In the former, products are grouped on the basis of their material and physical properties as well as according to the stage of processing. The HS is organised by economic activity or component material. It is divided into 21 sections which are subdivided into 96 chapters.
Increased fragmentation of production processes also resulted in new problems with defining an industry. This is connected with a rising share of processed semi-finished goods in international trade (cf. Box 1.3).

**Box 1.3. Definition of an industry and the fragmentation of international trade**

In addition to final products (e.g. simultaneous export and import of cars), intra-industry trade increasingly concerns intermediate goods. Furthermore, within the same industry final goods may be traded for components (e.g. simultaneous export of cars and import of engines) or transactions may only cover components (e.g. simultaneous export of engines and import of gearboxes).

The above was pointed out by Grubel and Lloyd (1975, pp. 102-118) as early as in the mid-1970s, but such issues did not gain importance until a later period when the scale of the phenomenon increased. The inclusion in the same industry of both the final product and a processed semi-finished product has certain implications. From the buyer point of view those are not substitutes but complementary goods, results of manufacturing at different stages of the production process. Likewise, from the producer point of view, final and intermediate goods are not substitutes as they are manufactured using production techniques characterised by significantly different input requirements. In statistical terms, however, it is not possible to group products within an industry so as to make finished and semi-finished goods disjoint sets. Therefore, in the literature it is assumed acceptable for a commodity group, referred to as an industry, to comprise both finished and semi-finished products (cf. sub-chapter 1.2).

**The Grubel-Lloyd index**

The pioneers in the measurement of the intensity of intra-industry trade include Kojima (1964) and Balassa (1966). However, the measures they proposed gained no recognition due to their imperfections. The first researchers to present a well-developed measurement method for intra-industry trade were Grubel and Lloyd (1975, pp. 20-24). They applied the following indices for measuring the intensity of inter-industry trade for an industry:

\[
A_i = \frac{|X_i - M_i|}{(X_i + M_i)} \cdot 100
\]

and of intra-industry trade:

\[
B_i = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \cdot 100 = (1 - A_i),
\]

where:

\(X_i\) – value of exports of industry \(i\);
\(M_i\) – value of imports of industry \(i\);
\(B_i\) – simple Grubel-Lloyd index of intra-industry trade for industry \(i\).

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8 Where exports \((X_i)\) and imports \((M_i)\) are expressed in the currency of the country under analysis (the home country) on the same price terms, i.e. exports and imports should be valued f.o.b. and c.i.f., respectively.
1.3. Measurement of the intensity of intra-industry trade

The Grubel-Lloyd index \( B_i \) takes on a minimum value of zero when there are no products in the same industry that are simultaneously imported and exported and a maximum value of 1 (or 100%) when all trade is intra-industry in nature.

\( B_i \) allows to measure the share of intra-industry trade in the total trade of an industry. For the purpose of measuring the intensity of intra-industry trade at a certain level of aggregation (e.g. a commodity section) or at the level of total trade, the above index must be modified (Grubel, Lloyd, 1975, p. 21). It will be as follows (\( \overline{B}_i \)):

\[
\overline{B}_i = \sum_{i} B_i \left( \frac{(X_i + M_i)}{\sum_{i} (X_i + M_i)} \right) \cdot 100 = \frac{\sum_{i} (X_i + M_i) - \sum_{i} |X_i - M_i|}{\sum_{i} (X_i + M_i)} \cdot 100,
\]

where:

\( n \) – set of industries \( i \).

The above listed IIT indices concerned the trade of a country with all its trading partners as a whole. Lloyd (1975, pp. 35-36) also designed a method for analysing bilateral intra-industry trade flows. It is as follows (\( B_{jk} \)):

\[
B_{jk} = \left( \frac{(X_{jk} + M_{jk}) - |X_{jk} - M_{jk}|}{(X_{jk} + M_{jk})} \right).
\]

where:

\( B_{jk} \) – means the intensity of the intra-industry trade in the trade of products from industry \( j \) with country \( k \).

The scientific community developed many other ways of measuring the intensity of intra-industry trade. Those include measures described by: Aquino (1981), Brülhart (1994), Hamilton and Kniest (1991). Most of those are based on the bilateral Grubel-Lloyd index, still being appreciated by most researchers.

**Issues related to the Grubel-Lloyd measure**

Measurement of the intensity of intra-industry trade has been problematic since the very beginning, i.e. the 1960s. In addition to the above-mentioned issues connected with the proper definition of the concept of an industry, the literature identifies several other causes of such difficulties (Greenaway, Milner, 2003; Fontagné, Freudenberg, 1997):

(a) geographical bias (this arises from an insufficient disaggregation of partner countries);
(b) sectoral bias and the level of aggregation of statistical data (this stems from an insufficient disaggregation of products in the trade classifications);
(c) trade imbalance (the greater the trade imbalance of a country the more undervalued the intensity of intra-industry trade).

Ad. (a) geographical bias
The value of the IIT index depends on whether the calculations are based on bilateral trade flows (e.g. Poland’s trade with individual EU-15) or whether the partner countries are put together before doing the calculations (e.g. Poland’s trade with the EU-15 as a whole), and in the extreme case, only a country’s trade relations with ‘the rest of the world’ are analysed.

For instance, in a given industry, country A’s trade with trading partners B and C (country A’s exports to B and country A’s imports from C), treated as a single trade bloc, may be qualified as intra-industry trade since exports and imports of 100 units present a perfect overlap [part (a) of Graph 1.2]. However, if we consider bilateral flows, we see that country A’s trade is a one-way trade with either partner, as A only exports to B and only imports from C [part (b) of Graph 1.2].

Graph 1.2. Geographical bias arising from statistical data aggregation

![Graph 1.2](image-url)


Thus, the computation of the intensity of intra-industry trade based on data aggregated for a group of countries (e.g. the EU-15) leads to an overstatement of IIT indices. Therefore, it seems justified to use bilateral data in calculations.

Ad. (b) Sectoral bias and the level of aggregation of statistical data
The value of the IIT index is sensitive to the level of product aggregation (Fontagné, Freudenberg, 1997): the more products are grouped together into an ‘industry’ (the less detailed the classification used), the higher the probability of overlap between exports and imports of that industry (the so-called ‘sectoral aggregation bias’ or the ‘categorical aggregation problem’). Consequently, the IIT intensity is lower and therefore difficult to interpret (Lipsey, 1976).
In practice, the intensity of intra-industry trade is most often analysed on the basis of GL indices computed either at the level of 4- / 6-digit HS codes or at the 3- / 5-digit level of the SITC. However, each of the levels of aggregation gives rise to certain objections. Excessive disaggregation does not imply more reliable results concerning the level of intra-industry trade.

Due to the lack of uniform rules for defining an industry, the selection of both the appropriate trade classification and the level of data detail is largely arbitrary. It significantly undermines the comparability of results obtained by various researchers.

**Ad. (c) Trade imbalance**

Failure to take account of the overall trade imbalance is regarded in the literature as a major drawback of the intra-industry trade intensity indices proposed by Grubel and Lloyd. The greater the degree of imbalance in total trade, the larger the differences between exports and imports in particular industries, which leads to undervalued intra-industry trade indices. If exports are permanently different from imports, the intra-industry trade (GL) index will be lower than 1 irrespective of the actual intensity of intra-industry trade. In such a situation, the value of the GL index reflects not only the intra-industry trade intensity but also the degree of trade imbalances. In order to eliminate this deficiency, adjustment methods have been suggested (Brülhart, 2002, p. 114). The most widely used correction is the one proposed by Aquino (1978). The author defined the so-called hypothetical values of exports and imports \( (X^e_{ij}, M^e_{ij}) \) for an industry assuming that the overall trade balance was zero. Those values were then used to correct the GL index (Aquino, 1978, pp. 280-281):

\[
Q_j = A = \frac{\sum_i (X^*_j + M^*_j) - \sum_i |X^e_{ij} - M^e_{ij}|}{\sum_i (X^*_j + M^*_j)} * 100,
\]

where:

\[
X^*_j = \frac{1}{2} \frac{\sum_i (X^*_{ij} + M^*_{ij})}{\sum_i X^*_{ij}}
\]

is the value of exports of products from an industry, assuming that the total exports of the country concerned equal its imports;

---

9 For example, an over-inclusive industry seems to be SITC 793 (ships and boats), comprising vessels from canoes to container ships.

10 Such an approach may lead to a situation where similar products (close substitutes from the consumer’s point of view) are included in different commodity groups and trade in them is consequently regarded as inter-industry trade.
Chapter 1. Theoretical framework of intra-industry trade and a review of the literature...

\[ M_{ij}^e = \frac{1}{2} \sum_i (X_{ij} + M_{ij}) \]

is the value of imports of products from an industry, assuming that the total exports of the country concerned equal its imports.

The index proposed by Aquino has a certain flaw. It assumes imbalanced imports and exports in all industries. In fact, that assumption may not always be valid.

Most researchers choose the basic GL index in their analyses. It allows a simple division of trade flows into intra- and inter-industry trade as well as – due to its widespread application in studies – comparative analyses of the results obtained.

Dynamic analysis – marginal intra-industry trade

The Grubel-Lloyd index is a static measure as it captures the degree of sectoral trade overlap in one particular period of time, usually one year (Brülhart, Elliot, 1998). Brülhart argues that ‘even an observed increase in “static” IIT levels between two periods could “hide” a very uneven change in trade flows, concomitant with inter- rather than intra-industry specialisation’ (Brülhart, 1994). Hamilton and Kniest (1991) proposed an index of ‘marginal IIT’ (MIIT), also referred to as a dynamic measure of IIT, to show changes over time in the GL index. Thus, the purpose of the marginal measure is to compare the pattern of changes in trade flows over time. It supplements the standard GL index which measures the composition of trade at different points in time (Brülhart, 1994).

MIIT is used mostly in studies on the smooth adjustment hypothesis, in the context of research on the extent of structural adjustments induced by trade changes. Numerous authors postulate that adjustment costs (e.g. unemployment) resulting from trade growth are lower in the case of IIT compared to inter-industry trade (cf. also sub-chapter 1.5). For the purpose of verifying this hypothesis, the standard GL index is not sufficient. In order to assess adjustments to trade conditions, it is of key importance to determine the changes in the intensity of intra-industry trade in trade flow movements (marginal intra-industry trade), rather than to compute the share of two-way trade in total trade.

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11 To be precise, the GL index is not a ‘static’ measure as it refers to flows of goods (or services). However, MIIT is a ‘dynamic’ measure in the sense that it relates to the change in these flows between defined time periods (Brülhart, 1994).

12 However, the practical application of the index is limited, as it may only be calculated for non-negative changes in the value of trade flows. It means that structural fluctuations can solely be measured in the case of trade increases. This is impossible with a fall in trade.
An alternative approach to the measurement of two-way trade

In the late 1990s, Fontagné and Freudenberg (1997) proposed a method – very different from the classical approach – for the measurement of intra-industry trade, based on the concept presented by Abd-el-Rahman (1986a, 1986b). It classifies all trade flows as either intra- or inter-industry trade. It means that in an industry trade can be regarded as intra-industry where the value of the minority flow (for example imports) represents at least a significant share (usually 10%) of the majority flow (for example exports). The condition in question can be formulated as follows:

\[
\frac{\min(X_i, M_j)}{\max(X_i, M_j)} > 0.1. 
\]

If trade flows do not satisfy the above inequality, total trade is considered to be of an inter-industry nature.

The concept of the measurement of intra-industry trade proposed by Fontagné and Freudenberg seems to bear more semblance to reality than that of Grubel and Lloyd. The reason is that all exports and imports of an industry are classified as either two-way or inter-industry trade. Exports of products of the industry concerned can be the result of a single specialisation only – intra- or inter-industry. In a situation where one of the trade flows is distinctly lower than the other (e.g. the value of exports is lower than that of imports by 10%), such trade cannot be considered two-way since the overlap of export and import flows is fortuitous. For comparison, in such a case Grubel and Lloyd regarded overlapping trade flows, i.e. the value of exports and the matching value of imports, as intra-industry trade. They considered the remaining flows to be inter-industry trade.

The measurement of horizontal and vertical intra-industry trade

*The concept proposed by Greenaway, Hine and Milner*

As already stressed, the literature distinguishes between two types of IIT: HIIT and VIIT (sub-chapter 1.2). The distinction between HIIT and VIIT is usually based on the assessment of product quality. To assess different qualities, the unit values of traded products in exports and in imports are commonly used. The underlying assumption is that relative prices are likely to reflect relative qualities of products. This approach, commonly adopted in research, was proposed by Greenaway et al. (1994) and developed by Hine et al. (1998).

According to the authors, IIT is considered to be HIIT if the following criteria are met:

\[
1 - \alpha \leq \frac{UV_{ij}^x}{UV_{ij}^m} \leq 1 + \alpha ,
\]
IIT is vertical trade when: 
\[ \frac{UV^x_{ij}}{UV^m_{ij}} < 1 - \alpha \quad \text{or} \quad \frac{UV^x_{ij}}{UV^m_{ij}} > 1 + \alpha, \]
where:
- \(UV^x_{ij}\) – unit value of exports for product \(i\) from industry \(j\);
- \(UV^m_{ij}\) – unit value of imports for product \(i\) from industry \(j\);
- \(\alpha\) – dispersion factor – relative unit values of exports and imports.

Thus, when unit values of products are close (it is usually assumed that the export and import unit values differ by less than 15%), they are considered to be similar or horizontally differentiated (two-way trade in varieties). Otherwise, traded products are vertically differentiated (two-way trade of qualities).

Trade in vertically differentiated products is also frequently divided into the following groups (e.g. Dautovic et al. 2014, Pittiglio 2008):

a) low-quality vertical intra-industry trade (low-quality VIIT) – when the ratio of the unit value in export to the unit value in import is below the 0.85 threshold; this situation is considered to characterise exports of low-quality products and imports of high-quality products;

b) high-quality vertical intra-industry trade (high-quality VIIT) – when the respective ratio is above 1.15 it is treated as an indicator of exports of high-quality products and imports of low-quality products.

However, it is sometimes impossible to establish the ratio of export to import prices, thus to determine the type of intra-industry trade (non-allocated IIT). This usually stems from the lack of data expressed in physical units for exports, for imports or for both trade flows at the same time (Fontagné et al. 2005, p. 20). This problem has become particularly serious in recent years.

The unit value approach has been repeatedly criticised for a number of reasons. First, unit values do not always correctly reflect the quality of goods (Box 1.4). Second, consumers may buy a more expensive product for reasons other than quality. Third, the 15% threshold of relative unit values is an arbitrary decision. Sometimes, a higher than 15% difference in unit values is accepted for calculations.

**Box 1.4. Practical problems related to the distinction between HIIT and VIIT**

The selection of unit values (in exports and imports) as the basis for distinguishing between horizontal and vertical intra-industry trade gives rise to certain problems. The unit value can be computed in various ways, e.g. as the value per kg, per piece, per pair, etc. Every method has both disadvantages and advantages. If the unit price of a product (i.e. the value per piece) is adopted for the purpose of analysing intra-industry trade, that price may be the function of the product size or other quality-related characteristics (such as the durability, finish or reliability of the product). At times, such quality properties are negatively correlated with size. For instance, a more expensive, larger vehicle with a worse finish is treated as a good of inferior quality in comparison with a small and cheaper but better finished car (Greenaway et al., 1994). As pointed out by Richter, unit values did not properly reflect quality differences of products especially in the case of the new Member...
States in the first period of their EU membership, because the poor image inherited from the communist era might lead to misinterpretations in this field. He gave the example of Škoda cars produced after the Volkswagen had taken over the Czech factory. Those cars were of excellent quality but relatively cheap, because otherwise customers would not have bought them. The vehicles were still considered to be of poor quality like the cars of the ‘old’ Škoda (Richter, 2009, p. 57); see also: Czarny and Śledziewska, 2008, p. 87.

According to Torstensson (1991, pp. 183-184), however, an essential practical drawback of the application of unit values is the limited availability of such data as compared to unit values expressed in kg.

But the approach based on unit values expressed in kg also involves certain constraints. For instance, a better quality product may be made of a heavier material, thus the unit value of such a product may be higher than that of a worse quality item.

Despite its various defects, the method developed by Greenaway et al. (1994), with the use of the unit value expressed in kg, is one commonly applied in the division into horizontal and vertical intra-industry trade.

**Alternative methods of breaking down IIT**

Fontagné and Freudenberg (1997) introduced a certain modification to the method of distinguishing between horizontal and vertical intra-industry trade proposed by Greenaway et al. (1994). It was aimed to ensure ‘symmetry between the upper and lower bounds in terms of their relative distance from unity’ (Azhar et al., 2008). Fontagné and Freudenberg (1997) proposed to consider horizontal intra-industry trade to be trade satisfying the equation below:

\[
\frac{1}{1 + \alpha} \leq \frac{UV_{ij}^x}{UV_{ij}^m} \leq 1 + \alpha,
\]

whereas vertical IIT should satisfy the following conditions:

\[
\frac{UV_{ij}^x}{UV_{ij}^m} < \frac{1}{1 + \alpha} \quad \text{or} \quad \frac{UV_{ij}^x}{UV_{ij}^m} > 1 + \alpha.
\]

That modification narrows down the range of relative unit values in exports which allow to regard two-way trade as horizontal intra-industry trade. For instance, if \( \alpha = 0.15 \), horizontal intra-industry trade will be recorded for \( \alpha \) being within the range <0.87; 1.15>, while according to the Greenaway et al. method it will occur where \( \alpha \) lies within the range <0.85; 1.15>.

An alternative way of breaking down intra-industry trade into horizontal and vertical IIT was presented by Azhar and Elliot (2006, 2008) as well as Azhar et al. (2008). It was a response to the imperfections of the methods developed by Greenaway et
al. and by Fontagné and Freudenberg, where the criterion of the division of intra-industry trade into horizontal and vertical was the ratio of unit values of trade flows. The ratio of export to import unit values and the ratio of import to export unit values \( \frac{UV_{ij}^x}{UV_{ij}^m} \) and \( \frac{UV_{ij}^m}{UV_{ij}^x} \), respectively) are non-symmetric. This may lead to possible distortions in the measurement of product quality in IIT and hence inaccurate measures of the extent of horizontal and vertical product quality in IIT (Azhar, Elliot, 2006). To solve the scaling or proportionality problem, Azhar and Elliott (2008) presented ‘a geometric tool called the Product Quality Space (PQS) and a related set of indices that allow the researcher to estimate more accurately the level of unit value dispersion so that the researcher can measure differences in product quality in IIT’. By construction, those indices have symmetrical limits and are projected or scaled equally on both the lower and upper bounds. The method is simple to use and allows to distinguish between high- and low-quality IIT from the perspective of either the home or foreign country (Azhar et al. 2008).

1.4. Determinants of the intensity of intra-industry trade

(Łukasz Ambroziak)

Studies of the determinants of intra-industry trade intensity have evolved in two directions. First, they focus on the description of the countries involved in intra-industry trade (macroeconomic factors). Basically, that approach aims to identify the qualities of national economies having positive or negative effects on two-way trade flows. Second, the research also covers the characteristics of industries and products (microeconomic factors). In practice, this means the identification of such attributes of industries and products that stimulate the development of intra-industry trade in the products concerned and such that impede the trade.

As already mentioned, owing to the complex nature of intra-industry trade, no single model presenting the mechanism and causes of the existence of all types of IIT flows has been proposed so far. As a matter of fact, the set of determinants of this type of trade – whether at the level of national economies or for particular industries and products – is basically unlimited. However, a number of models (concepts) have been developed to explain the mechanisms of the influence of certain (sometimes even individual) factors on the IIT level. Depending on the model assumptions, there may be different research results to explain the dominant factors in the past as well as future development of intra-industry trade. The analysis presented below focuses on the effects of macroeconomic determinants (at the level of a country) on IIT intensity, taking no account of the role of microeconomic factors. The latter are excluded from the model used to assess the impact of particular factors on the intensity of intra-industry trade in the new EU Member States (Chapter 3).
Initially, empirical research covered all intra-industry trade (with no distinction into horizontal and vertical trade). Loertscher and Wolter (1980) were the first to study the impact of specific variables – both macroeconomic and microeconomic – on the intensity of total intra-industry trade. Similar studies were later conducted (in the 1980s and the early 1990s) by researchers such as Tharakan (1986), Stone and Lee (1995), Globerman and Dean (1990). The separation of models explaining horizontal and vertical trade in the theory of intra-industry trade pointed to the need to separately analyse the causes of their development. A major work was published by Greenaway et al. (1994), who presented a method for dividing intra-industry trade into horizontal and vertical IIT and studied the effects of individual macroeconomic factors on the intensity of the two types of intra-industry trade.

In connection with the above, it seems useful to present the theoretical factors of the development of intra-industry trade separately for trade in horizontally and vertically differentiated products. Certain variables may affect both types of trade in the same or opposite direction. When the impact of a factor on horizontal and vertical intra-industry trade has the same direction, it is analysed for both types of trade together. But if the direction of the effect of the factor is different, it is analysed separately with regard to horizontal and vertical trade.

Size of the economies of the trading countries

The size of the economy is often identified with the occurrence of increasing returns to scale. Those are considered in the literature to be the main driver of intra-industry trade on the supply side. The lower the minimum efficient scale, the greater the number of businesses which may benefit from cutting production costs. Krugman (1985) argues that in a situation of a lack of returns to scale either of the two countries (Home and Foreign – included in the model) would be capable of producing all the varieties of differentiated good \( X \). Therefore, they would not be interested in engaging in intra-industry trade. However, the existence of increasing returns to scale induces each of the two countries under analysis to produce a different set of varieties of differentiated good \( X \). Maintaining the assumption on demand from both countries for all the varieties of the product means that Home will import certain varieties produced by Foreign. The larger the country concerned, the greater the capacity for expanding production characterised by increasing returns to scale, thus the greater opportunities for intra-industry trade. Krugman (1985) demonstrated that relationship for total intra-industry trade (without the separation of horizontal and vertical trade). A positive impact of the size of the economy on intra-industry trade in horizontally differentiated products was proven by Lancaster (1980), whereas the same was done for trade in vertically differentiated goods by Falvey and Kierzkowski (1987). In turn, Havrylyshyn and Civan (1985) indicated that a large
size of a country can also mean less border trade, which tends to lower the intensity of intra-industry trade.

**Differences in size between economies**

According to Helpman and Krugman (1985), the lesser the differences in market size between two countries, the larger the share of intra-industry trade in the mutual trade of the countries concerned. Dixit and Norman (1980) argue that the negative correlation between the level of intra-industry trade and differences in size between the economies of the trading countries results from dissimilar capacities (differences in capacity) to produce differentiated goods. The above relationship concerns horizontal and vertical intra-industry trade.

**Differences in per capita income between two countries**

In the literature differences in the level of per capita income are considered on the demand and supply side. The first author to analyse differences in the level of per capita income in terms of demand similarities was Linder (1961). According to him, the more equal the per capita incomes of two trading countries, the more similar their demand structures, thus consumer preferences are more similar. Countries characterised by similar demand structures of buyers will develop the production of similar groups of commodities – both for the domestic and foreign markets. Thus, the similarity of per capita incomes of the trading countries will push up the share of horizontal intra-industry trade. In contrast, it follows from the model of vertical intra-industry trade proposed by Falvey and Kierzkowski (1987) that increasing disparities in per capita incomes stimulate vertical intra-industry trade. This is due to the differences in the distributions of customer preferences in the countries concerned. Each of the countries specialises in output demanded at home, with domestic demand being the result of the incomes of the population. At the same time, demand from consumers having preferences similar to the tastes of foreign buyers will be satisfied through imports. Assuming that Home is characterised by lower per capita income than Foreign, it will follow from the distribution of consumer preferences that Home will produce articles of a relatively lower quality – for both the domestic market and export. Simultaneously, Foreign will make products of a relatively higher quality – for the domestic market and for export. The preferences of Home and Foreign customers will be sufficiently dissimilar for intra-industry trade in vertically differentiated products to occur.

Differences in per capita income have also been considered on the supply side. Assuming that the per capita incomes of two countries reflect their relative capital
endowments, Helpman and Krugman (1985) found that the greater the similarities between the countries concerned in terms of capital endowment, the higher the intensity of intra-industry trade (as a whole). Differences in the capital-labour ratios reflect different opportunities to develop capital-intensive manufacturing that fuels intra-industry trade. However, Falvey and Kierzkowski (1987) believe that the conclusions drawn by Helpman and Krugman (1985) mostly concern horizontal intra-industry trade. As regards vertical intra-industry trade in the mutual trade of two countries, it will be driven by differences in the capital-labour ratio between the countries in question.

Falvey (1981) also argues that there is a direct relationship between quality and the capital-labour ratio, reflected in differences in product quality. The model of Falvey implies that countries relatively abundant in capital will specialise in the production of better quality goods, whereas those with relatively abundant labour will specialise in producing lower quality articles. Therefore, the greater the differences in factor endowments between two countries (different capital-labour ratios in their domestic factor resources), the higher the share of trade in products of differentiated quality, thus of vertical intra-industry trade. Conversely, it follows from the model proposed by Davis that the proportion of intra-industry trade in trade between two countries is the highest for countries with identical capital-labour ratios (Davis, 1995).

Those observations of Davis are not corroborated by Yomogida (2004), who points out that the share of intra-industry trade in the mutual trade of two countries is not the highest in a situation where the countries concerned are characterised by identical relative factor endowments. It follows from the rejection of the assumption of Davis that the intermediate goods and final products of the same industry are made using the same production techniques. Yomogida (2004) argues that differences in the use of production factors to produce a final good and an intermediate product are much greater than in the case of two final goods being close substitutes (final goods within the same industry). According to him, differences in factor endowments between two countries will favour the development of vertical intra-industry trade.

In the model presented by Bergstrand (1990), the level of per capita income has a dual impact on trade and its composition between two countries – affecting supply and demand. On the supply side, income is identified with the capital-labour ratio – there is a positive correlation between those variables. As regards demand, per capita income reflects the distribution of consumer preferences in the country concerned – the greater the inequalities in income, the wider the differences in preferences of buyers from the two countries, even if the differences in the capital-labour ratio narrow down.

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13 Bergstrand assumed, in contrast to Helpman but similarly to Markusen, that consumer tastes were non-homothetic (Bergstrand, 1990).
Trade liberalisation

Balassa (1967), Falvey (1981) and Bergstrand (1990) agree that differentiated products have more substitutes than homogeneous products. Differentiated products are usually made in industries characterised by increasing returns to scale. This means that the larger the market for the goods produced, the lower the minimum unit cost of production. Therefore, a lower level of customs barriers determining lower prices of articles produced will be conducive to market expansion, thus to an increased potential of the development of intra-industry trade. Falvey (1981) stresses that trade liberalisation (reducing tariffs and possibly eliminating other barriers) will have a favourable effect on vertical intra-industry trade. Brander and Krugman (1983) argue that the creation of a free-trade area may be conducive to specialisation in accordance with the distribution of comparative advantages in individual countries and, as a result, the share of intra-industry trade in vertically differentiated goods in mutual trade will decline. Krugman and Venables (1990) found that there was a non-linear relationship between the share of intra-industry trade and trade costs. In fact, a reduction in trade costs may increase production concentration and lead to a diminished intensity of intra-industry trade. Culem and Lundberg (1986) believe that obstacles to trade have a greater downward effect on the volume of intra- than inter-industry trade (cf. sub-chapter 1.5). Havrylyshyn and Civan (1985) found that the positive impact of trade integration on IIT depends on the intensity of economic integration. In their opinion, ‘Integration schemes which result in a lot of trade diversion, do not on balance raise intra-industry trade. This is because the increased two-way trade within the group is offset by decreases caused by trade diversion’. Thus, the theory is ambiguous in terms of the effects of trade liberalisation on IIT growth.

Geographical proximity

The literature points out that the determinants of intra-industry trade also include geographical proximity. This factor concerns not only a common border with the trading partner but also a shared culture or a common language.

Balassa and Bawans (1987) argue that the share of intra-industry trade is positively correlated with the trading partners’ common border. Furthermore, a shared culture, including a common language, between two trading countries facilitates information flows, thus contributing to an increased potential of the development of two-way trade (Balassa, 1986; Clark, 1998; Deardorff, 1984; Matthews, 1998). Balassa and Bawans (1987) give the example of South Korea, which is a part of the cultural community comprising South and South-East Asian countries. South Korea’s intra-industry trade with those countries is, on average, higher than with other countries outside this region.
At the same time, there is a negative relationship between the level of intra-industry trade and the geographical distance between two countries. This distance reflects the transportation, insurance, transaction costs, etc. (Balassa, 1986; Culem and Lundberg, 1986). Distance also entails the cost of acquiring information necessary to pursue trade. The cost is higher for trade in differentiated products than in the case of standardised goods. In addition, Balassa notes that geographical distance, perceived as a direct measure of expenses involved in the process of production fragmentation, has a particularly adverse effect on trade (including on intra-industry trade) in intermediate goods (i.e. mostly on vertical trade). Even minor changes in transport costs may significantly affect decisions on fragmenting the production.

**Foreign direct investment (FDI)**

The theory of the FDI impact on IIT is only a part of the theory which attempts to describe the mutual relations between FDI and trade flows. Those depend on the nature of capital flows. Generally, horizontal foreign direct investment displaces trade and is positively correlated with trade costs (Box 1.5). Further, vertical foreign direct investment complements trade and is eased by low trade costs.

<table>
<thead>
<tr>
<th>Box 1.5. Horizontal versus vertical FDI</th>
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<tr>
<td>Horizontal FDI – its inflow is motivated mainly by seeking access to local markets and reduced trade costs, i.e. transport costs and the evasion of high tariffs. Horizontal FDI replaces trade flows.</td>
</tr>
<tr>
<td>Vertical FDI – it is driven mostly by the intention to achieve comparative advantages resulting from differences in international prices of production factors. Vertical FDI is connected with the process of production fragmentation and is complementary to trade flows.</td>
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The pioneering work explaining the impact of FDI on intra-industry trade was the publication of Helpman and Krugman (1985). They found that the presence of multinational enterprises (including those vertically integrated) removed any unambiguous relationship between the share of intra-industry trade and differences in relative factor endowments. The volume of trade and the share of intra-corporate and intra-industry trade grow as differences in factor endowment increase until such differences exceed the critical point. Such findings suggest the hypothesis that the greater the engagement of multinational corporations in the economy of a given country, the weaker the effect of changes in the differences in factor endowment (equated with differences in GDP per capita) on the share of intra-industry trade.

and no trade costs such investments will not be made. They are attracted by the existence of clear trade barriers to market access, which a multinational enterprise seeks to evade by investing in a production plant in the country where the products are sold. Therefore, horizontal FDI substitutes trade flows, i.e. it replaces exports. As a result, it also contributes to decreasing the share of intra-industry trade.

Recently, special attention has been paid in the theoretical literature to modifications of the traditional model with multinationals in the form of 2x2x2 (2 countries, 2 factors of production and 2 goods). Those modifications consisted in adding another factor of production (Egger et al., 2007), another country (Ekholm et al., 2007) or those two variables simultaneously (Baltagi et al., 2007). The modifications were induced by the continuously changing forms of multinational activities. The division of multinational enterprises into horizontally (market-seeking production) and vertically (resource-seeking investments) integrated FDI does not fully reflect the investment strategies of such enterprises. More and more frequently multinationals apply complex investment strategies, e.g. export-platform FDI. According to Ekholm et al. (2007), export-platform FDI is defined as investment and production in a host country where output is largely sold in third-country markets, not in the home- (the investor’s country of origin) or host-country markets.

The impact of export-platform FDI on IIT intensity depends on the market to which the goods produced in the plant in question are exported. Assuming the existence of imports of parts and accessories to the host country, growth in IIT occurs if final goods are exported to the home country. However, if final goods are exported to third countries, the result is a fall in IIT. Next, in the case of the so-called global platform FDI (final goods are exported to third countries as well as to the home country), the scale of IIT growth will depend on the part of exports of final goods reaching the home market. An increase in IIT intensity will result from vertical IIT as the differences between export and import unit values will be significant. It is worth stressing that intra-industry trade in final and intermediate goods can only occur if such final and intermediate goods are defined as the same industry. Vertical FDI can theoretically generate intra-industry trade in horizontally differentiated goods. This can happen in a situation of simultaneous export and import of intermediate goods with no significant differences in the unit value between the home and host countries.

1.5. Intra-industry trade and regional integration: a review of theory and empirical evidence

(Elżbieta Kawecka-Wyrzykowska)

Empirical research conducted in the 1960s revealed that European integration was not leading to increased inter-industry trade specialisation as was expected by theory
at that time, but to two-way trade within industries. Inspired by this phenomenon, researchers concentrated on three aspects of links between deepening integration and IIT: (a) the relationship between the level of trade barriers (the liberalisation of trade in goods) and the intensity of IIT; (b) the importance of intra-industry trade to reducing the costs of a monetary union (the risk of asymmetric shocks); (c) the extent of trade adjustment costs following trade liberalisation in the case of IIT versus inter-industry trade.

All those links are analysed below from the point of view of theory and empirical evidence. Answers to those questions have important practical implications. They are addressed in the ‘Concluding remarks’ at the end of this chapter.

The ‘discovery’ of IIT and the resulting research questions

The empirical evidence of the first integration blocs (the Benelux and later the European Economic Community, the EEC) during the 1960s showed that – surprisingly – an important part of intra-bloc trade was of what was later labelled as an intra-industry nature, that is simultaneous export and import of goods belonging to the same industry (Fontagné et al., 1998). The first study addressing the issue was presented by Verdoorn (1960, pp. 291-329), who analysed changes in trade flows between Belgium, the Netherlands and Luxembourg (Benelux) and mostly observed an IIT increase. That study was followed by Drèze (1961) and later (in 1966) by Balassa. Both researchers found that the formation of a customs union among the six countries of the EEC resulted in increased intra-industry trade flows of similar products and not in inter-sectoral specialisation. Those findings were at odds with the above-mentioned standard Heckscher-Ohlin model, which assumed that the elimination of tariffs and other trade barriers should result in increased inter-industry trade, based on the different factor endowments of trading partners and comparative advantages. They were also against the standard customs-union theory as presented by Viner (1950), who predicted an increased inter-industry specialisation. Researchers were interested, in particular, in the causal link between integration (as reflected in trade liberalisation) and IIT, that is whether there were ‘any reasons why economic integration may spur intra-industry trade to a greater extent than inter-industry trade’ (Sapir, 1992).

Another phenomenon to surprise economists was that the increase in IIT coincided with relatively painless adjustments to economic integration in the EEC. Re-allocation between industries and the related increase in unemployment, anticipated as a result of deeper inter-industry specialisation, had not materialised. A large share of IIT in EEC trade (and, more generally, in developed countries) was a great challenge to the traditional H-O theory. As follows from the literature review presented below, the development of IIT theories as well as of economic (especially
monetary) integration theories did provide certain answers. However, those explanations still do not unequivocally explain the relationship between economic integration (trade liberalisation) and the level of intra-industry trade.

Theoretical approaches to the impact of trade liberalisation on the level of intra-industry trade

Theorists show little interest in finding relationships between IIT and trade integration (and the related trade liberalisation, identified in practice with the reduction/elimination of tariffs, and sometimes of other border barriers). The answer to the question whether a reduction of trade barriers contributes more to an increase in intra- or inter-industry trade is mainly sought in empirical studies, mostly concerning the effects of creating preferential trade agreements (PTAs), including free trade areas. Theoretical models of IIT contain several factors explaining why the creation of an integration bloc is more likely to stimulate IIT than inter-industry trade. It is usually emphasised that the two types of trade are characterised by different price sensitivity (Falvey, 1981)\textsuperscript{14}. Demand for differentiated products (which are the essence of IIT) is more flexible in price terms than that for inter-industry trade products, as the former products have a lot of substitutes (Falvey, 1981). Therefore, it is easier to replace within IIT a more costly (due to customs duty or another barrier) imported product with a less expensive domestic variety than to do so in the case of inter-industry trade.

Moreover, IIT goods are produced in industries with increasing economies of scale (the larger the market, the lower the unit cost of production), which promotes a reduction in prices and market expansion after the opening up of the economy (elimination of trade barriers). Instead of producing every product, companies from individual countries can produce a reduced number of products and exchange them to consume a large variety of products. In this way, the country can take advantage of economies of scale and consume differentiated products. Therefore, a lower level of customs barriers determining lower prices of the articles produced will be conducive to market expansion opportunities, thus to an increased potential of the development of IIT. This phenomenon was modelled by Lancaster (1980) and Krugman (1979). In the EEC, the phenomenon of increasing economies of scale was reinforced by the wave of intra-European mergers and acquisitions (Fontagné et al., 1997)\textsuperscript{15}.

\textsuperscript{14} Falvey (1981) argued that trade liberalisation would have a positive impact on growth in vertical intra-industry trade, however, Brander and Krugman (1983) put forward a thesis to the contrary.

\textsuperscript{15} Let us add that inter-industry trade also becomes cheaper (like IIT) due to the elimination of tariffs and other barriers, but trade liberalisation does not offer additional incentives for its development.
According to theory, an important determinant of IIT growth is also the market size (not relevant for explaining inter-industry trade), which favours more variety as well as a larger quality spectrum, especially for rich countries. This factor, by definition, plays an important role in integration blocs (the market size increases with a rising number of the integration bloc members and their GDP).

Moreover, some authors argue that the mere creation of a regional trade bloc among developed countries stimulates intra-regional trade because similar income levels and similar preferences intensify the potential trade volume of intra-industry trade (Lovely, Nelson, 2002).

Most of these arguments were formulated during the rise of the so-called new trade theory, developed in the late 1970s and the 1980s, largely in response to the above-mentioned ‘discovery’ of fast-growing intra-industry trade within the EEC. At a later time, an opposing theoretical framework also appeared (the so-called Krugman’s approach16), arguing for more trade specialisation instead of more IIT within integration blocs (Krugman 1991, 1993). According to this view, specialisation will be fostered by concentration effects and externalities that determine the centralisation of economic activities in regional clusters or cities. As a result, the concentration of certain economic activities will take place (as well as divergence, not convergence, in economic structures)17. This is a part of the New Economic Geography (stressing agglomeration effects), which underlies centralisation tendencies determining industrial localisation. Krugman argued that in the case of high economies of scale and relatively low transportation costs manufacturing would concentrate in large cities (see also next sub-chapter: Monetary union and IIT).

Thus, among the determinants of IIT, economic integration turns out to be one of the most difficult to assess.

**Empirical verification in the European integration blocs**

A number of empirical studies, following the above-mentioned pioneering works on the Benelux and the EEC trade effects, concluded that trade liberalisation in the framework of economic integration blocs was an important factor of IIT growth. They included research for the EEC over a longer period (Balassa, 1975). Also, Grubel and Lloyd (1975) found a stimulating impact of the creation of a customs union

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16 De Grauwe (1997) was the first to use the names: the Commission’s and Krugman’s approaches.

17 Krugman’s scenario took into account not only HIIT (where different varieties of the product are of a similar quality) but also intra-industry trade in vertical differentiation. This type of trade is characterised by the exchange of similar goods of varying qualities or varieties of the product differentiated by quality (in short: exchange of qualities). What matters here is that the determinants and consequences of intra-industry trade in horizontally differentiated products are different from those in vertical differentiation (Fontagné et al., 1998) – cf. sub-chapter 1.2.
on IIT basing on longer-term EEC experience (1959-1967). In the following years, many researchers confirmed the causal link between EEC integration (level of trade barriers) and intra-industry trade (Balassa and Bauwens, 1987; Jacquemin and Sapir, 1988; Greenaway, 1989).

When the idea of the Single European Market (SEM) was proposed and discussed in the EEC in the mid-1980s the implicit assumption of most studies was that the removal of the remaining barriers to the free movement of goods would translate into an increase in trade flows within the bloc. It was also expected that most of this increase would be of the intra-industry type (Fontagné, Freudenberg, 1997; Fontagné et al., 1998). This optimistic assumption was based on the experience of the implementation of the customs union: contrary to the conclusions of the traditional theory of international trade linking integration and inter-industry trade, the EEC integration was accompanied by a sharp rise in intra-industry trade.

Such an optimistic scenario was adopted not only by scholars but also by the European Commission which initiated the idea of the Single European Market and prepared the necessary legal proposals. The approach of a faster growth in intra-compared to inter-industry trade also assumed that this type of trade would lead to relatively painless producer adjustments, increased efficiency and welfare gains associated with the variety of goods (Commission of the European Communities, 1990)\(^\text{18}\).

The \textit{ex post} empirical research found that there had been a rapid growth in IIT within the Single European Market. It was, however, almost entirely due to IIT in vertically differentiated products (VIIT), while horizontal IIT remained stable over time (Fontagné et al., 1998; Fontagné et al., 2005).

This conclusion had important implications for the scope of adjustment costs (cf. sub-chapter 1.5 further). It suggested that adjustments were taking place mostly within industries along the quality spectrum (VIIT) and not so much within trade of the horizontal type and, as such, might not be as smooth as previously expected.

\subsection*{IIT and trade liberalisation in other preferential agreements}

A more general link between IIT and preferential liberalisation was also confirmed by other authors: Loertscher and Wolter (1980) for the OECD countries over the years 1972-1973; Menon and Dixon (1995) – for the results of the ANZCERTA (Australia-New Zealand Closer Economic Relations Trade Agreement) over the period 1981-1991. In addition, the studies of Falvey (1981) and Bergstrand (1990) demonstrated

\textsuperscript{18} Let us add, however, that some studies, including the Commission’s forecasts, predicted that not all sectors and Member States would be affected in the same way (in sensitive sectors mostly inter-industry trade growth was expected, e.g. Commission of the European Communities, 1990; Fontagné et al. 1998).
that IIT became more intensive as the national economy opened up. A positive link between IIT and regional integration was more recently found in a broad study covering the EU, NAFTA, Mercosur and East Asian countries, although the case of Mercosur was not clear-cut (Ecochard et al., 2005).

However, other empirical research did not confirm the positive correlation between trade liberalisation and the intensity of IIT or showed a weak relationship (Lundberg, Hansson, 1986) for the Swedish industry in the years 1959-1972. Caves (1981), who tested the link between different barriers to trade and IIT, was not convinced either that there were good theoretical reasons for such a relationship and his doubts were confirmed by his results. Neither did Hamilton and Kniest (1990), who analysed trade between Australia and New Zealand in the context of the FTA between both countries, find any relation between the level of protection and IIT intensity. A similar conclusion was drawn by Globerman and Dean (1990) basing on the Canada-US Free Trade Agreement experience. The link between liberalisation and IIT was openly questioned by Lovely and Nelson (2002), who wrote: ‘Even in a world characterised by IIT, there is no particular reason for general liberalisation, whether preferential or multilateral, to generate more IIT than would be present in the general evolution of trading patterns’.

Menon and Dixon (1995) noticed that the reason for those divergent empirical results might be a methodological problem with measuring the impact of regional integration on IIT. The authors suggested a new methodology to overcome this problem (Box 1.6.).

**Box 1.6. Methodological problems of measuring the impact of preferential trade agreements (PTAs) on intra-industry trade**

Menon and Dixon (1995) stressed that the question whether PTAs promoted IIT had been addressed in the literature in two ways. In both cases, the standard Grubel-Lloyd (GL) index (Grubel, Lloyd, 1975) was applied to measure IIT changes over time:

(a) Changes in IIT before and after the formation of the preferential (regional) trade agreement (PTA) in question were analysed. If the value of the GL index during the post-PTA period was higher than it had been before the PTA creation, then this implied that the PTA increased IIT.

(b) The relative importance of IIT in intra- and extra-PTA trade was compared. If the value of the GL index was higher for intra-PTA trade than it was for extra-PTA trade, the conclusion was drawn that the PTA increased IIT.

Menon and Dixon (1995) pointed out that such an approach ignored the relationship between GL indices and trade imbalance in the total trade of the integrating countries (imbalance bias). To overcome this problem, they suggested a new methodology which decomposed the growth in total trade into the contributions of growth in net trade and IIT, as well as contributions of intra- and extra-PTA.

Thus, the suggestion that liberalisation generates increased IIT remains, in fact, unresolved.
Monetary union and IIT (the impact of a common currency on trade specialisation)

The programme of implementing the Economic and Monetary Union (EMU) in the EEC in the 1990s intensified the discussion on the possible effects of a common currency on the trade inside the euro area and the implications for the economies of the Member States. Some research studies concentrated on general trade growth resulting from the implementation of a currency union (the euro area). As expected, most studies confirmed the positive impact of the elimination of national currencies on trade increase among members of the euro area, albeit the concrete statistical estimates differed much (see Box 1.7.).

Box 1.7. Trade effects of a currency union

The first works forecasting trade growth as a result of the implementation of a common currency were extremely positive. For example, Rose (2000) predicted that currency unions tended to increase bilateral flows by about 200%! This study attracted many comments and much criticism – mostly suggesting that Rose’s first estimates were too optimistic. Baldwin et al. (2005) reviewed previous literature on the effects of the EMU on trade changes. The authors identified a number of errors in the earlier estimates of those effects. They argued, among other things, that the results were biased due to a misinterpretation of the gravity equation for trade that led to omitted variables bias. However, their empirical results confirmed the high trade creation effect between 54% and 108%, depending on the assumptions (for a review, see: Blanes-Cristóbal, 2009, and Baldwin, 2005).

A more important question was whether or not the increased intra-EEC trade was creating more harmonised business cycles among its members. According to the existing concept of an optimum currency area (OCA) as formulated in 1961 by Mundell and later developed by his successors, the intensity of trade relations and the harmonisation of business cycles (the extent to which domestic business cycles are synchronised with those of the other partners) are two of the most important criteria of the suitability of the creation of a currency union\(^\text{19}\). In turn, the harmonisation of business cycles is an important condition of lower susceptibility to asymmetric shocks, or one of the factors of a country’s suitability for entry into a currency union. More generally, the similarity of business cycles is an important prerequisite for the creation of an optimum currency area. Countries that enter a currency union are likely to experience different business cycles as compared to the previous period,

\(^{19}\) Mundell (1961), in his original contribution, stressed the importance of the mobility of production factors within the union, and in particular the high elasticity of labour markets, including territorial mobility and elasticity of wages (possibility of their decrease). His successors added new elements to this concept. For example, Kenen (1969, pp. 41–60) underlined the role of fiscal transfers in easing the adjustment of members of the monetary union to cyclical shocks in a situation when exchange rate changes were not possible anymore. McKinnon (1963) added the openness of a country to foreign trade.
partly because of changes in monetary policy (implementation of a new, single currency), and partly as a result of closer trade links with the other members of the union. They are also sensitive to asymmetric shocks that can be transmitted through trade channels. Theory says that the higher the similarity of business cycles, the lower the risk of asymmetric shocks and the greater the chances for a smooth functioning of monetary integration. If the business cycles in the countries creating/participating in monetary integration are not convergent enough, the single currency of the union will not be optimal for each country concerned.

As in the case of the discussion on the Single European Market trade implications, two opposing groups of opinions on the relationships between the EMU and the pattern of trade specialisation appeared (more IIT or more inter-industry trade) (Handler, 2013; Blanes-Cristóbal 2009).20

a) Proponents of the first group of opinions, the so-called Commission’s view (Commission of the European Communities, 1990), argued that deeper integration in the form of the EMU would lead to a situation whereby asymmetric shocks should occur less frequently.21 The reason is that, since most trade between EMU members is intra-industry trade, the more integrated the countries are, the more similarly they will be affected by disturbances. Therefore, their business cycles will also be more synchronised (possible changes of consumer preferences and related shifts of demand between products in individual industries will be symmetric). Also, monetary integration will be easier (less costly) for participating (and applicant) countries (Böwer, Guillemineau, 2006). The thesis on the increased share of IIT in total trade in the EMU was based on the argument that the common currency would reduce transaction costs – by removing different exchange rates – and the elimination of exchange rate volatility benefited trade in differentiated products (dominant part of IIT) more than trade in homogeneous products (typical of inter-industry trade).22 Thus, to the extent that a monetary union encourages intra-industry trade within the union, it may help – according to the Community’s approach – not only to enhance the welfare gains from regional trade integration, but also to stimulate closer synchronisation of business cycles. This greater synchronisation decreases the

20 The discussion revived after the financial and debt crisis of the late 2000s when it appeared that the endogenous forces within the EMU were too slow to absorb the shocks originating from the crisis. It became more obvious than before that for a currency union to survive in such a situation, it is all the more important that the OCA criteria are met.

21 This approach referred to Kenen (1969, pp. 41-60), who was the first to suggest that well-diversified economies, having a large share of intra-industry trade in their total trade, were less sensitive to asymmetric shocks.

asymmetry of shocks between the currency union members, which decreases the cost of losing the national currency. Due to this mechanism, more IIT can help justify the creation of a monetary union.

b) The opponents of this approach were mainly represented by the already mentioned Krugman’s view (Krugman 1991, 1993; Eichengreen 1992, pp. 138-161). Krugman argued that the EMU would increase the divergence of business cycles and would be likely to foster more inter-industry trade in Europe (a rise in trade specialisation), as opposed to growth in intra-industry trade. Thus, the EMU would result in the countries becoming more specialised in the goods in which they had comparative advantages (therefore, this concept is also referred to as the specialisation hypothesis). He referred to the example of the United States, arguing that, as in the USA, closer integration would lead to an increased regional concentration of industries (in order to profit from economies of scale) and thus more trade in the EEC would lead to more divergence between countries. As a result, the countries might become more sensitive to industry-specific shocks, which means that the potential for asymmetric shocks increases with greater integration among countries (and regions). Thus, in the case of inter-industry trade based on comparative advantages, which leads each country to specialise in different industries, the net effect of trade integration on business cycle synchronisation may turn out to be negative. In particular, in Krugman’s view, the integration of national markets within the Economic and Monetary Union of the EU will lead to a greater specialisation and cause regional crises to be more common in the future (Bąk, Maciejewski, 2015).

De Graauwe (2014, pp. 23-27) added one new argument in favour of the Commission’s view that economic integration might not lead to increased asymmetric shocks within a union. That argument has to do with the rising importance of services. He noticed that since economies of scale did not matter much for services, economic integration did not lead to a regional concentration of services as might be the case with industrial branches. In particular, high-technology industries, financial services, as well as the chemical and automotive industries illustrate this thesis well.

On the other hand, Bąk and Maciejewski (2015) stress that ‘eliminating law and economic barriers between regions boosts trade and likely fosters specialisation, i.e. divergence of economic structures’. Thus, in some cases, economic integration will lead to a higher concentration in fewer regions and a deeper specialisation of production, instead of convergence of economic structures and incomes.

However, the researchers stress that what is important in the context of the above-mentioned divergence versus convergence scenarios in the process of integration within the euro area is not only an increase in trade (intensity of trade, in general). The crucial point is what kind of trade is fostered by the creation of a currency union. As long as a currency union increases IIT more than inter-industry trade, it
will augment the similarity of its members’ production structures, thus, enhancing the synchronisation of business cycles. Therefore, intra-industry trade will contribute to the emergence of symmetric economic shocks. This conclusion has important implications for the members of a monetary union (e.g. the euro area): the higher the IIT share in the total trade of these countries, the lower the cost of the lack of an autonomous monetary policy in the case of an asymmetric shock (Misztal, 2013). The share of IIT is also important to countries aspiring for the euro area (Dautovic et al., 2014). As intra-industry trade leads to business cycle synchronisation, the costs of joining a currency union for applicant countries will diminish when this type of trade dominates.

The argument of the positive effects of the EMU (of trade growth resulting from monetary integration) on business cycle synchronisation was strengthened by the concept of the endogeneity of the optimum currency area (OCA), partly already incorporated by the Commission into its 1990 report (Commission of the European Communities, 1990). The endogeneity concept was formally formulated by Frankel and Rose (1996, 1998), who argued that a common currency area might gradually become an optimal currency area, despite not having been an optimum currency area (OCA) prior to currency unification. The reason is that both the degree of economic integration and business cycle synchronisation are processes endogenous in relation to those of economic and monetary integration (the OCA criteria can be affected by the integration factors)\(^{23}\). Frankel and Rose (1998) argued that the elimination of barriers and ‘EMU entry per se, for whatever reason, may provide a substantial impetus for trade expansion; this in turn may result in more highly correlated business cycles’\(^{24}\). In this way the optimistic conclusion was formulated that the monetary union would endogenously create the conditions for its success (Fontagné, Freudenberg, 1999)\(^ {25}\). At the same time, currency unification should bring about increased intra-industry trade and greater business cycle synchronisation among Member States.

In this context, let us notice that the original Mundell OCA approach considered business cycle similarity to be exogenous to monetary policy. In his approach, the synchronisation of business cycles was treated as a necessary (or desired) precondition for a successful monetary union. In contrast, the endogenous OCA stresses the possibility of achieving this criterion after the creation of a monetary union.

\(^{23}\) The OCA index was proposed by Bayoumi and Eichengreen (1997) to assess the endogeneity of OCA conditions.

\(^{24}\) Another famous credo of the endogeneity theory is as follows: ‘Countries which join EMU, no matter what their motivation, may satisfy OCA criteria \textit{ex post} even if they do not \textit{ex ante}!’ Frankel and Rose (1997).

\(^{25}\) At present, some economists argue that ‘The most recent literature and analyses presented in this paper suggest that the endogeneity effect in the EMU has been frail since its onset’ (Bąk, Maciejewski, 2015).
Empirical verification of links between IIT and business cycle synchronisation

The ambiguity of the economic theory on the links between trade changes and the synchronisation of business cycles (whether increased trade contributes to more similar or dissimilar cycles) has made this problem an essentially empirical question. A lot of studies have addressed this issue. A positive relationship between the convergence of business cycles and IIT was confirmed, among others, by Fidrmuc (2001) for the OECD countries in the 1990s. Shin and Wang (2003) also discovered that IIT was a major channel through which business cycles in 12 East Asian countries became synchronised and not by increasing trade by itself. Cortinhas (2007) found the same evidence for the ASEAN countries and Böwer, Guilleminneau (2006) for the euro area. The authors observed an increased degree of intra-industry trade in the first years of the euro area among euro area members and came to the conclusion that IIT growth was one of the main driving forces ensuring the coherence of business cycles. Fidrmuc and Korhonen (2006) reviewed the literature on business cycle correlation between the euro area and the Central and Eastern European countries (CEECs), a topic that gained attention as the newest EU members approached the monetary union. They carried out a meta-analysis which covered 35 identified publications. This analysis suggested that the economic cycles in several CEECs were highly correlated with the euro area cycle already in the first years of their accession to the EU.

Conversely, the results of a research conducted by Camacho et al. (2006) as well as by Blanes-Cristóbal (2009) were closer to Krugman’s approach. The authors suggested that European economic integration tended to strengthen regional concentration of economic activity, thus increasing the probability of asymmetric shocks and dissimilar business cycles.

To sum up this review of the literature, we can say that the existing empirical evidence is mixed. The majority of studies indicate a positive association between

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26 The first important study on this issue, most frequently cited in the literature, is that by Frankel and Rose of 1996. Using data for more than thirty years (1959-1993) applied to twenty-one developed countries, the authors came to the conclusion that ‘closer international trade links result in more closely correlated business cycles across countries’. They did not include IIT directly into the model but assumed implicitly that it was exactly IIT whose share increased in line with deepening integration and thus it was IIT that determined the rate of cyclical convergence. This conclusion was later confirmed by other studies. For a thorough overview of empirical studies on business cycle synchronisation in the euro area and on global and/or European business cycles see, for example: De Haan et al., 2008.

27 Meta-analysis is a research tool applied in economics (most notably in monetary economics), basically summarising published results on particular topics. Meta-analyses ‘provide an aggregate overview of a subject and allow analysis of factors that may influence the results such as data definition, time period, or author characteristics’ (Fidrmuc, Korhonen, 2006).
strong trade flows and business cycle synchronisation. However, some studies suggest a weak link between increased trade and the correlation of business cycles.

Adjustment implications of trade expansion and IIT

The relationship between IIT and the costs of adjustments associated with changes in trade patterns represent another area of interest of integration economists as adjustment costs constitute an important aspect of the welfare analysis of economic integration.\(^{28}\)

Balassa’s results (1966) on IIT suggested that trade liberalisation in an integration bloc among developed countries was likely to entail only modest trade-induced adjustment costs, since it led to specialisation within industries (intra-industry trade) rather than to movements of resources from import-competing to export industries.\(^{29}\) Thus, the assumption was that a high share of IIT in overall trade reflected relatively less labour market disruption as workers tended to move more within rather than between industries. As a result, the greater the IIT, the lower the adjustment costs would be. Granted that IIT was the main component of trade integration, the next conclusion was that trade integration would not lead to potentially important adjustment costs resulting from the elimination of trade barriers and intensified competition on the larger market of integrating countries.

On the basis of this approach, a loosely defined hypothesis was formulated in the literature in the 1970s, referred to as the smooth adjustment hypothesis (SAH)\(^{30}\). According to this concept, the labour-market adjustment costs in the form of unemployed resources (labour) will be lower if trade expansion is mainly intra-industry and not inter-industry in nature (Brülhart, Elliot, 1998).

The European Commission also adopted this approach and did not expect high adjustment costs as a result of the 1992 bold programme of the creation of the Single European Market (Commission of the European Communities, 1990).

However, developments in international trade theory complicated this relationship. In particular, Lloyd, Lee (2002, pp. 131-158), Nielsen, Lüthje (2002); Brülhart,  

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\(^{28}\) Adjustment costs are studied in the context of trade expansion (including trade resulting from the elimination of trade barriers, e.g. in the form of integration blocs) and are understood as ‘those welfare losses that arise in labour markets from temporary unemployment resulting from factor-price rigidity or from costs incurred through job search, relocation and retraining’ (Lloyd, Lee, [eds.], 2002, p. 110).

\(^{29}\) In 1966 Balassa wrote: ‘It would appear that the difficulties of adjustment to freer trade have been generally overestimated.’ (Balassa, 1966, p. 472, cited from: Lovely, Nelson 2002).

\(^{30}\) For a research survey on the smooth adjustment hypothesis, see: Greenaway and Milner (2003). Dixon and Menon (1995) called it ‘non-disruptive trade growth.’
Elliott, (2002) pointed that the ‘smooth adjustment’ hypothesis was challenged in connection with the identification of vertical product differentiation and the concept of agglomeration economies. Vertical and horizontal types of IIT are the results of different factors. Researchers discovered that this fact had implications for the level of adjustment costs. VIIT leads to specialisation along the quality spectrum and is a result of factors such as R&D expenses, endowments in human capital, or simply advertising (see sub-chapter 1.2). Those factors are likely to be less mobile as compared to factors underlying horizontally differentiated products which mostly result from a variety of goods (based on the love of variety and favourite variety approaches). Thus, the adjustment costs associated with VIIT (exchange of qualities) may be quite substantial as compared to HIIT (exchange of varieties). To put it differently, where the expansion of trade is more VIIT in nature labour adjustment costs may be relatively high. This conclusion is of crucial importance particularly for catching-up countries, which face more adjustment challenges than highly developed economies.

Another dimension of research on IIT and adjustment costs that can be crucial for accepting or rejecting the SAH is the lack of a uniform methodology to address the link between trade and adjustment costs (selection of the adjustment cost indicator), see Box 1.8.

**Box 1.8. Trade adjustment costs and the way they are measured**

Hamilton and Kniest (1991) were the first authors to argue that traditional indicators of IIT (like the change of the Grubel-Lloyd index of IIT) were not relevant to identify the level of trade adjustment costs. Such an approach can lead to serious measurement errors. The reason is that the traditional IIT indicator is static (in the sense that it describes trade patterns for one time period) and adjustment is a dynamic process which requires a measure of IIT that reflects changes in trade patterns taking place over a period rather than just measuring the structure of flows at discrete intervals at different points in time (Brülhart, Elliott, 1998; Thorpe, Zhang, 2005).

Hamilton and Kniest (1990) introduced the concept of marginal IIT (MIIT, also called a dynamic measure), which was later developed mostly by Brülhart (see e.g. Brülhart 1994; Brülhart, 2000). Therefore, nowadays researchers agree that MIIT better reflects changes in trade flows than a static GL index and, thus, better illustrates the effects of, for instance, trade changes on labour allocation. However, the marginal IIT index also has certain shortcomings (see sub-chapter 1.3).

In addition, empirical studies are ambiguous as regards the relationship between IIT and trade-related adjustment costs. A number of them are supportive of the smooth adjustment hypothesis (Brülhart, Elliott, 2002), while Greenaway et al. (2002) conclude that there is no evidence of ‘a systematic relationship between the type of trade expansion (inter- or intra-industry) and the type of employment adjustment (within or between industry adjustment) or that there is less labour market adjustment associated with intra- than inter-industry trade’.
Since the mid-1970s intra-industry trade has been addressed by a number of researchers. The empirical literature can be divided into two groups: studies containing statistical and descriptive analyses and papers identifying the effects of specific factors on intra-industry trade, also using econometric methods.

In this review, we concentrate on studies on IIT in the EU-10 published in English (with small exceptions) and having a more significant impact on the literature and development of the analysed subject. We consciously exclude comprehensive works that are meaningful for the development of theory and empirical research, but that have been published in the national languages of the EU-10. There was no possibility for us to compare them fully and objectively. Furthermore, their inclusion would have excessively extended that part of our study. That last argument is the main explanation for excluding studies on IIT published in Polish from the review.

**Statistical and descriptive analyses of intra-industry trade**

The originators of research on the intensity of intra-industry trade were Grubel and Lloyd (1975), who studied changes in the importance of intra-industry trade in selected OECD countries in 1959-1967. The early analyses of IIT for certain Central and Eastern European countries (CEECs) were conducted at the turn of the 1970s and the 1980s. Major works on the subject include the publications of Aquino (1978), Greenaway (1983) and Gleiser (1983). Those were usually fragmentary in nature as they only concerned individual countries or selected industries, e.g. the study by Weiss and Wolter (1983) on the trade of the Federal Republic of Germany with the then Comecon members.

The intensity of IIT of Poland, Hungary and the USSR with the Federal Republic of Germany, France and Austria was also studied by experts of the United Nations Economic Commission for Europe (Economic Commission for Europe, 1977). They demonstrated that the intensity of intra-industry trade of the countries in question was different from what the theorists suggested. Their results were corroborated by Lundberg (1982), who found that IIT intensity in Sweden’s trade with the CEECs had been half the level of that country’s trade with the EEC and the EFTA. The author’s explanation was that the production structures of Sweden and its EEC and

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31 In the 1980s and the 1990s similar analyses were carried out for Australia (Menon, Dixon, 1996), for eleven European Union Member States (Fontagné, Freudenberg, 1997) and in the 2000s – for most of the countries in the world (Fontagné et al., 2005).
EFTA partners were more similar than in the case of the CEECs concerned. He also pointed to a greater mutual openness of the markets, related to the absence of such tariff and non-tariff restrictions as those imposed on Sweden’s trade with the CEECs in question.

In the 1990s, following the commencement of the transition in Central and Eastern Europe, the emphasis was usually put on the CEECs’ IIT with EU Members States as the EU had become the main trading partner. Other factors playing an important role in the focus on trade with the EU included the economic significance of the EU, its geographical proximity, deep trade liberalisation resulting from association agreements between the CEECs and the EU, and, more recently, EU accession.

A number of authors noticed that before the transition the share of IIT was very low and horizontal IIT was almost non-existent (Aturupane et al., 1997). However, the rapid growth in IIT between the CEECs and the EU was already observed in the early years of transition (Gacs, 1994; Aturupane et al., 1999; Hoekman and Djankov, 1996; Kaminski, 2001).

The relative importance of vertical and horizontal IIT in bilateral trade between Central European countries and the EU was analysed by Aturupane et al. (1999), who concluded that: ‘Most of the IIT is vertical in nature (…) Horizontal IIT has also been static over the 1990-95 period for the majority of countries. However, for some countries such as the Czech Republic and Slovenia it has been growing rapidly and has attained levels that exceed those reported for countries such as Greece, Finland and Israel’. Similar conclusions were drawn by Ferto and Soos (2006).

Tiits and Jüriado (2006) attempted to assess the impact of economic integration on the development of intra-industry trade between the two groups of countries in the Baltic Sea region: Finland, Sweden, Denmark and Germany at the Western coast, and Estonia, Latvia, Lithuania and Poland at the Eastern coast of the Baltic Sea. The analysis of the change in the quality of the traded goods revealed that the economic integration in the Baltic Sea Region had not led by that time to a vast improvement of the competitiveness of industry at the relatively less developed Eastern coast of the Baltic Sea. The above supported the results of the previous research, that the economies of the Baltic States and Poland continued to act as lower value-added suppliers of the cross-border clusters in the Baltic Sea region.

Details of HIIT and VIIT between the former Central European Free Trade Agreement countries and the EU were analysed by Černoša (2007). He concentrated on IIT specialisation of the Czech Republic, Hungary, Poland, Slovakia and Slovenia in foreign trade with EU Member States in 1995-2001 (across countries and twenty manufacturing activities: divisions 17-36 of the SITC). This analysis revealed ‘the predominance of IIT specialisation of the majority of the chosen manufacturing activities in the production of lower quality products’. He also found, however, ‘a few activities in each of the five observed former CEFTA countries, which, by contrast, showed predominant specialisation in the production of higher quality products’. 
Czarny and Śledziewska (2008, 2009) conducted a number of empirical studies on changes of Poland’s IIT from 2000. They stressed fast and positive changes consisting in an increasing role of high-quality VIIT and of HIIT\(^{32}\). Those changes resulted from a modernisation in the Polish economy thanks to an inflow of FDI, gradual adjustments of Polish producers to EU technical standards and trade liberalisation before EU accession, and finally, from joining the Single European Market.

The increasing role of IIT in the trade of all the 12 new EU Member States (but one – Malta) was also confirmed by the research of Kawecka-Wyrzykowska (2010, pp. 11-31), covering the period 2000-2007. This author also concluded that ‘a new element is the relatively quickly changing specialisation pattern of a majority of the new Member States towards more horizontal intra-industry trade, usually typical for more developed countries’ (Kawecka-Wyrzykowska 2010, p. 30). An increasing share of high-quality VIIT was also identified. In another study covering the V4 countries the same author (Kawecka-Wyrzykowska 2009, pp. 285-315) concluded that relatively the fastest changes in the pattern of IIT specialisation with the EU-15 had been recorded in Poland and the slowest developments in the Czech Republic (with Slovakia and Hungary in the middle). However, the Czech Republic recorded the highest levels of IIT at all times. A higher level of IIT in the Czech Republic and Hungary compared to Poland was also noticed (in the earlier period 1995-2001) by Zielińska-Głębocka, Brodzicki 2005.

Toporowski (2010, 2012) argues that after the EU enlargement the new Member States (NMS), including the Visegrad Group countries, experienced boosted improvements in their trade patterns, including intra-industry trade growth and accelerated convergence processes. However, once the economic and financial crisis started, the convergence was weakened, albeit not significantly and for a short period only. A similar conclusion was formulated by Molendowski (2013) as well as by Molendowski and Polan (2013) with regard to the Visegrad countries’ trade with the EU-15 and with the EU-10 (in the years 2004-2012).

### Analysis of the determinants of intra-industry trade

The other group of studies in the empirical literature comprises works assessing the direction of the impact of particular determinants on intra-industry trade with the application of econometric analysis. Such research concerns factors at the level of countries, factors at the level of industries as well as factors at the country and industry levels at the same time. Although Pagoulatos and Sorensen (1975) were the first to identify the effects of specific factors on intra-industry trade intensity,

\(^{32}\) Similar trends were identified in Poland’s foreign trade in the period 1999-2006 by Brodzicki (2009).
Loertscher and Wolter (1980) are considered to have been the pioneers in research on the determinants of the development of intra-industry trade using econometric analysis tools. The latter authors took into consideration factors influencing IIT at both country and specific industry levels. Important contributions to the literature in the field of research on the determinants of IIT development were made, among others, by Hummels and Levinsohn (1993), Bergstrand (1990) and Nilsson (1999).

One of the first studies to analyse the drivers of intra-industry trade in the CEECs was the work by Aturupane et al. (1997). Vertical IIT was found to account for 80% to 90% of total IIT and was ‘positively associated with product differentiation, labour intensity of production, economies of scale, and foreign direct investment (FDI)’. A positive association was discovered between horizontal IIT and FDI, product differentiation and industry concentration, whereas a significant negative relationship was found for scale and labour intensity. The authors concluded that country-specific factors were the key determinants of horizontal IIT.

Fidrmuc et al. (1999) showed that a reduction of trade barriers among the selected CEECs and the EU had resulted in increased IIT indices. They observed, however, that ‘the increase of intra-industry trade is not uniform, but reflects different patterns of integration and progress of industrial restructuring’. Fidrmuc (2001) added the Baltic States (Estonia, Lithuania and Latvia) to the group of analysed countries, but, in contrast to the previous study, the author excluded from the factors the variable of foreign direct investment. Based on trade data for a period until 1998, he demonstrated that ‘the regional reorientation of Central and Eastern European trade towards the single market of the EU was associated with successful restructuring. The rise of intra-industry trade was one of the most important features of the recent developments in East-West trade in Europe’. The study of the factors determining the intra-industry trade of European Union Member States and of OECD members revealed that ‘countries’ size and the distance to their markets are the most important determinants of intra-industry trade’ and that ‘in contrast to the OECD countries, the development of EU’s intra-industry trade has been largely influenced by short-term factors’. Importantly, the work also contained long-run predictions of the development of EU’s intra-industry trade with the CEECs. The author forecasted that ‘in 2010, EU-15’s intra-industry trade could reach 70% of the trade volume with the Czech Republic, 60% with Hungary, Poland, Slovakia and Slovenia and 35% to 40% in EU’s trade with Bulgaria, Romania and the Baltic States’.

Kaminski (2001) found that countries that had received relatively large inflows of FDI in the 1990s had also experienced an expansion of IIT. For an earlier period, a similar conclusion was presented by Aturupane et al. (1999): ‘After controlling for country-specific factors, we find a positive and significant relationship between FDI and product differentiation and both vertical and horizontal IIT’.

Gabrisch and Segnana (2003) studied the horizontal and vertical intra-industry trade of candidate countries in 1993–2000. The analysis covered the 10 countries...
that joined the EU in 2004 and Turkey. A descriptive comparative study of HIIT
and VIIT indices was complemented by the econometric analysis of a model with
income distribution. The authors found, first, that relative differences in wages (per
capita income) and country size explained intra-industry trade when trade was
vertical and completely liberalised and, second, that cross-country differences in
income distribution played no explanatory role. In addition, EU firms were able to
increase their product quality and to shift low-quality segments to transition econo-
 mies. That might suggest ‘a product-quality cycle’ prevalent in trade between the EU
and transition economies.

Caetano and Galego (2007) noticed that the determinants of horizontal and verti-
cal IIT within the enlarged Europe (25 EU Member States) differed, although both
had a statistically significant relationship with a country’s size and foreign direct
investment.

Fainštein and Netšunajev (2009) studied intra-industry trade dynamics for
Estonia, Latvia and Lithuania in 1999-2007. IIT was decomposed into its vertical and
horizontal components. Using panel data analysis, the authors estimated three static
models and a dynamic model of IIT determinants. Market size was observed to be
important in the Baltic States for IIT in general and for horizontal IIT only, taking
into account particular countries or industries. A negative relationship between
distance and the intensity of IIT was a standard finding. Among factor endowment
variables, the authors found the difference in human capital to be significant in
explaining IIT.

Kang (2010) examined the evolution of intra-industry trade in the period before
and after accession of the Central and Eastern European countries to the EU. With
the use of gravity-type empirical tests, the author verified determinants of IIT at the
intra-European level. As a conclusion, the researcher suggested that the CEECs had
experienced a considerable increase in IIT, particularly during the transitional period
before their EU accession. However, the level of the CEECs’ IIT was still markedly
low, being half of that of the EU-15. ‘Given that a trade-investment nexus exists
to explain IIT in intra-European trade, IIT in CEECs can increase further, as they
receive more FDI from their neighbours’.

The paper by Dautovic et al. (2014) found that some common factors were
driving intra-industry trade between the EU-15 as the main trading block and the
Central, Eastern and South-Eastern European (CESEE) countries. The CESEE group
was divided into the ‘new’ EU Member States (NMS), the EU candidate countries
and potential candidates (CCPC). Those factors included the corporate tax rate,
the flexibility of exchange rate regimes and the quality of political institutions. The
authors stressed, however, that the determinants of IIT between the NMS and the
EU-15 deviated considerably from those between the CCPC and the EU-15 countries.

Some authors focus on analysing intra-industry trade factors for a selected
industry or for an individual country only. Surugiu and Surugiu (2012, 2015)
examined the determinants of intra-industry trade in the Romanian automobile parts and accessories sector. The authors studied trade in this sector between Romania and 13 EU Member States (Austria, Belgium, Bulgaria, the Czech Republic, Finland, France, Germany, Hungary, Italy, Poland, Portugal, Slovakia and Spain). Econometric computations were conducted for the period 1995-2012. The results of the econometric analysis indicated that the ‘economic growth’ had a direct influence and ‘physical capital endowments’ had an indirect effect on Romanian IIT.

Jámbor (2014) identified the determinants of horizontal and vertical intra-industry agri-food trade between 10 new Member States (NMS) and the EU-27 in 1999-2010, by applying static and dynamic models with different specifications to panel data. The results showed that IIT was mainly of a vertical nature in the NMS. Factor endowments were negatively correlated with agri-food horizontal intra-industry trade (HIIT) but positively with vertical intra-industry trade (VIIT). Economic size was positively and significantly correlated with both types of IIT, while distance and IIT were found to be negatively related in both cases. The results also suggested that EU accession had positive and significant impacts on both HIIT and VIIT, suggesting that economic integration fostered IIT.

The most recent analysis for IIT determinants was conducted by Grančay et al. (2016). The authors assessed the empirical validity of the Linder hypothesis in the Visegrad countries. Using a variant of the gravity model of trade calculated at the three-digit SITC level, they found that ‘the Visegrad countries tend to trade more with countries with similar per capita income levels than with significantly richer or poorer countries’. ‘The Visegrad countries have one of the highest shares of intra-industry trade among total trade in the world. The roles of consumer preferences and vertical trade have been strong’.

A few Polish authors have analysed factors determining IIT developments, usually concentrating on the role of FDI. Contrary to the majority of the studies, a very low interrelationship between FDI and IIT was found in Polish foreign trade by Cieślik (2008): ‘It was found that although the activity of multinational firms is positively related to the volume of bilateral trade between Poland and EU-15 countries, at the same time these firms do not seem to contribute to the development of the intra-industry trade’. An opposite view was presented by Ambroziak (2010, 2012), who identified a statistically significant positive correlation between intra-industry trade (of both the horizontal and vertical types) and foreign direct investment in the Visegrad countries.

A paper by Czarny and Śledziewska (2015) presented the results of an econometric analysis of the determinants of IIT in all new Member States of the EU in the period 2004-2013. It took into account the standard determinants of IIT (similar to those used in our model) and also specific factors related to the stage of integration. The conclusion was that ‘economic integration plays a significant and positive role in IIT growth. The more comprehensive and deep the RTAs, the more positive their impact on IIT growth’.
To analyse the determinants of IIT in Poland in the years 1999-2013, several factors were used in a study edited by Gawlikowska-Hueckel and Umiński (2016). Apart from the standard determinants of IIT (applied in our model), the econometric model also took into account differences in global expenditure on R&D activities (GERD), differences in human capital endowment, differences in the overall productivity level (TFP) and the technological gap between partners. The researchers showed ‘a considerable role of the economic integration process, having the form of free trade areas, customs unions or other economic agreements, in fostering intra-industry trade’ in Poland. In turn, an increase in the differences in GERD had ‘a negative effect on the intensity of both vertical and horizontal IIT’ (p. 134).

Concluding remarks

(Elżbieta Kawecka-Wyrzykowska, Łukasz Ambroziak,
Edward Molendowski, Wojciech Polan)

Intra-industry trade was first observed in the 1960s in connection with the integration processes in Europe (in the Benelux countries and in the EEC). Researchers discovered that there was specialisation within industries and that trade occurred despite the lack of significant differences in factor endowments between members of the integration groups concerned. As a consequence, it was difficult to explain its causes with the use of the then dominating Heckscher-Ohlin approach based on differences in comparative costs.

The first theoretical models of IIT were developed in the late 1970s and the early 1980s. The seminar papers by Krugman (1979) and Lancaster (1980) promoted a theoretical framework associating IIT with economies of scale and trade in varieties of differentiated products. That monopolistic competition framework explained trade in horizontally differentiated goods. Later, new models appeared, including those addressing intra-industry trade in vertically differentiated products. Due to the fact that the models are widely discussed in the literature, this chapter only indicated the selected theoretical elements that seem important for the attainment of the research objectives adopted.

A part of IIT in vertically differentiated products results from the phenomenon of production fragmentation. Fragmentation strengthened with the lifting of many barriers to international trade in goods (products) and the deregulation of the movement of capital, and partly also of services.

A new research element is IIT in services, although only a few studies have addressed this subject so far.

Intra-industry trade is difficult to measure statistically, because regarding products as ‘the same’ is partly a matter of definition and classification. In practice, the correct definition of an industry consists in choosing one of the two classifications used in
foreign trade (the HS or the SITC) and an appropriate level of statistical disaggregation (e.g. 4-digit HS or 3-digit SITC codes). There is no single measure of intra-industry trade intensity accepted by all as the best one. From the point of view of the analysis objectives, the selection of a specific index and the level of aggregation are much less important than the presentation of its changes over time (in geographic or product terms). Those ensure the comparability of assessments.

As regards empirical studies on IIT, the important role of this type of specialisation in the evolution of integration process (as reflected in trade liberalisation) has been discovered and confirmed in many works, first of all relating to the creation of the customs union and the Single European Market in the EEC/EU. An unambiguous relationship between the reduction of trade barriers (trade liberalisation) and the intensity of IIT has not been, however, corroborated in the case of other integration blocs. Thus, the question remains open: does integration lead to more intra-industry trade or rather to more specialisation among industries?

There is an agreement in the theoretical literature on close links between trade developments and the monetary stage of integration (the elimination of barriers resulting from national currencies). However, the effect of more trade between countries on the synchronisation of their business cycles depends on the type of their trade: only a rise in intra-industry trade results in the synchronisation of the trading countries' business cycles and contributes to the emergence of symmetric economic shocks, which makes monetary integration easier. This conclusion has important implications for members of a monetary union (e.g. the euro area): the higher the IIT share in the total trade of these countries, the lower the cost of the lack of an autonomous monetary policy in the case of an asymmetric shock. The share of IIT is also important to countries aspiring for the euro area. As intra-industry trade leads to business cycle synchronisation, the costs of joining a currency union in applicant countries will diminish when this type of trade dominates.

Trade integration and liberalisation result in higher or lower trade-induced adjustment costs. In a situation where the reduction of barriers pushes up IIT (rather than inter-industry trade) the adjustment costs are increasingly likely to be lower. However, this must be IIT based on horizontally differentiated products. If vertical differentiation prevails, adjustment costs associated with the displacement of resources may be significant. This conclusion is of crucial importance particularly for catching-up countries that face more adjustment challenges than highly developed economies.
Chapter 2

Changes in the intensity of EU-10 intra-industry trade in 1995-2014

Introduction

This chapter offers empirical evidence on major trends in the intra-industry trade (IIT) of the 10 Central and Eastern European countries which acceded to the EU in 2004 and 2007 (the EU-10). The analysis covers the period 1995-2014 and the ten new Member States of the EU (NMS): Bulgaria, the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovakia and Slovenia. The intra-industry trade intensity and the IIT pattern of the EU-10 are analysed from various angles. Developments in EU-10 trade are analysed with regard to the total trade of the EU-10 group and of individual EU-10 countries, broken down: (a) by the main groups of trading partners (intra-EU-10 trade; trade with the EU-15, with the rest of the world); (b) by the main categories of IIT (vertical versus horizontal IIT); (c) by the main sections (HS product groups) of trade.

According to the remarks presented in Chapter 1, such an approach will allow to assess the direction and nature of changes in the commodity specialisation of the EU-10 as well as advancement in the income convergence of the countries concerned in relation to the remaining EU Member States (EU-15) and other trading partners.

2.1. Methodology adopted for the analysis and data sources

(Łukasz Ambroziak)

The analysis covers the period 1995-2014, i.e. the recent 20 years. We compare the developments in the internal trade of the whole group and in the trade of the individual EU-10 countries with three groups of their main partners: the EU-15, the EU-10 (mutual trade of the EU-10) and other countries (the rest of the world). The analysis also covers changes in the intra-industry trade of the EU-10 in specific product groups, separated according to HS sections.
In order to more accurately identify the main trends in the trade concerned, the period 1995-2014 was divided into three stages: 1996-2003 (the pre-accession period); 2004-2008 (the post-accession period); and 2009-2014 (the period affected by the adverse consequences of the global crisis).

The calculations are based on the standard Grubel-Lloyd measure (the so-called GL index; Grubel, Lloyd, 1975, pp. 21-36 – see sub-chapter 1.3), appropriately transformed for the purpose of data aggregation (see Box 2.1.)\(^{33}\). It allows to compute the share of two-way trade in the total trade in an industry between two countries. It takes on values from the interval \(<0;1>\) or \(<0;100>\). An industry is understood as a group of products at the 4-digit HS code level. The GL indices were calculated for every country pair (including individual EU-10 counties as reporters and about 200 countries as partners), for above 1200 industries covering a 20-year period (the whole database contained nearly 7 million GL indices). Then they were aggregated in an appropriate manner.

### Box 2.1. Measuring intra-industry trade

For the purpose of this study, the intra-industry trade indices were calculated according to the following equation:

\[
GL_i = 1 - \frac{\sum_{k \in K} \sum_{k' \in K'} \sum_{i \in N} \left| X^{kk'}_{i,t} - M^{kk'}_{i,t} \right|}{\sum_{k \in K} \sum_{k' \in K'} \sum_{i \in N} \left( X^{kk'}_{i,t} + M^{kk'}_{i,t} \right)}
\]

where:
- \(N\) – number of industries in total trade or at the HS section level between countries \(k\) and \(k'\);
- \(X^{kk'}_{i,t}\) – exports of a country \(k\) to country \(k'\) of products from industry \(i\) in year \(t\);
- \(M^{kk'}_{i,t}\) – imports of a country \(k\) from country \(k'\) of products from industry \(i\) in year \(t\);
- \(K’\) – total number of trading partners or the number of trading partners in specific groups of countries, i.e. the EU-15, the EU-10 and third countries;
- \(K\) – number of trading countries, i.e. the EU-10 group as a whole.

Source: Based on Fontagné and Freudenberg (1997).

We adopted the unadjusted GL indices, based on the view that the arguments for adjusting the GL index for trade imbalance were weak (for more, see Box 2.2.).

\(^{33}\) In practice, the computation of indices involves a number of methodological issues (cf. Ambroziak, 2013). Therefore, it is more important to analyse the scale of changes in the IIT index over time rather than its absolute level.
In the literature on IIT, there is a discussion on whether the Grubel-Lloyd (GL) index should (or should not) be adjusted for aggregate payments imbalance. Grubel and Lloyd discussed the possible bias resulting from their index if a country’s total commodity trade is imbalanced. In such a situation, the index must be less than 100 because exports cannot match imports in every industry. They proposed an adjustment for the aggregate trade imbalance ‘by expressing intra-industry trade as a proportion of total commodity export plus import trade less the trade imbalance’ (Grubel, Lloyd, 1975, p. 22). Aquino (1978) also argued that such an adjustment was necessary but proposed this adjustment at the level of industry and not at the aggregate level.

However, some authors prefer uncorrected GL indices. Greenaway and Milner (1981) questioned the rationale for the adjustment ‘on the grounds that we have no a priori knowledge of the particular set of transactions which will be balanced in equilibrium nor do we know the nature and effects of the (balance of payments) adjustment forces initiated by imbalance’. Vona (1991) also presented arithmetic examples showing the superiority of the uncorrected GL index over corrected indices. A critical approach to adjusted GL indices was presented by Brülhart (2002) as well.

In order to calculate the horizontal and vertical IIT indices, the Greenaway et al. (1994, p. 95) approach was used. According to this methodology, the distinction between HIIT and VIIT is based on the assessment of product quality. To assess different qualities, unit values are applied. The underlying assumption is that relative prices are likely to reflect relative qualities of products. When unit values of products are close (it is usually assumed that the export and import unit values differ by less than a certain subjectively assumed value; very often this is 15%) they are considered to be similar or horizontally differentiated (two-way trade of varieties). Otherwise, traded products are vertically differentiated (two-way trade of qualities).

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**Box 2.2. Discussion on the adjustment of the Grubel-Lloyd index for overall trade imbalance**

In the literature on IIT, there is a discussion on whether the Grubel-Lloyd (GL) index should (or should not) be adjusted for aggregate payments imbalance. Grubel and Lloyd discussed the possible bias resulting from their index if a country’s total commodity trade is imbalanced. In such a situation, the index must be less than 100 because exports cannot match imports in every industry. They proposed an adjustment for the aggregate trade imbalance ‘by expressing intra-industry trade as a proportion of total commodity export plus import trade less the trade imbalance’ (Grubel, Lloyd, 1975, p. 22). Aquino (1978) also argued that such an adjustment was necessary but proposed this adjustment at the level of industry and not at the aggregate level.

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**Box 2.3. Measuring horizontal and vertical IIT**

In order to maintain the symmetry of the range of deviations of relative export unit values, increasing as the index of deviations of relative export unit values rises, the approach modified by Fontagné and Freudenberg was used. According to that method, horizontal IIT is considered to be trade satisfying the condition below:

\[
\frac{1}{1 + \alpha} \leq \frac{UV_{ij}^x}{UV_{ij}^{m}} \leq 1 + \alpha,
\]

trade in vertically differentiated products where exported products are of a relatively worse quality than that of imported products should satisfy the following condition:

\[
\frac{UV_{ij}^x}{UV_{ij}^{m}} < \frac{1}{1 + \alpha},
\]

---

34 For the modification of this, see: Fontagné, Freudenberg (1997).
whereas trade in vertically differentiated products where exported goods are of a relatively higher quality than that of imported articles (high-quality VIIT) should satisfy the inequality below:

\[
\frac{UV^x_{ij}}{UV^m_{ij}} > 1 + \alpha,
\]

where:

- \( UV^x_{ij} \) – unit value of exports for product \( i \) from industry \( j \);
- \( UV^m_{ij} \) – unit value of imports for product \( i \) from industry \( j \);
- \( \alpha \) – dispersion factor – relative unit values of exports and imports (\( \frac{UV^x_{ij}}{UV^m_{ij}} \)). In the literature, it is usually assumed that \( \alpha = 15\% \).

The sum of the above-mentioned three types of IIT (low-quality VIIT, HIIT and high-quality VIIT) is not always equal to the intensity of intra-industry trade (IIT) due to the existence of the so-called non-allocated intra-industry trade for which it is impossible to determine the export/import price relationships.

Source: Based on Fontagné and Freudenberg (1997).

The source of data on trade flows used for the calculation of IIT was Comtrade – a trade database with statistics expressed in USD. Only this database allowed analysing the intensity of IIT for the whole period adopted in this book (1995-2014).

2.2. **Major changes of trade rules in the EU-10 resulting from their EU accession**

*(Edward Molendowski)*

The onset of the political and economic transition in the early 1990s meant a major change for the Central and Eastern European countries – future EU Member States (EU-10) – also in terms of their economic relations and trade with foreign partners. As a result of the transformation undertaken, foreign trade ceased to be an enclave governed by detailed state regulations and – as the majority of sectors in the EU-10 economies – was increasingly subjected to the competition mechanism. Consequently, it played an ever-growing role in the modernisation of the whole economy.

The introduction of the principle of freedom to engage in foreign trade largely spurred entrepreneurship. It is worth emphasising that noticeable effects of the

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35 The Eurostat Comext database allows for comparative analysis only from 1999.
36 It followed internal and external liberalisation. The former mostly consisted in lifting the state monopoly in foreign trade (which allowed all interested businesses to engage in trade with foreign countries) and in price deregulation, which led to prices being shaped by the demand and supply mechanism. External liberalisation involved a significant reduction of the customs protection level (mostly under mutually preferential trade agreements with major trading partners), the elimination of quantitative restrictions, of mandatory licences and the limitation of other non-tariff barriers.
changes in the rules of trade with foreign countries started to materialise as early as in the mid-1990s. From the beginning of the transition, most countries of the EU-10 group made efforts to accede to the European Union. This required wide-ranging adjustments in the economic, political and social spheres. Their endeavours were successful and – which is a well-known fact – on 1 May 2004 the Czech Republic, Poland, Slovakia, Slovenia, Hungary and the three Baltic States (Estonia, Lithuania and Latvia) joined the EU as its full Member States, followed by Bulgaria and Romania on 1 January 2007.

For the EU-10 countries EU accession meant, among other things, an essential change of previous principles and rules of trade with all partners. This primarily resulted from the adoption of the entire acquis communautaire in the areas of the ‘free movement of goods’ and the ‘customs union’. The most important changes were related to the following (Kawecka-Wyrzykowska, 2003):

- the inclusion of the EU-10 in the internal market of the EU, with the free movement of goods, services, capital and persons as well as the applicable harmonised laws concerning technical requirements for products, indirect taxes and a number of other economic issues;
- the adoption by the EU-10 of all the principles and instruments of the EU common commercial policy towards third countries (the Common Customs Tariff, non-tariff tools and the system of trade agreements with non-EU partners).

However, various adjustments in the area of legal laws had been previously introduced under a number of international agreements negotiated by the EU-10 with their trading partners. The most important commitments included the following: (a) the association agreements (the so-called Europe Agreements), signed by the EU-10 with the then EEC by the mid-1990s; (b) the terms of membership of the World Trade Organisation (WTO); (c) the agreements with the EFTA, CEFTA and BAFTA. The agreements in question required certain adjustments, such as the (direct or indirect) harmonisation of legislation of the EU-10 with the EU requirements even prior to the accession of the candidates to the EU (Kawecka-Wyrzykowska, 2006). The essential purpose of all those agreements was mutual liberalisation: easier access for goods from the EU-10 to foreign markets and the simultaneous opening-up of their own markets to foreign competition. As a result, the level of protection was greatly reduced in EU-10 trade with all their trading partners (within the framework of the WTO), with the most considerable reduction concerning the parties to preferential agreements.

Due to the introduction of market mechanisms and the opening-up of the EU-10 economies to foreign competition, upon EU accession most producers from the

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37 EFTA – European Free Trade Association (created in 1960); CEFTA – Central European Free Trade Agreement (which entered into force in 1993); BAFTA – Baltic Free Trade Area (which entered into force in 1994).
region suffered no big shock and relatively smoothly adjusted to much fiercer competition from economically stronger, as a rule, EU-15 operators.

Therefore, for the new Member States, their EU accession involved a change of the rules and conditions of trade with the EU-15, in their mutual relations and in trade with third countries. Undoubtedly, this substantially influenced trade flows, both in terms of total trade and in specific relations.

2.3. Dynamics of the IIT of the EU-10 and of individual EU-10 countries by group of trade partners

Edward Molendowski

The most important trends in the development of trade links of the EU-10 before and after EU accession

For the majority of the new Member States (EU-10) the first years following accession (2004-2008) proved to be much more favourable than Eurosceptics had anticipated. In the pre-accession period, they had warned that those countries would be net payers in the EU, whereas their markets would be flooded with more competitive EU goods. After the first few years of membership it appeared that such opinions and concerns were unfounded or definitely exaggerated.

Throughout the period under study, i.e. 1995-2014, there was a distinct acceleration of the value of EU-10 trade (both exports and imports) after the countries concerned had acceded to the EU. However, the economic crisis of 2008-2009 significantly slowed down the dynamics of exports, whereas imports even showed a fall in absolute terms in relations with the EU-15. Those developments are illustrated in Table 2.1 and Fig. 2.1.

In the first years after accession (2004-2008), the greatest acceleration of EU-10 trade was recorded in mutual relations (intra-EU-10 trade). Over the period in question, EU-10 exports to and imports from the other countries of the group showed a 4.1-fold and 3.4-fold increase, respectively, whereas the total exports and imports of those countries rose by a factor of 2.9 and 2.7, respectively. This was a marked improvement on the developments observed in the pre-accession period when the steepest growth had been noted in EU-10 exports to the EU-15 (2.7 times) and in imports from third countries (2.5 times). Simultaneously, exports to other EU-10 countries increased 2.8 times, while imports from this group increased by 2.3 times. In the period following the outbreak of the world crisis (2009-2014) the EU-10 remained the trading partners with the fastest-growing exports and imports (but at much lower annual average growth rates).

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38 An overview of those costs is presented, for example, in: Baldwin (1995).
39 For the purpose of ensuring data comparability, the calculations for the years 2004-2006 for the EU-10 also take account of Bulgaria and Romania, even though they did not join the EU until 2007.
Table 2.1. Foreign trade of the EU-10 by group of main trading partners in 1995-2014 (current prices, USD million)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value (USD million)</th>
<th>Annual average growth rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td>87,451</td>
<td>210,892</td>
</tr>
<tr>
<td>Imports</td>
<td>122,904</td>
<td>277,027</td>
</tr>
<tr>
<td>EU-15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td>52,499</td>
<td>140,975</td>
</tr>
<tr>
<td>Imports</td>
<td>73,253</td>
<td>157,507</td>
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<td>EU-10</td>
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<tr>
<td>Exports</td>
<td>13,247</td>
<td>30,190</td>
</tr>
<tr>
<td>Imports</td>
<td>14,419</td>
<td>32,809</td>
</tr>
<tr>
<td>Third countries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exports</td>
<td>20,817</td>
<td>39,118</td>
</tr>
<tr>
<td>Imports</td>
<td>34,187</td>
<td>84,164</td>
</tr>
</tbody>
</table>

Source: As calculated by Łukasz Ambroziak and Wojciech Polan on the basis of the Comtrade database.

Fig. 2.1. Annual average growth rates of EU-10 trade by group of main trading partners in 1996-2014 (%)
The strengthening of mutual trade links of the EU-10 in the period immediately following accession is mostly attributable to the elimination of previously existing barriers to trade between the countries (especially in agricultural trade, as well as physical, technical and fiscal barriers to trade in industrial goods) after 1 May 2004. Combined with an economic upswing in the markets of major partners, it pushed up sales, especially to the new Member States. A certain role was also played by the general recovery in world markets in the period in question. Accelerated exports to the EU-15 show that producers from the EU-10 were prepared to face the competition and rivalry in the demanding single market. It must also be emphasised that the phasing-in of commodity trade liberalisation (prior to accession), both in relations with the EU-15 and in mutual trade, largely facilitated those preparations. The strengthened position of third (non-EU-25) countries in EU-10 exports must be considered to have been favourable as well. This meant a greater diversification of outlets, with a considerable role played by the changed trade conditions after 1 May 2004 following the adoption of the EU common commercial policy rules.

**Intensity of intra-industry trade in the total trade of the EU-10**

Although inter-industry trade (exchange of goods coming from different industries) still accounts for the majority of EU-10 trade, its share decreased steadily in almost all of those countries in the recent 20 years under study.

The outbreak of the world crisis caused a certain decline in the value of EU-10 trade with all the groups of partners. In 2009-2012 it was accompanied by a slowdown in the previously rather robust growth in the IIT index. This means that the fall in intra-industry trade was not more abrupt than the drop in inter-industry trade.

As a result of those changes, in 2014 the index of IIT in the total trade of the EU-10 reached 33%, up by 8.6 percentage points (pp) compared to 1995 (Fig. 2.2 and Table 2.2.).

As follows from the data presented in Table 2.2, throughout the period in question (1995-2014) intra-industry trade intensity varied distinctly between individual EU-10 countries. The most significant changes were found in the countries with the lowest IIT indices at the beginning of the period under study (the low base effect)\(^{40}\). Those included: Romania, Bulgaria, Latvia, Lithuania and Poland. In the countries in question the IIT indices showed 2- to 3-fold increases. The countries recorded relatively the most buoyant growth in the index both in the pre- and post-accession periods, including the post-crisis years (2009-2014). The sole exception was Poland, where the index practically remained unchanged after the crisis (approx. 32-33%). However, it was the highest among the above-mentioned countries.

\(^{40}\) The lower the index in the initial period, the easier its growth in the following years.
Fig. 2.2. Indices of intra-industry trade in Bulgaria, Estonia, Latvia, Lithuania, Romania and in the total trade of the EU-10 in 1995-2014 (% of total trade)

Fig. 2.3. Indices of intra-industry trade in the Czech Republic, Hungary, Poland, Slovakia, Slovenia and in the total trade of the EU-10 in 1995-2014 (%)

Source: As in Figure 2.1.
Table 2.2. Indices of intra-industry trade in the total trade of the EU-10 in 1995-2014 (% of total trade)

<table>
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<td>31.4</td>
<td>30.8</td>
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<td>32.9</td>
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</tbody>
</table>

Source: As in Table 2.1.
A marked rise in the index throughout the period under study was also noted in the case of Hungary – particularly in the first years after accession. Consequently, it ranked among the top performers at the end of the period in question (38%). As regards other countries: in Slovenia and Slovakia the IIT index augmented from 22% and 25% to 29% and 33%, respectively. In the case of Slovenia, the rise in the index was nearly even in the years before and after accession. Slovakia, in turn, experienced particularly distinct increases in the IIT index in the pre-accession period. In the country characterised by the highest intensity of intra-industry trade at the beginning of the period in question, i.e. in the Czech Republic (40% of total trade in 1995), its share even slightly declined (to 39%) over the period in question.

As a result of the aforementioned changes, in 2014 the highest intra-industry trade indices (above the EU-10 average, i.e. 33%) were noted in the Czech Republic, Hungary, followed by Poland and Slovenia. In the case of Romania, Latvia and Slovakia, the index was close to the EU-10 average. At the same time, the lowest indices were found in Lithuania, Estonia and Bulgaria (19-22%).

**Intensity of intra-industry trade in EU-10 trade with the main groups of partners**

The period in question witnessed increasing IIT with all the partners of the EU-10. The growth was slightly faster in trade within the EU-10 than with the EU-15. As a result, at the end of the period under study the mutual trade of the EU-10 was characterised by slightly more intensive IIT than trade with the EU-15 (Fig. 2.4.). The IIT index in trade with non-EU countries also showed an increase in the period under analysis but its level was distinctly (approx. 3 times) lower than that in trade with the aforementioned groups of countries.

The trends observed with regard to the IIT index were different in the pre- and post-accession periods. In trade with the EU-15 relatively the fastest growth in the IIT index was noted in the pre-accession period (from 30% in 1995 to 36% of total trade in 2003), whereas in relations within the EU-10 – in the post-accession period (from 31% to 42%, respectively). This seems to be attributable to the full elimination of various (physical, technical and fiscal) barriers to trade within the EU-10 in connection with their inclusion in the single market of the EU on 1 May 2004. This confirms the thesis that a rising level of the openness of the economy improves conditions for the development of intra-industry trade (Balassa and Bauwens, 1987).

In the period of the crisis, there were no major changes in the IIT index in the trade of the countries concerned with all the groups of trading partners. In 2009–2014

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41 In trade with the EU-15 the effects of liberalisation followed the conclusion of the association agreements in the early 1990s.
the annual average rate of growth in the IIT index did not differ much from the figure for the whole post-accession period.

**Intensity of intra-industry trade of individual EU-10 countries with the main groups of partners**

The analysis presented is based on the hypothesis assuming that the intensification of intra-industry trade experienced by the EU-10 was an important factor reflecting the preparedness of the producers (as well as of exporters and importers) from those countries to cope with competition in the single European market. Therefore, the authors of the study considered it advisable to compare the development of IIT indices with regard to particular groups of partners (the EU-15, the EU-10 and non-EU-25 countries). The relevant data are shown in Table 2.3. Even a cursory analysis of the data indicates the existence of diverse trends in this regard.

**Intensity of intra-industry trade of individual EU-10 with the EU-15**

In trade with the EU-15 the highest intensity of intra-industry trade characterised the Czech Republic (cf. Table 2.3). As early as in the mid-1990s, nearly half of Czech...
trade with the EU-15 was of an intra-industry nature. By 2014, however, that share showed a minor decrease (by approx. 2 pp), which is most likely attributable to the significant saturation of trade with this type of specialisation already at the start of the period in question.

At the beginning of the period under study (1995), relatively high IIT indices were also noted in trade with the EU-15 in the case of Hungary and Slovenia (slightly above 30%). Over the following 20 years, the indices exceeded 40%. In 2014 that group was also joined by Poland, with an IIT index in trade with the EU-15 of nearly 44%. Simultaneously, Poland (in addition to Latvia and Romania) ranked among the countries with the fastest-growing IIT indices in the period covered. In the other countries the IIT index, in both 1995 and 2014, was below the average level for the EU-10. The lowest index was recorded in Lithuania (21%), less than half of the figure for the top performer, i.e. the Czech Republic (47%).

Table 2.3. IIT indices in EU-10 trade with three major groups of partners in 1995-2014 (% of total trade)

<table>
<thead>
<tr>
<th>Country \ year</th>
<th>Trade with EU-15</th>
<th>Mutual Trade of the EU-10</th>
<th>Trade with third countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG</td>
<td>17.5</td>
<td>21.9</td>
<td>23.8</td>
</tr>
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<td>49.7</td>
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<td>EE</td>
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<td>45.3</td>
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<td>PL</td>
<td>21.5</td>
<td>35.3</td>
<td>42.6</td>
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<tr>
<td>RO</td>
<td>14.7</td>
<td>20.3</td>
<td>32.1</td>
</tr>
<tr>
<td>SK</td>
<td>18.6</td>
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<tr>
<td>SI</td>
<td>31.0</td>
<td>36.8</td>
<td>37.9</td>
</tr>
<tr>
<td>EU-10</td>
<td>30.2</td>
<td>35.6</td>
<td>40.5</td>
</tr>
</tbody>
</table>

Source: As in Table 2.1.

In the period following the outbreak of the world economic crisis, the majority of the countries concerned suffered no marked slowdown of growth in intra-industry trade. The exceptions included Estonia, Hungary, Slovakia and Romania.

Most of those trends seem to have resulted from the varying rates of industrial restructuring in the new EU Member States (both in the period of preparations for accession and in the years after joining the EU). This facilitated the building of
more efficient production structures, closer to those observed in the EU-15\textsuperscript{42}. As a consequence, the composition of EU-10 trade became more similar to that of the EU-15. It had a considerable impact on growth in the share of intra-industry trade in relations between the two groups of countries.

**Intensity of intra-industry trade in the mutual trade of the EU-10**

As already demonstrated above, in 1995-2014 intra-industry trade markedly gained in importance in the mutual trade of the EU-10, with the IIT indices for 2014 even exceeding those in trade with the EU-15 (Table 2.3.). At the beginning of the period analysed, the highest IIT indices in mutual trade were noted in the case of the Czech Republic (39%) and Slovakia (35%). Those were at least twice as high as in the rest of the EU-10. In 2014 indices above the EU-10 average (42%) characterised as many as 4 countries: Latvia, the Czech Republic, Hungary and Slovakia. The respective figures were not much lower for Lithuania and Romania.

In the case of most of the EU-10, in 1995-2014 there was an (even 2- to 3-fold) increase in the growth rate and share of intra-industry trade in their mutual trade. Only for the Czech Republic and Slovakia the dynamics of change were lower, but in both countries IIT intensity in their trade with the rest of the EU-10 was relatively the highest in 1995.

A particularly marked rise in the share of intra-industry trade in the mutual trade of the EU-10 could be seen after their joining the EU. Only in the case of Poland the respective indices were lower in the post-accession period than in the years before accession. After the outbreak of the crisis, i.e. in the years 2009-2014, there was no significant decline in intra-industry trade in the mutual trade of the EU-10 (with the exception of Poland and Slovakia). Apparently, a particularly important role was played by the lifting, as of 1 May 2004, of various (physical, technical and fiscal) barriers previously existing in trade between those countries. That buoyant growth in intra-industry trade in the mutual trade of the EU-10 must also be attributed to increased trade between branches of EU-15-based multinational corporations located in the new Member States.

**Intensity of intra-industry trade in trade with third countries (non-EU-25)**

As an exception, trade with other countries continued to be clearly dominated by inter-industry specialisation and IIT accounted for as little as 13% in 2014, while in 1995 it was at only 8%. Presumably, that trade mostly occurred between the EU-10

\textsuperscript{42} This was also stressed by Kang (2010).
and the most developed non-EU countries included in the group. Even where bilateral flows of trade with those countries showed high IIT indices, this was not reflected in the whole group owing to the modest share of those countries in the total foreign trade of the EU-10 (the share of the largest partner, i.e. the USA, was 2.5% in Poland’s exports and imports in 2014).

In 1995 IIT indices above the EU-10 average were noted in trade with non-EU countries in the case of Lithuania, Slovenia, Estonia and the Czech Republic (approx. 16-12% in 2014). As regards the other countries, the figures ranged from 2% to 6%. In the following years, the presented index considerably increased in most of the EU-10. The exceptions were the Baltic States (Lithuania, Latvia and Estonia). Their indices of IIT in trade with third countries showed an almost steady decline every year, falling significantly below 10% in 2014.

2.4. Main trends in the intra-industry trade of the EU-10 and of individual EU-10 countries by type of IIT
(Elżbieta Kawecka-Wyrzykowska)

In Chapter 1 we pointed out that the concept of intra-industry trade in horizontal differentiation (HIIT) is understood as offering diverse products of the same quality (exchange of varieties), whereas IIT in vertical differentiation (VIIT) – as supplying the same products or very close substitutes of different quality (exchange of qualities). According to the methodology of Greenaway et al. (1984), this division is based on the assumption that prices (measured by export and import unit values) reflect quality differences between traded goods and differences in quality are the key element in explaining the nature of vertical intra-industry trade. When unit values of products are close they are considered to be of similar quality or horizontally differentiated (HIIT). Otherwise, traded products are vertically differentiated (VIIT). Within vertical trade, the exchange of high- and low-quality goods is separated. If a country exports better quality goods and imports worse quality articles within IIT, the phenomenon is referred to as high-quality VIIT; otherwise, it is low-quality VIIT – for more see sub-chapter 2.1.

Low- and high-quality vertical intra-industry trade of the EU-10

As already mentioned, in order to gain a better insight into the type of specialisation, it is useful to break down vertical IIT into trade in low- and high-quality products. In 1995-2014 important changes took place in the proportions of both types of VIIT. The share of VIIT in high-quality products of the whole EU-10 group (i.e. exports of high-quality products and imports of low-quality products within the
same industries) increased substantially: from 5.3% to 11.5% of total trade (Table 2.4 and Fig. 2.5). At the same time, the percentage of low-quality VIIT declined: from 14.8% to 11.7%. As a result of those developments, at the end of the period under study (in 2014) the share of high-quality VIIT in total EU-10 trade was nearly the same as that of low-quality VIIT (i.e. 11.5% and 11.7%, respectively).

The changes reflected the scale of improvement in the quality of EU-10 exports within IIT (measured by changes in unit values). Positive changes in the commodity specialisation of the countries concerned consisted in fast growth in vertical intra-industry trade in high-quality products, with higher unit values in exports than in imports and based on quality rather than only price competition. Relatively the steepest increase in the share of vertical intra-industry trade in high-quality products took place in trade with the EU-15 (the share of this type of trade augmented nearly 3 times in the total trade with this group of countries), that is the most demanding market. In 2014 it accounted for 14.4% of total trade with the EU-15, whereas the respective indices for the mutual trade of the EU-10 and their total trade were 13.6% and 11.5%.

The EU-10 as a group appeared to be resilient to the fall in the share of (both high- and low-quality) vertical intra-industry trade in total trade in the period of the financial and economic crisis. The shares of both types of VIIT in the total trade of the EU-10 even went up slightly in the crisis year 2009 against the previous year (Fig. 2.5).

**Fig. 2.5.** IIT indices in the EU-10 by type of IIT (% of EU-10 total trade)

Source: As in Figure 2.1.
Changes in the horizontal intra-industry trade of the EU-10

Another positive trend in EU-10 trade was a steady rise in the intensity of HIIT. Its share in the total trade of the group of countries in question more than doubled, to slightly over 8% of their total trade in 2014 (from below 4% in 1995 – Fig. 2.6 and Table 2.4). The growth was even more rapid in trade with the EU-15 (by a factor of 2.5), whereas the intensity of HIIT in relations between the EU-10 increased slightly less than 2 times. As a consequence, the intensity of HIIT in the EU-10 trade with the EU-15 became similar to the intensity of such trade within the EU-10 (respectively: 10.1% and 12.9% of trade with the EU-15 and within the EU-10 in 2014).

The trends in HIIT in 1995-2014 and the proportions found in 2014 are consistent with the theoretical projections. Let us recall that theory explains horizontal specialisation mostly by similar preferences of customers in the trading countries, reflecting the income convergence of the countries concerned (i.e. the EU-10). At the beginning of the period in question, the level of such trade was rather low in relations with all the trading partners. It was still much higher in the mutual trade of the EU-10 than in their trade with the EU-15, which suggests greater similarities (e.g. measured by GDP per capita) within that group of countries than between them and the EU-15. It was attributable to the fact that in the mid-1990s the EU-10 were at the beginning of their transition from centrally planned to market economies. They were characterised by a similar structure of factor endowments and all of them

Fig. 2.6. Changes in the IIT pattern in EU-10 trade with major groups of partners (% of total trade)

Source: As in Figure 2.1.
represented low (or very low) development levels, particularly in comparison with the EU-15. Over the following 20 years, that gap in the level of economic development of the EU-10 relative to the EU-15 narrowed and this was reflected in the above-mentioned trends of HIIT indices with individual groups of countries.

Horizontal trade – in contrast to vertical IIT – appeared to be sensitive to the consequences of the financial and economic crisis from the beginning of the 21st century. In 2009 its share dropped nearly by one-fourth on the previous year (Fig. 2.5.). Its absolute value declined as well.

Changes in patterns of IIT specialisation in individual EU-10 countries

The scale of the above-mentioned positive changes in the foreign trade of the EU-10 varied between the countries of the group (Table 2.4.). At the beginning of the analysed period (in 1995), the trade of almost all the EU-10 was dominated by specialisation in low-quality vertically differentiated products (Table 2.4.). The exceptions were Lithuania and Estonia, with shares of low-quality VIIT slightly lower than those of high-quality vertical trade. At the beginning of the period in question, the highest share of low-quality VIIT in total trade was found in the Czech Republic – 27%, ahead of Slovenia (15%), Poland, Hungary and Slovakia – ca. 12%. The following years witnessed a fall in that share in the majority of the EU-10. Only Poland, Latvia and Estonia experienced minor increases, whereas Lithuania and Romania noted substantial growth (almost by 100%) in the share of low-quality VIIT in their total trade.

At the same time, almost all of the EU-10 countries recorded a significant rise in the proportion of high-quality VIIT, showing an improved competitiveness of their exports. The steepest (nearly six-fold) growth characterised Romania, but from the lowest level (a 2.4% share of total trade in 1995). An almost three-fold increase was noted in Poland, yet from a low level as well (3.1%). The index more than doubled, from the highest absolute levels, in Hungary and in the Czech Republic. Slightly less robust growth was also recorded in Slovakia and Slovenia. The dynamics were also similar in Bulgaria and Latvia but from relatively low levels. The situation in Lithuania was stagnant, whereas Estonia showed a limited rise.

Growth in high-quality VIIT usually concerned all the directions of trade. In 2014 the intensity of this type of trade was slightly higher in trade with the EU-15 than in the mutual trade of the EU-10. In Estonia and Poland the indices of high-quality VIIT were nearly the same in trade with the EU-15 as within the EU-10. Higher indices of high-quality VIIT in trade within the EU-10 than with the EU-15 characterised Latvia (the former index being more than double the latter), Bulgaria, the Czech Republic and Lithuania.

With regard to the participation of the EU-10 in horizontal intra-industry trade (i.e. simultaneous exports and imports of products of similar quality and technology,
Table 2.4. Shares of IIT in the total trade of the EU-10 in 1995-2014, by type of IIT and by group of trading partners (%)

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>IIT in trade with</th>
<th>Low-quality VIIT in trade with</th>
<th>High-quality VIIT in trade with</th>
<th>HIIT in trade with</th>
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<tbody>
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<td></td>
<td>EU-15</td>
<td>EU-10</td>
<td>Other</td>
<td>World</td>
</tr>
<tr>
<td>Bulgaria</td>
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<tr>
<td></td>
<td>2003</td>
<td>21.9</td>
<td>19.1</td>
<td>6.3</td>
<td>16.2</td>
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<tr>
<td></td>
<td>2014</td>
<td>28.4</td>
<td>32.3</td>
<td>8.7</td>
<td>21.7</td>
</tr>
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</tr>
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<td>High-quality VIIT in trade with</td>
<td>HIIT in trade with</td>
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<td>28.6</td>
<td>24.4</td>
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<td>18.7</td>
<td>32.8</td>
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<td>24.3</td>
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<td>41.6</td>
<td>13.0</td>
<td>32.9</td>
<td>15.6</td>
</tr>
</tbody>
</table>

* due to the lack of comparable data, the first year of analysis for Bulgaria is 1996.

Note: The sum of the above-mentioned three types of IIT (low-quality VIIT, HIIT and high-quality VIIT) is not always equal to the intensity of intra-industry trade (IIT) due to the existence of the so-called non-allocated intra-industry trade for which it is impossible to determine the export/import price relationships.

Source: As in Table 2.1.
which leads to economic convergence of the trading partners), as already mentioned, in the mid-1990s it was limited, mostly up to 4%. Over the following 20 years HIIT showed marked growth in the whole of the EU-10, except for Estonia. The most rapid rise in HIIT was recorded in Bulgaria and Latvia, a five-fold increase in the share of this type of trade in their total trade. In Bulgaria, despite the impressive growth, the index remained limited (below 4%) in 2014. It was less than half of the average index for the whole group, due to the very low initial level (below 1% in 1995). At the same time, the Latvian index came close to the EU-10 average. In addition to Bulgaria and Latvia, the highest dynamics of HIIT characterised Poland, Lithuania and Romania (four-fold, three-fold and over four-fold increases, respectively). At the end of the period under study, the top EU-10 performer in terms of HIIT intensity was the Czech Republic (a 11% share in total trade), closely followed by Poland, with a share of 10%. The lowest-ranking countries were Estonia (merely 3%), Bulgaria, Lithuania and Romania (4% each). In general, the shares of HIIT, higher at the end of the period under study than 20 years before (with the exception of Estonia), remained modest.

All the analysed changes mainly resulted from internal transition-related factors and the elimination of inefficient types of production, the opening-up of the economies to foreign competition (accelerated on account of free-trade agreements concluded with the EEC and other major trading partners in the early 1990s), forcing improvements in output quality, as well as FDI inflow and the ensuing access to more advanced technologies and know-how, etc. In the 21st century positive changes were stimulated by the prospect of EU accession and the related adjustments to the requirements of the European single market, and upon joining the EU – by access to the large single market of the EU, allowing for additional economies of scale, improvements in production efficiency, etc. (Kawecka-Wyrzykowska, 2014).

The above-mentioned factors influenced all of the EU-10 countries under analysis, but with varying strength and at different times, with dissimilar synergies between them and differentiated impact of other, additional determinants. The starting point was also different for each country. All this resulted in the varying scale of changes and effects achieved in the 20 years under study.

2.5. Development of EU-10 intra-industry trade by HS sections

(Łukasz Ambroziak, Wojciech Polan)

IIT intensity and the structure of IIT by type is analysed in this sub-chapter at the HS section level. The analysis excludes those product groups (five HS sections) which were of little significance to EU-10 foreign trade. The first part of this sub-chapter

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43 The analysis covered those HS sections whose shares in trade (on average, throughout the period under study) exceeded 1% in at least one country. Therefore, the following HS sections were
presents changes in IIT intensity and in the structure of IIT by type for the EU-10 as a whole. The analysis covers sixteen HS sections (Box 2.4.).

<table>
<thead>
<tr>
<th>Box 2.4. HS sections covered by the analysis of changes in IIT intensity and structure by type</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Animal products; II. Vegetable products; IV. Prepared foodstuffs; V. Mineral products; VI. Products of the chemical industry; VII. Plastics; IX. Wood and articles of wood; X. Pulp of wood and paper; XI. Textiles and textile articles; XII. Footwear; XIII. Ceramic products; XV. Base metals and articles of base metal; XVI. Machinery and equipment; XVII. Transport equipment; XVIII. Precision instruments and apparatus; XX. Miscellaneous manufactured articles.</td>
</tr>
</tbody>
</table>

The second part of the sub-chapter analyses changes in the intensity and structure by type of the IIT of individual EU-10 countries. For the purposes of this study, the number of HS sections was limited to seven. Those include two sections playing the greatest role in trade in most of the EU-10 (machinery and equipment, transport equipment), three sections characterised by high dynamics of IIT intensity in the period analysed (animal products, vegetable products, prepared foodstuffs, combined in the analysis as ‘agri-food products’), a section with one of the lowest IIT indices (mineral products) and a section including technologically advanced products (precision instruments and apparatus).

The trends in IIT and its intensity are characterised in this sub-chapter in relation to overall intra-industry trade rather than to total foreign trade, in contrast to the previous sub-chapters. Therefore, due to sometimes minor changes and absolute index levels, the conclusions drawn are more clear.

**Intensity and pattern of intra-industry trade of the EU-10 (as a whole) by sectors**

In 1995 the highest intra-industry trade indices characterised trade in footwear (section XII), machinery and equipment (XVI), transport equipment (XVII) and plastics (VII). Approximately one-third of EU-10 trade in those commodity groups was of an intra-industry nature (Table 2.5.). The lowest IIT indices, not exceeding 10%, were noted in trade in vegetable products (section II), mineral products (V) and animal products (I). Those were commodity groups containing unprocessed raw materials (e.g. cereals) or products that undergo little processing (such as petroleum oils).
Table 2.5. Intra-industry trade indices in EU-10 trade by HS section (% of trade of section concerned)

<table>
<thead>
<tr>
<th>HS section</th>
<th>IIT by HS section</th>
<th>Share of section in total trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Animal products</td>
<td>9.0</td>
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<tr>
<td>II. Vegetable products</td>
<td>5.7</td>
<td>7.4</td>
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<tr>
<td>IV. Prepared foodstuffs</td>
<td>11.3</td>
<td>19.7</td>
</tr>
<tr>
<td>V. Mineral products</td>
<td>8.3</td>
<td>9.3</td>
</tr>
<tr>
<td>VI. Chemical products</td>
<td>16.5</td>
<td>16.6</td>
</tr>
<tr>
<td>VII. Plastics</td>
<td>32.2</td>
<td>37.8</td>
</tr>
<tr>
<td>IX. Wood and articles of wood</td>
<td>16.1</td>
<td>19.2</td>
</tr>
<tr>
<td>X. Pulp of wood and paper</td>
<td>23.5</td>
<td>31.6</td>
</tr>
<tr>
<td>XI. Textiles and textile articles</td>
<td>22.8</td>
<td>19.9</td>
</tr>
<tr>
<td>XII. Footwear</td>
<td>34.1</td>
<td>25.9</td>
</tr>
<tr>
<td>XIII. Ceramic products</td>
<td>21.1</td>
<td>26.9</td>
</tr>
<tr>
<td>XV. Base metals and articles of base metal</td>
<td>26.6</td>
<td>31.4</td>
</tr>
<tr>
<td>XVI. Machinery and equipment</td>
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<td>XVII. Transport equipment</td>
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<td>31.4</td>
</tr>
<tr>
<td>XX. Miscellaneous manufactured articles</td>
<td>28.9</td>
<td>28.1</td>
</tr>
<tr>
<td>Total</td>
<td>23.7</td>
<td>28.3</td>
</tr>
</tbody>
</table>

Source: As in Table 2.1.

In 1995-2014 there were significant changes in the intensity of IIT in specific commodity groups. The share of intra-industry trade only went down for one HS section (footwear, by nearly 9 pp) and increased in the other fifteen. The most robust growth in the share of IIT in EU-10 trade was found in the group of prepared foodstuffs – in the years 1995-2014 it jumped by 17.8 pp, i.e. nearly three times. In trade in plastics the index rose by 13.3 pp, whereas in trade in transport equipment, chemical products, pulp of wood, paper and paperboard, animal products – by ca. 11 pp. The slowest increases in IIT intensity were recorded in the following commodity groups: miscellaneous manufactured articles, machinery and equipment, textiles and textile articles – by less than 2 pp.

In certain HS sections intra-industry trade grew more buoyantly before EU-10 accession to the EU, whereas in other – in the period of their EU membership. The former group comprised: transport equipment, pulp of wood, paper and paperboard, precision instruments, ceramic products, base metals and articles of base metal. At the same time, higher dynamics of intra-industry trade after accession than in the
pre-accession period characterised animal and vegetable products, prepared foodstuffs, mineral products, chemical products, plastics, textiles and textile articles as well as machinery and equipment. Conversely, the post-accession period saw a slight decline in the intra-industry trade intensity in the trade of the EU-10 (as a whole) in transport equipment.

As a result of those changes, in 2014 the highest IIT indices were noted in trade in transport equipment and plastics. Approximately 45% of EU-10 trade in those products was of an intra-industry nature. High IIT indices (ca. 35%) characterised trade in commodity groups such as: machinery and equipment, pulp of wood, paper and paperboard, base metals and articles of base metal, precision instruments. As in the mid-1990s, the least intensive intra-industry trade was recorded in trade in vegetable and animal products as well as in mineral products (IIT indices below 20%).

Undoubtedly, this partly stemmed from the nature of the commodity groups in question: their limited capacity for differentiation, thus the development of intra-industry trade specialisation. In other product groups IIT indices ranged from 20% to 30%. Therefore, in the commodity groups playing the most important role in EU-10 trade (as a whole) the intensity of intra-industry trade was the highest.

Changes in the intensity of the intra-industry trade in specific commodity groups of the EU-10 (as a whole) were accompanied by changes in the IIT structure by type (Fig. 2.7.). With the exception of two of the HS sections discussed here, i.e. animal products as well as textiles and textile articles, there was a fall in the share in intra-industry trade of vertical IIT where exported goods were of a relatively lower quality than the quality of imported products. In 1995-2014 the most dramatic fall (by more than 30 pp) in the share of low-quality vertical IIT was observed in the intra-industry trade of the EU-10 (as a whole) in plastics, base metals and articles of base metal and transport equipment, whereas a less abrupt decrease affected trade in mineral products, machinery and equipment. In 2014 this type of IIT was the least important in intra-industry trade in mineral products (15% of two-way trade), transport equipment (26%), textiles and textile articles as well as in prepared foodstuffs (around 30%). However, low-quality vertical IIT continued to account for more than half of intra-industry trade in precision instruments and apparatus, thus technologically advanced products. This means that EU-10 countries mostly specialised in exports of cheaper (lower quality) varieties of those goods and imported relatively more expensive (higher quality) varieties. In most of the other HS sections covered, the share of low-quality vertical IIT exceeded 40%.

Simultaneously, the years 1995-2014 saw an expansion of vertical IIT in articles of a higher quality in exports compared to imports as well as of horizontal IIT. As regards horizontal IIT, in 2014 it represented the highest share of intra-industry trade in mineral products (accounting for more than half of that trade) as well as in base metals and articles of base metal and transport equipment (approx. 40%) – for more details see below.
High-quality vertical IIT played the greatest role in intra-industry trade in footwear (over half of that trade), agri-food and chemical products, textiles and textile articles, machinery and equipment (above 40%).

The above analysis of the intensity and structure by type of IIT in specific HS sections allowed to illustrate and describe relevant trends for the EU-10 as a whole. The following sub-chapter assesses the changes observed in intra-industry trade in selected sectors of the national economies of individual EU-10 countries.

**Intra-industry trade in individual EU-10 countries by sectors: intensity and pattern**

**Machinery and equipment**

In the majority of the EU-10 countries under study (except for Bulgaria and two of the Baltic States – Lithuania and Latvia), the most important commodity group in exports and imports, at the HS section level, was machinery and equipment (Table 2.6.)\(^{44}\). In 1995-2014 the share of those products in trade, particularly in exports, augmented significantly.

\(^{44}\) In 1995-2014 the highest shares of machinery and equipment were noted in the trade of Hungary (an average of 42% of trade in the period analysed), the Czech Republic (34%), Slovakia (29%), Estonia, Poland and Romania (24%).
Table 2.6. Composition of EU-10 exports and imports by HS section, annual average share in 1995-2014 (%)

<table>
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<tr>
<th></th>
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Source: As in Table 2.1.
Table 2.7. Share of IIT in EU-10 trade by HS section (%)

<table>
<thead>
<tr>
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<th>Lithuania</th>
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<td>29.1</td>
<td>13.0</td>
<td>22.6</td>
</tr>
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<td>XI</td>
<td>19.4</td>
<td>24.6</td>
<td>54.7</td>
<td>34.7</td>
<td>18.9</td>
<td>8.7</td>
<td>27.6</td>
<td>30.6</td>
<td>13.8</td>
<td>26.8</td>
</tr>
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<td>25.2</td>
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<td>45.6</td>
<td>35.5</td>
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</tr>
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<td>21.5</td>
<td>28.3</td>
<td>38.9</td>
<td>16.2</td>
<td>11.6</td>
<td>22.9</td>
<td>24.3</td>
<td>7.8</td>
<td>17.1</td>
</tr>
<tr>
<td>XV</td>
<td>7.0</td>
<td>12.8</td>
<td>42.8</td>
<td>43.7</td>
<td>20.3</td>
<td>20.1</td>
<td>24.6</td>
<td>32.6</td>
<td>7.8</td>
<td>22.4</td>
</tr>
<tr>
<td>XVI</td>
<td>19.4</td>
<td>35.0</td>
<td>48.4</td>
<td>39.1</td>
<td>38.2</td>
<td>22.1</td>
<td>34.2</td>
<td>39.7</td>
<td>14.2</td>
<td>30.7</td>
</tr>
<tr>
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<td>9.3</td>
<td>24.0</td>
<td>49.6</td>
<td>41.3</td>
<td>38.2</td>
<td>18.0</td>
<td>24.4</td>
<td>49.9</td>
<td>13.8</td>
<td>35.2</td>
</tr>
<tr>
<td>XVIII</td>
<td>10.0</td>
<td>35.5</td>
<td>34.7</td>
<td>44.6</td>
<td>23.1</td>
<td>26.9</td>
<td>31.4</td>
<td>33.3</td>
<td>12.7</td>
<td>25.2</td>
</tr>
<tr>
<td>XX</td>
<td>28.0</td>
<td>29.1</td>
<td>44.0</td>
<td>33.6</td>
<td>36.1</td>
<td>17.9</td>
<td>39.0</td>
<td>43.6</td>
<td>29.3</td>
<td>31.8</td>
</tr>
</tbody>
</table>

Source: As in Table 2.1.
The expansion of trade in those products in Hungary, Poland, Romania, Slovenia, Latvia and Bulgaria was accompanied by a growing role of intra-industry trade in this commodity group (Table 2.7.). In the period covered, the most significant (more than two-fold) increase in the share of intra-industry trade in trade in machinery and equipment characterised Romania (from 17% in 1995 to 38% in 2014). As regards the other four countries, IIT diminished in importance in the group of machinery and equipment. In 2014 intra-industry trade played the greatest role in trade in machinery and equipment in Hungary (40%), the Czech Republic (39%), Romania (38%), Poland (36%), Bulgaria and Slovenia (35%).

The structure by type of intra-industry trade in machinery and equipment showed considerable changes in the EU-10 over the period 1995-2014 (Table 2.8.). In general, the share of low-quality vertical IIT (exports of goods of a relatively low quality and imports of articles of a relatively high quality) in IIT in the products under analysis was on the decline. Therefore, in the group of machinery and equipment there was an increase in the proportion of intra-industry trade in horizontally differentiated products and of high-quality vertical IIT (exports of goods of a relatively high quality and imports of items of a relatively low quality). Horizontal IIT gained most in importance in Lithuania, Latvia and Bulgaria, whereas high-quality vertical IIT – in Romania (a more than eight-fold growth in the share of high-quality vertical IIT in the total trade in machinery and equipment between 1995 and 2014, but from a low initial level), Poland, Bulgaria and Latvia (3.8-, 3.3- and 2.8-fold increases, respectively). In 2014 the highest share of high-quality vertical IIT in total trade in machinery and equipment was found in Romania (20%), ahead of the Czech Republic and Hungary (18%). Thus, high-quality vertical IIT accounted for more than half of intra-industry trade in machinery and equipment in Romania and nearly half in the Czech Republic and Hungary. Despite a significant improvement, in 2014 Poland, in addition to Slovakia, had the least favourable structure by type of intra-industry in trade machinery and equipment. High-quality vertical IIT represented a mere 31% of total intra-industry trade in those articles, whereas horizontal intra-industry trade accounted for 14%.

The direction of changes in the structure by type of intra-industry trade in machinery and equipment in the EU-10 can be considered advantageous from the point of view of their economies. The rising share of high-quality vertical IIT and, to a lesser degree, of horizontal IIT means that the majority of the countries under analysis ceased to be merely suppliers of unprocessed or low-quality goods and products, increasingly exporting semi-finished products and final goods characterised by a high quality and considerable technological advancement (Czarny, Śledziewska, 2009). Those changes are attributable to the modernisation of the machinery and equipment industry and to the inflow of foreign direct investment to that sector. As at the end of 2014, the inward FDI stock in the machinery and equipment industry accounted for approx. 12%-14% of total FDI in the Czech, Romanian, Slovakian and
Table 2.8. EU-10 IIT by type and HS section, in % of intra-industry trade in products of the HS section concerned (%)

<table>
<thead>
<tr>
<th>HS section</th>
<th>IIT type</th>
<th>Bulgaria</th>
<th>Czech Republic</th>
<th>Estonia</th>
<th>Hungary</th>
<th>Latvia</th>
<th>Lithuania</th>
<th>Poland</th>
<th>Romania</th>
<th>Slovakia</th>
<th>Slovenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>IIT</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>VIIT low</td>
<td>15.9</td>
<td>32.8</td>
<td>37.4</td>
<td>28.8</td>
<td>22.4</td>
<td>34.3</td>
<td>33.9</td>
<td>29.5</td>
<td>65.8</td>
<td>32.8</td>
</tr>
<tr>
<td></td>
<td>HII T</td>
<td>3.3</td>
<td>33.5</td>
<td>52.9</td>
<td>28.1</td>
<td>8.4</td>
<td>22.9</td>
<td>24.6</td>
<td>28.1</td>
<td>10.4</td>
<td>27.2</td>
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<td></td>
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<td>80.8</td>
<td>33.7</td>
<td>9.6</td>
<td>41.3</td>
<td>69.2</td>
<td>42.8</td>
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<td>42.4</td>
<td>23.8</td>
<td>40.0</td>
</tr>
<tr>
<td></td>
<td>IIT n.a.</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>V</td>
<td>IIT</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>VIIT low</td>
<td>86.7</td>
<td>22.9</td>
<td>44.1</td>
<td>11.9</td>
<td>21.4</td>
<td>73.0</td>
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<td>7.7</td>
<td>12.2</td>
<td>4.7</td>
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<tr>
<td></td>
<td>HII T</td>
<td>9.5</td>
<td>25.6</td>
<td>10.8</td>
<td>32.4</td>
<td>9.5</td>
<td>6.7</td>
<td>53.8</td>
<td>50.8</td>
<td>1.0</td>
<td>90.5</td>
</tr>
<tr>
<td></td>
<td>VIIIT high</td>
<td>3.8</td>
<td>34.7</td>
<td>33.1</td>
<td>28.8</td>
<td>69.1</td>
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<td>16.2</td>
<td>42.0</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>IIT n.a.</td>
<td>1.8</td>
<td>16.8</td>
<td>12.0</td>
<td>26.8</td>
<td>0.0</td>
<td>3.6</td>
<td>0.0</td>
<td>25.3</td>
<td>44.8</td>
<td>1.7</td>
</tr>
<tr>
<td>XVI</td>
<td>IIT</td>
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<td></td>
<td>VIIT low</td>
<td>68.0</td>
<td>37.5</td>
<td>76.7</td>
<td>40.4</td>
<td>15.1</td>
<td>40.3</td>
<td>52.3</td>
<td>40.6</td>
<td>43.6</td>
<td>30.5</td>
</tr>
<tr>
<td></td>
<td>HII T</td>
<td>6.4</td>
<td>15.7</td>
<td>5.0</td>
<td>14.3</td>
<td>59.1</td>
<td>128</td>
<td>15.0</td>
<td>13.8</td>
<td>21.1</td>
<td>23.0</td>
</tr>
<tr>
<td></td>
<td>VIIIT high</td>
<td>25.6</td>
<td>46.8</td>
<td>18.3</td>
<td>44.9</td>
<td>17.5</td>
<td>46.9</td>
<td>32.7</td>
<td>45.6</td>
<td>35.3</td>
<td>46.4</td>
</tr>
<tr>
<td></td>
<td>IIT n.a.</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.5</td>
<td>8.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>XVII</td>
<td>IIT</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>VIIT low</td>
<td>64.3</td>
<td>57.8</td>
<td>59.7</td>
<td>17.1</td>
<td>1.4</td>
<td>527</td>
<td>70.8</td>
<td>19.1</td>
<td>21.1</td>
<td>24.2</td>
</tr>
<tr>
<td></td>
<td>HII T</td>
<td>8.4</td>
<td>16.4</td>
<td>4.0</td>
<td>62.3</td>
<td>0.0</td>
<td>20.6</td>
<td>3.4</td>
<td>30.1</td>
<td>0.6</td>
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</tr>
<tr>
<td></td>
<td>VIIIT high</td>
<td>27.3</td>
<td>25.8</td>
<td>36.3</td>
<td>20.6</td>
<td>0.5</td>
<td>26.7</td>
<td>25.9</td>
<td>50.7</td>
<td>78.2</td>
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<td>98.0</td>
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<td>0.0</td>
<td>0.1</td>
<td>71.9</td>
</tr>
<tr>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>VIIT low</td>
<td>47.7</td>
<td>40.9</td>
<td>74.2</td>
<td>59.2</td>
<td>12.7</td>
<td>427</td>
<td>71.1</td>
<td>27.2</td>
<td>13.9</td>
<td>19.7</td>
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<td></td>
<td>HII T</td>
<td>7.2</td>
<td>19.0</td>
<td>5.8</td>
<td>14.9</td>
<td>18.3</td>
<td>17.8</td>
<td>13.2</td>
<td>17.3</td>
<td>2.1</td>
<td>6.7</td>
</tr>
<tr>
<td></td>
<td>VIIIT high</td>
<td>41.7</td>
<td>40.0</td>
<td>15.5</td>
<td>25.9</td>
<td>27.7</td>
<td>39.4</td>
<td>12.8</td>
<td>55.5</td>
<td>79.0</td>
<td>67.2</td>
</tr>
<tr>
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<td>IIT n.a.</td>
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<td>0.1</td>
<td>4.5</td>
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<td>41.3</td>
<td>0.0</td>
<td>2.9</td>
<td>0.0</td>
<td>5.0</td>
<td>6.4</td>
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</table>

Source: As in Table 2.1.
Table 2.9. Inward FDI stock in EU-10 manufacturing as at the end of 2014*

<table>
<thead>
<tr>
<th>Industry Item</th>
<th>Industry Item</th>
<th>Czech Republic</th>
<th>Estonia</th>
<th>Hungary</th>
<th>Latvia</th>
<th>Lithuania</th>
<th>Poland</th>
<th>Romania</th>
<th>Slovakia*</th>
<th>Slovenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing, total value, USD billion</td>
<td>33.5</td>
<td>2.1</td>
<td>20.3</td>
<td>1.6</td>
<td>2.5</td>
<td>50.9</td>
<td>19.3</td>
<td>13.6</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>Food products, beverages and tobacco products</td>
<td>8.7</td>
<td>21.6</td>
<td>8.1</td>
<td>12.4</td>
<td>12.8</td>
<td>18.5</td>
<td>12.6</td>
<td>5.5</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>Textiles, apparel, leather, related products</td>
<td>1.4</td>
<td>6.1</td>
<td>1.5</td>
<td>2.3</td>
<td>5.1</td>
<td>1.0</td>
<td>5.1</td>
<td>1.6</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>Wood and paper products and printing</td>
<td>4.6</td>
<td>21.5</td>
<td>4.2</td>
<td>25.9</td>
<td>11.1</td>
<td>9.5</td>
<td>7.8</td>
<td>3.5</td>
<td>10.4</td>
<td></td>
</tr>
<tr>
<td>Coke, petroleum, chemicals, pharmaceuticals</td>
<td>6.1</td>
<td>8.5</td>
<td>20.1</td>
<td>3.8</td>
<td>43.3</td>
<td>10.2</td>
<td>10.1</td>
<td>11.9</td>
<td>29.1</td>
<td></td>
</tr>
<tr>
<td>Rubber, plastics, other non-metallic mineral products</td>
<td>12.5</td>
<td>13.7</td>
<td>14.0</td>
<td>0.0</td>
<td>8.1</td>
<td>8.8</td>
<td>15.8</td>
<td>13.6</td>
<td>16.9</td>
<td></td>
</tr>
<tr>
<td>Basic metals, fabricated met., prod., ex mach. &amp; equip.</td>
<td>10.1</td>
<td>6.3</td>
<td>7.5</td>
<td>6.2</td>
<td>2.4</td>
<td>12.9</td>
<td>14.1</td>
<td>17.7</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>Computer, electronic, optical products</td>
<td>4.9</td>
<td>5.7</td>
<td>11.0</td>
<td>1.2</td>
<td>0.2</td>
<td>2.5</td>
<td>2.7</td>
<td>5.8</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>Electrical equipment, machinery and equipment n.e.c.</td>
<td>8.7</td>
<td>9.6</td>
<td>9.8</td>
<td>1.1</td>
<td>5.4</td>
<td>3.6</td>
<td>12.1</td>
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<tr>
<td>Transport equipment</td>
<td>31.7</td>
<td>3.7</td>
<td>18.8</td>
<td>4.6</td>
<td>5.4</td>
<td>17.8</td>
<td>16.8</td>
<td>24.4</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>Other manufacturing</td>
<td>11.1</td>
<td>3.2</td>
<td>5.0</td>
<td>42.5</td>
<td>6.2</td>
<td>15.3</td>
<td>2.9</td>
<td>3.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Manufacturing, total (%)</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Lack of data for Bulgaria. Data for Slovakia as at the end of 2013.

Source: Own study on the basis of wiw Foreign Direct Investment Database.
Slovenian industries (Table 2.9.). In other countries the machinery and equipment industry played a lesser role in attracting foreign investors.

**Transport equipment**

In most of the EU-10 a major role in trade, particularly in exports, was played by transport equipment, dominated by automotive products. Several countries of the group under study, i.e. the Czech Republic, Poland, Romania, Slovakia, Slovenia and Hungary, joined in the global automotive industry value chain after the mid-1990s (Table 2.6.). They became destinations for foreign capital in the form of foreign direct investment in that sector, largely in motor vehicle assembly plants (Box 2.5.).

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**Box 2.5. FDI in the transport equipment sector**

The most foreign direct investment in the transport equipment sector was attracted by the Czech Republic (Table 2.9.). At the end of 2014 the stock of inward FDI in the transport equipment industry exceeded EUR 10.6 billion. It accounted for nearly one-third of FDI in Czech manufacturing. The second largest recipient of foreign capital was the transport equipment industry in Poland (EUR 9.1 billion at the end of 2014). But FDI in this sector played a lesser role than in the Czech Republic (nearly 18%). At the end of 2014 in Hungary, Slovakia and Romania the stock of inward FDI in the transport equipment industry was below EUR 4 billion, whereas in Slovenia – EUR 0.5 billion. Notably, in Slovakia the transport equipment industry accounted for as much as 24% of foreign capital invested in manufacturing. In Hungary, Romania and Slovenia these shares were about 15%.

The division of production processes into specific stages, frequently located in a number of countries, created trade flows: between plants producing parts and components, between plants making semi-finished products and car assembly plants, and between assembly plants and outlets for the cars produced. In 2014 the highest shares of transport equipment in exports characterised Slovakia (26%), the Czech Republic (20%), Romania and Hungary (16%) as well as Poland (14%) – Table 2.6. Most of the flows of trade in transport equipment were intra-industry in nature. In 2014 as much as 57% of Poland’s trade in transport equipment was intra-industry trade (Table 2.7). Compared to 1995, this meant a rise by 27 pp. In the period under study, the share of intra-industry trade in Hungarian trade in transport equipment doubled (to 50% in 2014), while there was a nearly five-fold increase in Romania (to 46% in 2014). A less buoyant growth in the intensity of intra-industry trade in transport equipment was noted in Slovenia (from 30% to 38%), whereas in the Czech Republic and Slovakia it declined, by 8 pp (to 41%) and 1 pp (to 31%), respectively. A markedly lower share

---

45 The share of transport equipment in Polish exports rose until 2009 (when it was 17.9%) and then dropped to 14.1% in 2014. It stemmed from a fall in the production of motor vehicles due to the lack of new investments in car assembly plants after other countries of the region had attracted such projects.
of intra-industry trade in Slovakian trade in transport equipment resulted from its intra-industry specialisation in the assembly of vehicles using mostly imported parts and components. To a certain extent, the above finding contradicts the theory (Jones et al., 2002) according to which the fragmentation of production processes stimulates IIT (cf. Box 2.6.).

**Box 2.6. Fragmentation and IIT in automotive products**

An analysis carried out for automotive products (accounting for a dominant share of transport equipment) in the selected EU-10 countries demonstrated that the inflow of foreign direct investment to the sector was only conducive to increased intra-industry trade in automotive products (both in cars and in parts and accessories) to a certain level (the critical point). Such a point was exceeded in Slovakia and the Czech Republic. The rising production of vehicles was much larger than the demand for cars in the countries in question. The vast majority of output was exported, whereas imports of new and used cars were minor. Considering the high level of car production, the prospects for IIT development in the group of parts and components were limited since a major share of component output was absorbed by domestic plants manufacturing vehicles (e.g. the Czech Republic and Slovakia) and only an insignificant part thereof, owing to robust domestic demand, could be exported. In addition, this was accompanied by increased imports of parts and components. Therefore, a rise in vehicle output, resulting from participation in the processes of production fragmentation, may also contribute to a decline in the intensity of trade in vehicles as well as in parts and components thereof (Ambroziak, 2016).

It follows from the analysis of IIT structure by type that in 1995-2014 low-quality vertical IIT distinctly diminished in importance in four of the EU-10 countries (Table 2.8.). In 2014 this type of trade accounted for less than 20% of Czech, Slovakian and Hungarian intra-industry trade in transport equipment, whereas in Poland the respective share was slightly higher (33%). In other countries, with the exception of Bulgaria and Estonia, the index did not exceed 40%.

In 1995 the significance of horizontal intra-industry trade in transport equipment of the countries under analysis was marginal. The sole exception was Slovenia, with horizontal IIT accounting for 11% of trade in those goods (or 40% of intra-industry trade in transport equipment). But in the period under study the role of this type of trade increased very distinctly in several of the countries concerned, i.e. the Czech Republic, Poland, Hungary and Latvia (a country with no vehicle production; it was trade in used cars), and – to a lesser degree – in Slovenia. In 2014 horizontal IIT represented more than half of Czech and Polish intra-industry trade in transport equipment. In Hungary, Latvia and Slovenia the shares did not exceed 40%.

The years 1995-2014 witnessed a rise in the proportion of high-quality vertical intra-industry trade in the majority of the countries (Table 2.8.). The most rapid growth in this type of trade was recorded in Hungarian and Romanian trade in transport equipment. In 2014 over one-fourth of trade in transport equipment
(or more than half of intra-industry trade in transport equipment) of those countries was high-quality vertical IIT. To a slightly lesser degree, the role of this type of trade also increased in Poland, Slovakia and Slovenia in the period covered (in 2014 the share of high-quality vertical IIT ranged between 10% and 20% of the trade in transport equipment of the above countries).

The conclusions from the analysis of the structure by type of EU-10 intra-industry trade in the section comprising transport equipment must be treated with particular caution. The section in question includes articles varying in production method and use of the goods produced. The items falling within this section include motor vehicles (passenger cars, delivery vans and lorries, buses and coaches), parts and components of such vehicles, railway and tramway rolling stock and parts thereof, aircraft and parts thereof as well as vessels and parts thereof. Whereas the manufacture of motor vehicles, particularly of passenger cars, was highly fragmented, in the case of railway and tramway rolling stock or vessels the fragmentation of production was distinctly lower. According to theory, the higher the degree of production fragmentation, the greater the potential for differentiating varieties of goods produced at particular stages of production, thus the more favourable conditions for the development of intra-industry trade in vertical differentiation (Jones et al., 2002, p. 69; see also sub-chapter 1.2). The importance of particular commodity groups varied between individual EU-10 countries, which was reflected in the structure by type of intra-industry trade at the level of the transport equipment section.

Earlier studies corroborated the reservations presented above. An analysis of the structure by type of intra-industry trade in automotive products of the new EU Member States (EU-12), broken down into final goods (cars) and semi-finished products (parts and components), indicated a continuing specialisation of several countries, e.g. the Czech Republic, Poland, Romania, Slovakia and Slovenia, in the export-oriented production of small cars (Ambroziak, 2012b). From the late 1990s in the EU-12 the ratio of export to import unit values of motor vehicles was on the decline, thus low-quality vertical IIT gradually gained in importance46. Due to the high import-intensity of the exports of motor vehicles of the countries concerned, they imported parts and accessories of decreasing unit values. Therefore, in those countries there was a rise in the ratio of export to import average prices of parts and accessories, thus the share of high-quality vertical IIT was on the increase. The process of ongoing specialisation of the NMS in the manufacture and export of small cars distinctly strengthened in 2009, i.e. in the period of the financial and economic crisis, which resulted from the above-mentioned (Box 2.7.) introduction of subsidised purchases of new vehicles (Ambroziak, 2012b).

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46 The growing share of small cars in the exports of the new Member States pushed down their export unit prices, thus the ratio of export to import prices.
Chapter 2. Changes in the intensity of EU-10 intra-industry trade in 1995-2014

Box 2.7. The IIT pattern in automotive trade during the crisis

Noticeably, in 2009 there was a distinct increase in the shares of low-quality vertical IIT in the Czech Republic, Poland and Slovakia as well as, to a lesser degree, in Romania. The above-mentioned countries benefited from subsidised purchases of new cars, introduced in a number of EU-15 countries (mostly in Germany). As the subsidy amount in the EU-15 country concerned was the same for all, vehicle consumers found it most profitable to buy the smallest vehicle possible. As a result, there was a rise in demand for city, compact cars produced in certain new EU Member States, thus small vehicles gained in importance in the exports of those countries. This had a downward effect on the export unit price, thus on the ratio of export to import unit prices. Those changes affected the structure by type of intra-industry trade in transport equipment since cars as well as car parts and components account for a dominant share in this commodity group. Therefore, the decreasing ratio of export to import unit prices for transport equipment indicated a rise in the share of low-quality vertical IIT. However, this was a short-term effect which disappeared after the EU-15 had withdrawn the subsidies (Ambroziak, 2012b).

Agri-food products (animal and vegetable products, prepared foodstuffs)

In the mid-1990s most of the EU-10 noted low indices of intra-industry trade in agri-food products (with the exception of prepared foodstuffs in Czech and Slovakian trade). Between 1995 and 2014, particularly after the countries under analysis joined the EU, those indices steadily increased, most rapidly in the group of prepared foodstuffs, especially following European Union accession. The intensified IIT in the products in question in those countries after their joining the EU primarily resulted from the elimination of barriers to intra-Community agri-food trade. Whereas trade in industrial goods was fully liberalised before accession, trade in agri-food articles was only subject to a partial reduction of trade barriers. The degree of the openness of the economy, also measured by the level of customs barriers, is indicated in the literature as a major determinant of intra-industry trade (Loertscher, Wolter, 1980). Since demand for differentiated goods – the main subject of two-way trade – is relatively price elastic (they have plenty of substitutes), trade in such commodities is subject to greater restrictions owing to protection compared to inter-industry trade. A reduction in protection level fuels IIT more than inter-industry trade. The increased intensity of IIT is also largely caused by the confidence of consumers from the EU-15 in agri-food products originating in the new Member States. In 2014 the highest IIT indices characterised the agri-food trade of the Central European countries (the Czech Republic, Hungary, Poland and Slovakia) as well as of Latvia (Table 2.7.). Apart from the above-mentioned factors, the indices were undoubtedly attributable to major foreign investments in the food industries of the countries in question. Those investment projects contributed to the restructuring and modernisation of many branches in the food industry, which resulted in a wider range of products offering similar qualities to consumers. Poland led the way in attracting foreign capital to the food industry (Table 2.9.). At the end of 2014 the stock of inward FDI in the Polish food industry exceeded EUR
9.4 billion, which accounted for nearly 20% of the value of foreign capital invested in Poland’s manufacturing.

With regard to agri-food articles, the most intensive intra-industry trade occurred in groups of differentiated and relatively highly processed products. The higher the degree of processing of the traded items, the greater the potential for the differentiation of varieties of such products, thus for IIT development. Less intensive intra-industry trade was found in the case of differentiated commodities undergoing little processing, including agricultural raw materials, and homogeneous goods (Ambroziak, 2014; Szczepaniak, 2013). In the group of unprocessed products, IIT mostly resulted from the seasons of production, transport costs, etc. In 2014 more than 35% of trade in prepared foodstuffs in the Czech Republic, Hungary and Slovakia as well as 30% of Poland’s trade in those products was of an intra-industry nature (Table 2.7.). In the group of animal products, the highest IIT indices characterised Latvia (nearly 34%) and Slovakia (27%), whereas in the group of vegetable products – the Czech Republic, Hungary and Latvia (approx. 20%).

In 1995-2014 the majority of the countries under study noted improved ratios of export to import unit prices in the group of prepared foodstuffs. This means that the countries concerned increasingly exported products of a relatively higher quality than that of imported goods (Table 2.8.). Thus, there was a rise in the share of high-quality vertical IIT and of horizontal IIT in intra-industry trade in prepared foodstuffs in most of the EU-10, whereas the proportion of low-quality vertical IIT went down. In 2014 the proportion of high-quality vertical IIT in trade in prepared foodstuffs was the highest in Slovakia (16%), followed by the Czech Republic and Hungary (15% each) as well as in Poland (12%), whereas the lowest figures were recorded in Estonia and Lithuania (7%). With the exception of Bulgaria, vertical IIT represented over 40% of intra-industry trade in prepared foodstuffs, and more than half in Romania. Intra-industry trade in vertically differentiated products of a relatively higher quality in exports than in imports played the greatest role in the commodity groups dependent on imported raw materials (e.g. imports of raw salmon and exports of smoked salmon). As regards horizontal intra-industry trade, in 2014 its highest share in trade in prepared foodstuffs was noted in the Czech Republic and Slovakia (11%), ahead of Hungary (10%), Bulgaria and Poland (8%). Thus, HIIT accounted for approx. 25% to 35% of intra-industry trade in those products. Essentially, trade in horizontally differentiated products consists in a country exporting products of a similar quality to that of imported goods. However, from the point of view of consumers they had different non-quality characteristics such as the country of origin (e.g. Czech and Slovak beer) or packaging (e.g. canned and bottled beer). Low-quality vertical IIT was relatively the most important in intra-industry trade in prepared foodstuffs in the Czech Republic, Hungary and Lithuania. In 2014 approximately 11% trade in those products was vertical trade where products exported were of a relatively lower quality than imported goods.
In the period covered, IIT in vegetable products and, to a lesser degree, also in animal products was generally lower than IIT in prepared foodstuffs in the countries under analysis (in 2014 higher IIT indices in trade in animal products than in prepared foodstuffs were only noted in Latvia, Slovakia and Estonia). This primarily resulted from the lesser potential for differentiating varieties of products undergoing little processing or unprocessed goods, representing a dominant share in those commodity groups (Table 2.7.). Nevertheless, in 1995-2014 there was a distinct increase in the intensity of intra-industry trade in animal and vegetable products.

The rapid growth of IIT intensity in EU-10 trade in agri-food products was also identified in previous studies (Jámbor 2014; 2015). The increase of IIT was mainly vertical in nature.

**Mineral products**

In the countries under analysis mineral products played a greater role in imports than in exports, which largely resulted from imports of energy materials. In certain countries, i.e. Lithuania, Estonia and Bulgaria, the share of mineral products in exports was relatively high (above 10% in 2014). The intensity of intra-industry trade in mineral products was among the lowest for the commodity groups taken into account (Table 2.7.). This followed from the nature of specialisation in trade in such products, i.e. inter-industry specialisation. As regards the structure by type of IIT in certain countries, i.e. Bulgaria, the Czech Republic, Hungary, Poland, Lithuania and Latvia, it is worth noting the relatively high share of horizontal intra-industry trade (Table 2.8.). The share of this type of trade sometimes even exceeded 60%. This may indicate a large proportion of re-exports of those products – imports of a raw material and exports thereof after minor processing.

**Precision instruments**

Considering the structure by type of intra-industry trade in precision instruments and apparatus, two groups of countries deserve attention. One included Poland and the Czech Republic, where low-quality vertical IIT dominated in the intra-industry trade in those articles (Table 2.8.). In 2014 this type of trade accounted for as much as 69% and 59%, respectively, of the intra-industry trade in precision instruments and apparatus of the two countries (which represented approximately one-fourth of the total trade in those articles of the countries concerned). The other group comprised Latvia and Hungary. Compared to the rest of the EU-10, the shares of low-quality vertical IIT in the intra-industry trade in those articles were minor (at 27% and 20%, respectively, in 2014), whereas the dominant role was played by high-quality vertical IIT (in 2014 the respective shares were 67% and 56% of intra-industry trade). This means that Latvia and Estonia specialised in exports of precision instruments and apparatus of a higher quality than the quality of imported products. It is worth pointing out that there was a significant change in the structure by type of intra-industry trade between 1995 and 2014.
trade in precision instruments and apparatus in Hungary. In the mid-1990s low-quality vertical IIT accounted for more than 70% of intra-industry trade, whereas the 2014 share was a mere 27%. There was also a decline in the proportion of this type of trade in Hungarian trade in precision instruments and apparatus – from 22% in 1995 to 9% in 2014.

**Concluding remarks**  
(Elżbieta Kawecka-Wyrzykowska, Łukasz Ambroziak, Edward Molendowski, Wojciech Polan)

The results of the analysis carried out in sub-chapter 2.3 corroborate the trend characteristic of present-day international trade, i.e. an increasing role of intra-industry trade in EU-10 trade. This was observed in the trade of most of the EU-10 (with the exception of the Czech Republic and Estonia, whose IIT intensity was roughly at the same level in 2014 as it was in 1995). However, inter-industry trade based on comparative advantage continued to dominate in the trade of all of the EU-10 countries. At the end of the period under study (2014), inter-industry trade accounted for approximately two-thirds of EU-10 total trade (with intra-industry trade representing the remaining share).

The intensity of IIT rose in EU-10 trade with all three groups of the countries under analysis. In comparison with the years before accession, the post-accession period witnessed greater positive changes in the pattern of specialisation in the mutual trade of the EU-10 countries compared to their trade with the EU-15. At the beginning of the period analysed the IIT indices for the majority of the EU-10 were lower in their intra-trade than in trade with the EU-15, and in 2014 these figures were usually higher in relations within the EU-10 than with the EU-15. As a result, at the end of the period under study (2014) the IIT index in the mutual trade of the EU-10 as a whole slightly exceeded the respective index for trade with the EU-15 (in both directions it was nearly 42%). In trade with third countries this index was merely 13%.

The slowdown of trade caused by the world crisis did not significantly affect the post-accession trends in intra-industry trade, whether in relations with the EU-15 or within the EU-10. Only several countries of the EU-10 experienced a fall in IIT intensity in 2007-2008, but the decrease rates were insignificant.

The trends observed in EU-10 intra-industry trade may confirm the thesis of Loertscher and Wolter (1980) that the IIT intensity of a group of countries increases as their economic development levels grow.

The results obtained also seem to corroborate the hypothesis following from the studies of Balassa (1966) and Falvey (1981). They indicated that there was a strong correlation between the intensity of intra-industry trade and the degree of regional trade liberalisation. It is characteristic of free trade areas and customs unions that the
liberalisation of trade between the countries concerned is accompanied by expanding markets, which boosts the scale of production and two-way trade. As demonstrated above, such processes took place in the trade of the EU-10 with the EU-15.

There were also changes in the pattern of intra-industry specialisation in the EU-10 (identified in sub-chapter 2.4). Specifically, a shift towards VIIT in high-quality products (i.e. exports of high-quality products and imports of low-quality products within the same industries) was recorded: from 5.3% to 11.5% of the total trade of the EU-10 in 1995-2014. At the same time, the percentage of low-quality VIIT decreased (from 14.8% to 11.7%, respectively). Those changes reflected the scale of improvement in the quality of the EU-10 exports within IIT. Positive changes in the commodity specialisation of the countries in question within IIT consisted in a faster growth in the unit values of manufactures in exports compared to imports. Such a type of specialisation is based on quality characteristics (human capital, economies of scale, etc.) rather than on price competition only. This results in more advantages than inter-industry specialisation, which mostly reflects different factor endowments. The share of products of a relatively (compared to imports) better quality was, and still is, usually higher in exports to other EU-10 countries than to more demanding EU-15 markets. However, the gap in indices narrowed significantly (whereas their absolute levels went up) in comparison with the mid-1990s. In 2014, high-quality vertical intra-industry trade reached 14.4% of EU-10 total trade with the EU-15, whereas the index for trade within the EU-10 was 13.6%. In 1995 the respective indices were 5% and 11%.

Another positive trend of EU-10 trade development was a steady rise in the intensity of horizontal intra-industry trade (HIIT). Its share in the total trade of the group of countries concerned more than doubled, to slightly over 8% of their total trade in 2014 (from below 4% in 1995). The growth was even more rapid in trade with the EU-15. In 2014, as in 1995, the level of HIIT was, however, the highest in trade within the EU-10. This type of trade is considered in theory to be an expression of income convergence, reflecting the similar preferences of customers in the trading countries. At the beginning of the period in question, the level of such trade in the EU-10 was rather low in relations with all the trading partners. It was still much higher in the mutual trade of the EU-10 than in their trade with the EU-15, which suggested greatersimilarities (e.g. measured by GDP per capita) within that group of countries than between them and the EU-15. This was attributable to the fact that in the mid-1990s the EU-10 were at the beginning of their transition from centrally planned to market economies. They were characterised by a similar structure of factor endowments and all of them represented low (or very low) development levels, particularly in comparison with the EU-15. Over the following 20 years, that gap in the level of economic development of the EU-10 relative to the EU-15 countries narrowed considerably, as mentioned above. In other words, the majority of the EU-10 managed to modify their production patterns from complementary to
Concluding remarks

competitive and move towards products based on high quality and high value added, thereby accelerating convergence towards the EU-15. However, due to the considerable differences noted in 1995, the level of that convergence – as measured by IIT indices – still varied widely in the EU-10: in relation to the EU-15 it was the highest in the Czech Republic and in Poland, whereas it was the lowest in the Baltic States.

In the light of the above observations, it can be stated that the most favourable changes in the nature of trade specialisation occurred in the countries which in the period under study, 1995-2014, simultaneously experienced two phenomena: an increase in the intensity of horizontal intra-industry trade and an increase in the intensity of high-quality vertical trade. This criterion was satisfied by a vast majority of the countries concerned. A different situation was found in Lithuania, where substantial growth in the share of HIIT in total trade was accompanied by a stagnant proportion of high-quality vertical IIT. Another exception was Estonia, recording a decline in the share of HIIT in total trade and a simultaneous rise in high-quality vertical IIT. The scale of change in individual countries as well as their initial positions in 1995 varied, as a result of which the level and nature of intra-industry trade specialisation were also different at the end of the period analysed. In 2014 the highest indices of HIIT and high-quality VIIT were noted in the Czech Republic, Hungary, Slovakia, Slovenia and Poland.

In the conducted analysis of the intensity and structure by type of EU-10 intra-industry trade in selected commodity groups, the highest IIT indices were found in the case of trade in highly processed goods. Such products were frequently manufactured in industries characterised by a high degree of production internationalisation, measured by the level of foreign investor involvement. Therefore, the most intensive intra-industry trade occurred in the groups of plastics, transport equipment as well as machinery and equipment. The significant differences in IIT intensity by industry between individual EU-10 countries resulted from the fact that the Central European countries and, to a lesser degree, also Slovenia and Romania actively participated in the processes of production fragmentation, becoming foreign direct investment destinations. At the same time, FDI played a much lesser role in the Baltic States and Bulgaria.

In the period covered by the analysis, the majority of the product groups discussed showed a reduced importance of vertical IIT, where exported products were of a relatively higher quality than that of imported articles. The scale of change varied between countries. In 2014 low-quality vertical IIT played the greatest role in intra-industry trade in precision instruments and apparatus (technologically advanced products), while it was the least important in intra-industry trade in mineral products and transport equipment. Horizontal IIT contributed the most to intra-industry trade in mineral products (accounting for more than half of that trade) as well as

47 For the sake of transparency of the argument, we excluded here as a breakdown criterion the rise in the share of low-quality VIIT in the three Baltic States as well as in Poland and Romania.
Chapter 2. Changes in the intensity of EU-10 intra-industry trade in 1995-2014

Changes in the intensity of EU-10 intra-industry trade in 1995-2014

Corporations seeking to minimise production costs (vertical investment) or to supply local markets (foreign direct investment – FDI – horizontal in nature). Owing to relatively low unit labour costs, businesses from the EU-15 relocated mostly labour-intensive production to a number of EU-10 countries. As a result, the share of labour-intensive (low-quality) goods in exports was rather high. Nevertheless, the inflow of FDI through technology transfer and spill-over effects facilitated the restructuring of industries and the change of economic structures of the countries concerned. In the period following EU accession this was reflected in the rising importance in exports of more technologically advanced products, thus in the increasing intensity of high-quality vertical IIT.

Definitely more of the countries under study experienced faster growth in IIT intensity after joining the EU compared to the earlier period (Table 2.4.). That phenomenon occurred despite the post-accession acute financial and economic crisis (2008-2009) and the related slowdown of IIT dynamics, or even a temporary minor decline. A very different situation (i.e. a distinctly greater increase in the IIT index in 1995-2003 than in the following years) was noted in Poland, both in total trade and in trade with the EU-15, whereas in trade with the EU-15 this was also experienced by Lithuania, Romania and Slovakia.

The significance of EU accession as a driver of trade also seems to be confirmed by the acceleration of growth in the total trade of the EU-10 with the EU-15 immediately before accession and in the first years after accession. Furthermore, accession was more favourable for IIT than for inter-industry trade, fostering the former both directly and indirectly. Direct effects materialised, among other things, in the elimination of border formalities, which reduced transaction costs and boosted mostly intra-industry trade. Border formalities were not a big obstacle to specialisation along comparative advantages. In the latter case, differences in production costs

48 In the period immediately following accession an important role was also played by other factors, such as a favourable economic situation in the world and the related increased demand in a number of markets as well as a rise in world prices for many commodities, especially raw materials.
were large enough to cope with additional transaction costs in the pre-accession period (European Commission, 1996). At the same time, any extra transaction costs would hinder trade in substitutes (the essence of IIT), which are sensitive to price levels. Also, accession to the EU main economic pillar in the form of the European internal market boosted intra-industry trade directly. Intra-industry trade mostly concerns substitutes manufactured in industries characterised by increasing returns to scale. In accordance with the theory, increasing returns to scale are an important determinant of intra-industry trade. The access of individual EU-10 countries to the large EU internal market increased the possibilities of expanding the scale of production in specific industries and deriving benefits of reduced unit production costs.

Another important factor contributing to IIT growth, according to theory, is the market size (not significant in explaining inter-industry trade). That determinant can be expected to have played a vital role in the EU-10. For each of the countries in question, joining the EU-15 and simultaneous accession of other partners from the EU-10 group had the direct effect of increasing the size of the market (representing a market without internal borders where it was easier to sell products than as part of traditional exports) by a factor of around a dozen. The measure of market size for each of the EU-10 countries was the GDP of the partners in the enlarged EU.

One might also find indirect impacts of EU accession on IIT increase, e.g. those of EU structural funds. These funds have been used for many years in poorer regions and countries of the EU (all the NMS have been their beneficiaries) in order to foster real convergence. The general opinion prevails that an income convergence of the NMS toward the EU-15 took place, although at a varying pace in individual countries (Matkowski et al., 2016, pp. 40-46). Therefore, EU funds most probably contributed to increased GDP levels in the EU-10 (both per capita and total GDP). As already mentioned, the GDP level is considered in theory to be an important determinant of IIT. It reflects market size, which leads both to a greater product variety (horizontal differentiation) and a larger quality spectrum (vertical differentiation), thus contributing to a rise in consumer welfare and producer efficiency.

However, it is also true that many economic and legal adjustments to the EU-15 requirements took place before accession. These partly resulted from the commitments included in the association agreements (changes of laws) and from a tougher competition within the free trade areas underlying the bilateral association agreements entered into by each of the EU-10 countries with the EU. Some of the adaptation to the EU-15 rules was undertaken as part of the preparations for EU accession. Thus, due to liberalisation and legal modifications, many real economic changes took place already in the pre-accession period, enabling an improved competitiveness of EU-10 products and resulting in a better type of trade specialisation.

We seek to verify those and other determinants of IIT in Chapter 3, in which we estimate the impact of factors – identified on the basis of theory – on changes in the intensity of EU-10 intra-industry trade.
Chapter 3

Determinants of intra-industry trade changes in the EU-10 – econometric analysis

Introduction

Chapter 3 presents the results of studying the direction of the impact of factors – identified on the basis of theory – on changes in the intensity of EU-10 intra-industry trade (separately for horizontal and vertical IIT). The analysis was carried out with the use of a regression model on panel data. The determinants of the level of intra-industry trade were presented in the model through appropriate variables. The dependent variable was the bilateral index of intra-industry trade in horizontally and vertically differentiated products. The explanatory variables were as follows: gross domestic product (GDP) of the trading countries; differences in GDP; differences in GDP per capita; the geographical distance; the existence of a common border; the trading country’s inward and outward foreign direct investment; the financial and economic crisis of 2008/2009; participation in preferential trade groups, including membership of the European Union; and the adoption of the euro. The random effects panel data Tobit model was used. The robustness of the results was also tested by estimating the regression equation parameters with the use of the PPML (Poisson pseudo-maximum-likelihood) log-linear regression model.

3.1. Specification of the model

(Łukasz Ambroziak)

The impact of factors, identified on the basis of theory, on changes in the intensity of intra-industry trade in the new EU Member States was studied on the basis of a panel regression model. For the purposes of the empirical analysis, those determinants were
included (presented) in the model with the use of appropriate variables (Table 3.1.). A suitable proxy for the factor concerned was selected on the basis of the existing empirical literature.

3.1.1. The dependent variable and the independent variables

The dependent variable

The dependent variable in the applied regression model was the bilateral index of intra-industry trade in horizontally and vertically differentiated products. From the point of view of econometric analysis, it is irrelevant whether the share of intra-industry trade in total trade is expressed as a fraction (from 0 to 1) or as a percentage (from 0% to 100%). In the previous studies, the index was sometimes transformed using one of the three methods: the logarithmic, logit or Box-Cox transformations. In the case of the logarithmic transformation, the dependent variable was $ln(IIT^{kk'})$ and for the logit transformation $-\ln \frac{IIT^{kk'}}{1-IIT^{kk'}}$, where $IIT^{kk'}$ denotes the bilateral index of trade between the trading country ($k$) and the partner country ($k'$). The logarithmic transformation was used by authors such as Greenaway, Hine and Milner (1994), whereas the logit transformation was applied by Türkcan (2011), Türkcan and Ateş (2009), Yoshida et al. (2009) and Yoshida (2008) applied the Box-Cox transformation, according to the formula $BCL(IIT^{kk'}) = \left( \frac{IIT^{kk'}}{1-IIT^{kk'}} \right)^{-1}$, where $\lambda \in (0,1]$\textsuperscript{49}. In contrast to the logit transformation, the Box-Cox transformation has a merit of allowing to transform intra-industry trade indices with a value of zero. In the trade of a country, a major part of the bilateral indices of intra-industry trade indices (mostly for countries with the lowest values of trade) take the value of zero. The application of the logit transformation removes such observations from the sample.

Despite the merits of the above-mentioned transformations of the IIT index, in the analysis presented in this book the adopted dependent variable is a percentage of horizontal and (low- and high-quality) vertical intra-industry trade in the total trade between two countries. The described index is commonly used in econometric analysis of the determinants of intra-industry trade. Such an approach can be considered all the more justified given that for pairs of countries with zero intra-industry trade indices there also tended to be no data on FDI flows (therefore, those observations were eliminated from the sample).

\textsuperscript{49} In the literature it is assumed that $\lambda = 0.1$. 
The explanatory variables
On the basis of the theoretical literature discussed in Chapter 1, the factors described below were identified as having an essential impact on the development of intra-industry trade in the EU-10. Those only include macroeconomic determinants and exclude the sectoral (microeconomic) factors mentioned in Chapter 1, on account of the lack of available data illustrating the effect of those factors in the countries under study.

1) Economic size of the trading countries
A proxy commonly used in regression models for the economic size of the trading countries is their gross domestic product, at current prices or purchasing power parity. It is treated in the regression equation in various ways. Bergstrand (1990), Stone and Lee (1995), Gabrisch (2006), Veeramani (2002) et al. include in the model the value of GDP for each country in a pair of trading partners. Fidrmuc (2001), Caetano and Galego (2006), Clark and Stanley (1999), Śledziewska and Czarny (2016) take the logarithm of the GDP value. The proxies frequently applied in the literature also comprise the trading countries’ average GDP; this is applied by authors such as Greenaway et al. (1994), Crespo and Fontoura (2001), Loertscher and Wolter (1980), Türkcan (2005), Türkcan (2011), Türkcan and Ateş (2009), Wickham and Thompson (1989), Nilsson (1999). In turn, Leitão et al. (2010), Yoshida et al. (2009), Phan and Jeong (2014) as well as Jámbor (2014) introduce the natural logarithm of the average GDP value. The application in the model of a variable in the form of the sum (or average) of two countries’ GDP seems to be an incorrect solution. The same value of the aggregate GDP of two countries may imply two different situations: two countries of the same economic size or one large and one small economy. From the point of view of the determinants of intra-industry trade this is of vital importance. In the former case, there will be conditions for growth in this type of trade, whereas in the latter its development will be distinctly limited.

Another important issue is the choice between GDP at current prices and GDP at purchasing power parity (PPP)\(^{50}\). Owing to the fact that the dependent variable is the share of intra-industry trade in total trade, thus an abstract value, the value of the GDP variable should not be expressed at current prices. GDP at purchasing power parity allows for a more reliable comparison of the economic size and the living standard between countries. Contrary to GDP at current prices, it takes account of differences in prices between individual countries. The lower the economic development level of a country, the higher the GDP value expressed at PPP as compared to that at current prices since prices in such a country tend to be lower

\(^{50}\) PPP (purchasing power parity) – a method of calculating the size of activities of various countries, taking into account not only the current level of exchange rates but also the prices in individual countries.
than in an economically developed one. The opposite is the case for countries that are relatively advanced economically – GDP at PPP is higher than at current prices due to a higher price level. As a result, for the purposes of the study, as the proxies for the economic size of the trading countries the model includes two variables in the form of the natural logarithm of those countries’ GDP at purchasing power parity ($GDP_k; GDP_{k'}$).

2) Differences in economic size

Differences in economic size between the trading countries are presented through GDP-based measures. One of the most commonly applied proxies is the absolute difference in GDP between a pair of trading countries. That measure, usually in the form of a logarithm, is applied by authors such as Balassa and Bauwens (1987, 1988), Greenaway et al. (1994), Loertscher and Wolter (1980), Türkcan (2011), Türkcan and Ateş (2009). In turn, Balassa and Bauwens (1997), Bergstrand (1990), Somma (1984), Sawyer et al. (2010) and Xing (2007) measure differences in the level of GDP with the use of the following formula:

$$DIF_{kk'} = 1 + \frac{w \ln(w) + (1-w) \ln(1-w)}{\ln 2},$$

where $w = \frac{GDP_k}{GDP_k + GDP_{k'}}$, $GDP_k; GDP_{k'}$ – GDP of the countries concerned.

Helpman (1987), Hoekman and Djankov (1996) applied the following index of the difference in economic size between the countries under analysis:

$$DIF_{kk'} = \ln \left[ \left( \frac{GDP_k + GDP_{k'}}{1 - w^2 - (1-w)^2} \right) \right].$$

In this study, the differences in economic size between two countries are presented with the use of the variable $\text{diffGDP}_{kk'}$ – the natural logarithm of the absolute difference in GDP between two countries, expressed at purchasing power parity.

3) Differences in per capita income

Differences in per capita income may refer to either the propensity of consumers to buy differentiated products (the demand side) or to the capital-labour ratio in the domestic resource of production factors.

Differences in per capita income are usually measured by GDP per capita of the trading countries. Balassa and Bauwens (1987, 1988), Byun and Lee (2005), Culem and Lundberg (1986), Fukao et al. (2003), Türkcan (2005), Gabrisch (2006), Veeramani (2002) as well as Proença and Faustino (2015) included in their models the variable of the absolute difference in GDP per capita between the countries in question. Leitão et al. (2010), Yoshida et al. (2009), Fidrmuc (2001) and Hu and Ma (1999) use the logarithm of the above formula. Lee (1989) expressed differences in per capita income as the following formula:
\[
DIFpc_{kk'} = \frac{|GDPpc_k - GDPpc_{k'}|}{\frac{1}{2}(GDPpc_k + GDPpc_{k'})}, \text{ where } GDPpc_k; GDPpc_{k'} - GDP per capita of the trading countries. Balassa and Bauwens (1987), Somma (1994) as well as Lee and Lee (1993) applied the following formula: 
\[
DIF_{kk'} = 1 + \frac{w\ln(w) + (1-w)\ln(1-w)}{\ln 2}, \text{ where } w = \frac{GDPpc_k}{GDPpc_k + GDPpc_{k'}}, \text{ GDPpc}_k; GDPpc_{k'} - GDP per capita of a pair of trading countries.
\]

GDP per capita also tends to be applied to present differences in factor endowment. The absolute difference in GDP per capita between two trading countries was applied, among others, by Greenaway et al. (1994), Bergstrand (1990), Crespo and Fontoura (2001), Fukao et al. (2003), Türkcan (2011), Türkcan and Ateş (2009), Nilsson (1999). Sawyer et al. (2010), Jámbor (2014, 2015), Śledziewska and Czarny (2016) proposed to calculate the logarithm of the absolute difference in GDP per capita\(^{51}\). In turn, Dautovic et al. (2014) applied the natural logarithm of the absolute difference in capital stock between the trading countries’ economies to measure differences in factor endowment.

For the purposes of this study, differences in per capita income were measured using the variable \(\text{diff } GDPpc_{kk'}\) – the natural logarithm of the absolute difference in GDP per capita between two countries; GDP is expressed at purchasing power parity.

4) Geographical proximity

In the literature, there are a number of variables reflecting geographical proximity. The most popular measure is the distance between the capital cities of trading countries, expressed in kilometres or miles. This is applied by the following authors: Balassa and Bauwens (1987), Byun and Lee (2005), Culem and Lundberg (1986), Fukao et al., (2003), Hoekman and Djankov (1996), Loertscher and Wolter (1980), Martín and Blanes (1999), Nilsson (1999), Türkcan (2011), Türkcan and Ateş (2009), Veeramani (2002), Yoshida et al., (2009). Some researchers calculate the logarithm of the above variable – e.g. Kang (201), Okubo (2004), Leitão et al., (2010), Ito (2004), Śledziewska and Czarny (2016), Jámbor (2014, 2015) as well as Proença and Faustino (2015). However, according to a number of authors, geographical distance is not a good variable to illustrate geographical proximity, mostly identified with transport costs. As a result, instead of physical distance, they often applied the distance weighted by the partner country’s share in the aggregate output of the whole group of trading partners (e.g. Fidrmuc, 2001; Caetano and Galego, 2006 – for the EU-15), by the partner country’s share in the GDP of the whole group of trading partners (Türkcan, 2011 – Turkey’s trading partners; Toporowski, 2010 – the EU-15). Sawyer et al. (2010),

\(^{51}\) Leitão et al. (2010) used the natural logarithm of the absolute difference in per capita electricity consumption between two countries in order to measure differences in factor endowment.
3.1. Specification of the model

Stone and Lee (1995) calculated the logarithm of distance weighted by the partner country’s share in the trade of a group of partners, whereas Lee and Lee (1993) introduced to their model the square of physical distance.

In the literature, there are also cases of using proxies for geographical proximity other than distance. Lee and Lee (1993), Crespo and Fontoura (2001) measured transaction costs between countries by the cost of sending, by post, goods weighing 1 kg.

In addition, other frequent proxies for geographical proximity also include dummy variables, such as: the existence of a common border (Balassa and Bauwens, 1987, 1988; Kang, 2010; Ito, 2004; Loertscher, Wolter, 1980; Pittiglio, 2008; Somma, 1994); having a common official language (Balassa and Bauwens, 1987, 1988; Kang, 2010; Loertscher, Wolter, 1980); location in the same continent (Kang, 2010); and sharing the same culture (Byun, Lee, 2005; Loertscher, Wolter 1980; Lee, Lee, 1993).

For the purposes of this analysis, two variables illustrating geographical proximity were applied. One is the logarithm of physical distance (in km) between the capital cities of the trading countries ($dist_{kk'}$). The other is a dummy variable reflecting the existence/lack of a common border between two countries ($border_{kk'}$).

5) Foreign direct investment

The impact of foreign direct investment (involvement of international corporations) on intra-industry trade has been tested in the empirical literature – for both countries and industries – with the use of a number of variables. The first authors to take account of activities of multinational enterprises in their regression model were Balassa and Bauwens (1987), incorporating them at the industry level. They applied three variables: 1) the sum of dividends from foreign affiliates and foreign tax credits divided by total business receipts of the industry; 2) the ratio of trade – exports plus imports – with majority-owned foreign affiliates to the industry’s total exports; 3) the relative importance of offshore assembly plants in individual industries. However, most studies address the effects of FDI on intra-industry trade at the country level.

Caetano and Galego (2006) applied as a variable the natural logarithm of the ratio of inward FDI stock to GDP of the importing country. Hu and Ma (1999), Kang (2010) included in their models inward FDI from individual partner countries (with the logarithm of the above value applied by Kang). Lee (1989) defined the ratio of the total amount of inward and outward foreign direct investment over total domestic investment of a country and included in the model the variable of the average direct investment ratios of the respective countries. Jámbor (2015) explained the impact of activities of multinational enterprises using the logarithm of net FDI inflows. Sawyer et al. (2010), Phan and Jeong (2014) and Dautovic et al. (2014) adopted the ratio of net FDI inflows to the GDP of a trading country. Śledziewska and Czarny (2016) applied the natural logarithm of the share of FDI in GDP of a partner country. In turn, Türkcan (2011), Türkcan and Ateş (2009) used the stock of outward FDI of a trading country in a partner country (Austria and the United States). Yoshida et al.
(2009) used as a variable the accumulated number of foreign subsidiaries of a trading country in individual partner countries. As a proxy for the activities of multinational enterprises, Cieślik (2008) adopted the number of foreign subsidiaries established by a partner country in the trading country, i.e. in Poland.

Some researchers tested the impact of FDI on intra-industry trade at the country and industry levels at the same time. To that end, Hoekman and Djankov (1996) applied the natural logarithm of the stock of inward FDI from a partner country in specific industries of the trading country. For the purpose of illustrating the activities of multinational enterprises, Xing (2007) applied two variables, i.e. annual FDI inflow and the stock of FDI from a partner country in particular industries of the trading country.

The selection of a suitable proxy for the importance of foreign direct investment is a difficult task due to the nature of the impact of FDI on trade, including on intra-industry trade. FDI is often divided into two main types: horizontal and vertical investment, having different effects on intra-industry trade. Owing to the lack of statistics on FDI broken down into the above-mentioned categories, it is impossible to empirically (on the basis of an econometric model) verify the impact of particular investment types on intra-industry trade. Furthermore, the complex influence of FDI on trade, including on intra-industry trade, adds difficulty to the choice of an appropriate variable (direct and indirect effects). A direct impact will be reflected, among other things, in increased trade between the host country and the FDI source country as a result of the location of production activities in the host country. In the case in question, it seems unjustified to use a variable in the form of inward FDI in the economy under study, as in the year of FDI inflow such an investment does not yet have any impact on intra-industry trade. Its effects on this type of trade will not materialise until the following years of investment implementation. A better solution is to apply as a variable the stock of inward FDI in the trading country as at the end of the year in question. However, there are certain drawbacks to this method (see below).

One must not forget that FDI may also influence intra-industry trade indirectly. Its inflow may be conducive to the host country’s economic growth, thus leading to narrowing the difference in the level of economic development between the trading countries. Most certainly, also in this case a more reliable proxy for the indirect effects of FDI on IIT is the stock of inward FDI in the trading country from the partner country concerned.

Therefore, in this analysis attention was given to several ways of including in the model a variable reflecting the level of involvement of multinational enterprises in the form of foreign direct investment. First, the authors considered applying the variable of annual FDI inflow from a partner country to the trading country. However, as already mentioned, invested capital had long-term effects on trade flows, therefore this proxy was rejected. Second, consideration was given to a variable in the form of the ratio of the stock of inward FDI from a partner country to the stock of the
trading country’s overall investment. It must be pointed out that the FDI stock and the stock of investment represent two different economic categories. According to a commonly accepted definition, foreign direct investment means the acquisition by a resident in one economy of the ownership of business assets in another country with a view to establishing a lasting interest. Investment is understood as fixed capital formation or increase in an enterprise. Therefore, the use of the ratio of FDI to investment stock as a variable was abandoned. Third, as already mentioned, the application of FDI stock as a variable involves certain shortcomings. The variable in question refers to resources, whereas the other variables in the model concern flows. The FDI stock in a given year contains the value of investment from the previous year. One method to solve this issue would be to introduce lagged variables in the model (the stock of FDI in the previous years) or a moving variable, in the form of inward FDI stock in a specified period preceding the time of observation. The proposals described above share one essential defect – they shorten the period of analysis.

Taking into consideration the aforementioned issues, in the present analysis the proxies for the activities of multinational enterprises in the form of foreign direct investment are two variables: (1) a lagged variable of the stock of inward FDI from a partner country in the trading country as at the end of the previous year \((FDI_{in \, kk}')\); and (2) a lagged variable of the stock of outward FDI from the trading country (individual EU-10 countries) in a partner country as at the end of the previous year \((FDI_{out \, kk}')\). The stock (EU-10 inward and outward) of FDI was expressed at purchasing power parity. This allowed to maintain comparability with data on GDP and GDP per capita. The model includes the stock of inward FDI in all the economic sectors of the NMS under analysis and that of EU-10 outward FDI in all the industries covered in a partner country. This resulted from the lack of data concerning the composition of FDI by industry in bilateral terms. Nonetheless, the authors of the analysis are aware that such a solution has certain limitations. Merchandise trade flows, thus the intensity of intra-industry trade, are mostly influenced by direct investment in the manufacturing sector. At the end of 2014 (at the end of 2012 in Slovakia and at the end of 2013 in the Czech Republic), the stock of inward FDI in EU-10 manufacturing divisions accounted for approximately 30% of the total inward FDI stock (with the exception of Lithuania, Estonia and Latvia where the respective proportions were lower). The share of manufacturing in the stock of EU-10 outward foreign direct investment was even lower. Except for Slovenia (30%), Hungary (20%) and Poland (15%), it did not exceed 10%. Furthermore, it must be noted that for

\[ As a matter of fact, the adoption of variables lagged by one year does not fully reflect the phenomenon of a delayed impact of FDI on trade, including on intra-industry trade (as such effects typically materialise in a longer term), only indicating the existence of such a problem.\]

\[ The value of EU-10 inward FDI was calculated at the purchasing power parity of the host country. The value of EU-10 outward FDI was computed at the purchasing power parity of the partner country concerned.\]
several percent of the observations at least one of the two FDI values included in the model was negative\textsuperscript{54}.


According to theory, an economic crisis reduces the propensity to engage in trade. Intra-industry trade mostly concerns differentiated products, i.e. substitutes. These are usually made in industries characterised by increasing returns to scale. The occurrence of a crisis and the ensuing fall in output – in conditions of increasing returns to scale – push up average production costs. Seeking to curb the adverse effects of their reduced incomes during a crisis by necessarily cutting their purchases, consumers shift some of their demand from imports to similar but relatively cheaper domestic goods (if the crisis has rendered domestic articles relatively less costly than foreign merchandise) or they limit their expenditure. Such a change is made easier by the fact that the subject of IIT are substitutes, which are not indispensable.

For the purposes of this study, the impact of the crisis on IIT was measured by the dummy variable \textit{crisis}.

7) Trade liberalisation

The 'level of trade (customs) barriers' between two trading countries can be treated in a model in various ways. To this end, Bergstrand (1990), Clark (1993), Clark and Stanley (1999) and Lee (1989) applied the average tariff rate between two countries, whereas Clark (1993) also used a non-tariff barrier index. The most proxies for the level of customs barriers were incorporated in their models by Pagoulatos and Sorensen (1975) as well as by Toh (1982). Those included the average tariff rates and non-tariff barriers for a pair of countries and the difference in the level of tariff rates and non-tariff barriers between the countries concerned, computed in accordance with the following formula:

\[
TD_{kk'} = \frac{t_k + t_{k'}}{t_k + t_{k'}} - \frac{|t_k - t_{k'}|}{t_k + t_{k'}},
\]

where:

\(TD_{kk'}\) – the index of the difference in the level of tariff rates/non-tariff barriers between countries;
\(t_k, t_{k'}\) – the level of tariff rates/non-tariff barriers in the trading countries.

\textsuperscript{54} For example, Poland's negative liabilities in respect of direct investment as the end of 2014 towards Belarus and Ukraine mean that direct investment enterprises owned by Ukrainian and Belarusian entities and established in Poland were net creditors of Ukrainian and Belarusian direct investors. Such a situation stemmed from cumulative losses incurred in Poland by direct investors from the above-mentioned countries. It was also a result of specific forms of capital flows between direct investors from the countries concerned and the direct investment enterprises based in Poland in which they held interests. See: \textit{Zagraniczne inwestycje bezpośrednie w Polsce i polskie inwestycje bezpośrednie za granicą w 2014 roku}, Narodowy Bank Polski, Warsaw, 2015, p. 16.
In most empirical studies, the proxy for the level of customs barriers is a dummy variable denoting the participation of two countries in the same preferential trade group and the lack of trade barriers. Such a solution was applied, among others, by Balassa and Bauwens (1987, 1988), Kang (2010), Leitão et al., (2010), Loertscher and Wolter (1980), Nilsson (1999), Okubo (2004), Pittiglio (2008), Sawyer et al., (2010), Türkcan (2011), Türkcan and Ateş (2009). In the empirical literature on the determinants of the intra-industry trade of European Union Member States, it is frequent to introduce an additional dummy variable in models, denoting the EU membership of two countries (e.g. Crespo, Fontoura, 2001; Kang, 2010; Greenaway et al., 1994; Martín-Montaner, Ríos, 2002; Ambroziak, 2012; Śledziewska and Czarny, 2016; Jámbor, 2014; Proença and Faustino, 2015).

For the purposes of the present study, the factor of the ‘trade liberalisation’ level was included in the econometric model with the use of six dummy variables:

- the variable $BAFTA_{kk}$ denotes the participation of a pair of countries in the preferential trade group BAFTA;
- the variable $CEFTA_{kk}$ denotes the participation of a pair of countries in the preferential trade group CEFTA;
- the variable $othFTApre_{kk}$ denotes the participation of a pair of countries in a preferential trade group other than association with the EU, CEFTA or BAFTA in the pre-accession period;
- the variable $FTAEU_{kk}$ denotes a free trade areas created under the association agreements concluded by the EU-10 countries with the European Communities;
- the variable $memEU_{kk}$ denotes the membership of an individual EU-10 country and a partner country from the European Union;
- the variable $FTApost_{kk}$ denotes the participation of a pair of countries in a preferential trade group as a result of the adoption of the EU common commercial policy by the EU-10 upon accession.

According to theory, another factor having an effect on the intensity of trade between two countries is their participation in a single currency area (Mundell, 1961; Kenen, 1961; McKinnon, 1963). Therefore, the estimated model was expanded to include a dummy variable $euro_{kk}$, denoting the participation of a pair of countries in the euro area. Such a variable was also applied in the model by Blanes-Cristóbal (2009). In turn, Dautovic et al. (2014) analysed the impact of exchange rate volatility on intra-industry trade.

### 3.1.2. Database description

The regression analysis was based on panel data. As the starting point for creating the observation base, the authors used bilateral indices of the (horizontal and vertical) intra-industry trade of the ten new EU Member States for the years 1995-2014. The
number of observations was mostly limited by the availability of data on the stock of EU-10 inward and outward FDI. The reasons for this were twofold. First, data on the stock of EU-10 inward and outward FDI were not available for the whole period under study. Second, for each year and country the FDI database (\textit{wiiw Database on Foreign Direct Investment}) only took account of approximately 30 major partners in inward and outward FDI. The sample included those observations for which at least one of the two FDI values (EU-10 inward and outward FDI stock) was not zero. Furthermore, non-typical observations, i.e. pairs of countries for which particular IIT indices showed considerable instability over time, were removed from the sample thus obtained. High values of such indices for some years resulted from specific commercial transactions, e.g. trade statistics recorded the fact of sending ships to repair shipyards – first as imports (the receipt of a ship for repairs) and then as exports (the sending of a repaired ship to the ship owner). Such transactions were fortuitous and did not reflect structural changes in mutual trade. For instance, certain observations eliminated from the sample in question pairs of countries such as: Poland-Hong Kong, Poland-Norway, Lithuania-Cyprus, Poland-Cyprus, the Czech Republic-Estonia, Romania-Malta. The number of observations included in the sample was 8,141.

The IIT indices were calculated on the basis of trade data from the WITS-Comtrade database, expressed in dollars and in physical units – kg. Data on individual countries’ GDP and GDP per capita was derived from the International Monetary Fund database (\textit{World Economic Outlook database}). The sources of data concerning the FDI stock in the new EU Member States were the database of the Vienna Institute for International Economic Studies – \textit{wiiw Database on Foreign Direct Investment} – and the OECD database. Data on the geographical distance between countries and on the existence of a common border came from the CEPII (\textit{French Research Centre in International Economics}) database. In turn, the source of data on the membership of countries in preferential trade groups and the EU was the database of the World Trade Organisation (\textit{Regional Trade Agreements – International System}).

### 3.1.3. Selection of method for estimating the model parameters

The selection of an appropriate estimation method is an important element in the process of estimating the parameters of a regression model. The model applied in our study is similar to the gravity model frequently used to estimate the determinants of foreign trade (of exports, imports or of both flows combined). Gravity model parameters are usually estimated using panel data and random effects estimators, fixed effects estimators or the method of instrumental variables. However, such estimators are not always consistent and unbiased. Since the mid-2000s, gravity model parameters have been increasingly estimated with the use of the \textit{PPML} (Poisson pseudo-maximum-likelihood) log-linear regression model (see: Santos Silva, Tenreyro, 2006). This method
3.1. Specification of the model

was used in the present study in order to estimate the parameters of the model explaining intra-industry trade determinants. The model applied in our study was as follows:

\[ IIT_{kk'} = \beta_0 X_{kk'}^0 \cdot \ldots \cdot X_{kk'}^m \cdot \varepsilon_{kk'}^{ij} \cdot \varepsilon_{kk'} \cdot \varepsilon_{kk'}^i, \]

where:

- \( IIT_{kk'} \) – the share of particular types of intra-industry trade in the trade of two countries;
- \( X_{kk'} \) – explanatory variables in logarithmic form (Table 3.1.);
- \( m \) – the number of explanatory variables in logarithmic form;
- \( Y_{kk'} \) – explanatory variables in non-logarithmic form and dummy variables (Table 3.1.).

One disadvantage of the PPML method is that it is typically used to estimate models based on cross-sectional and not panel data. Moreover, in contrast to the gravity model where the dependent variable is the value of exports, imports or of both flows combined, in the estimated model the dependent variable is the share of intra-industry trade in total trade. That variable lies within the range \(<0;1>\) or \(<0;100>\) if expressed as a percentage. Therefore, the properties of the dependent variable justify the application of the adopted estimation technique. The reason is that the theoretical value of the dependent variable could fall outside the range defined for intra-industry trade changes, i.e. \(<0;1>\). For the purpose of avoiding such situations, the parameters of the regression equation were estimated with the use of the random effects panel data Tobit model (Tobin, 1958). The model was expressed with the following equation:

\[ IIT_{kk'}^* = X_{kk'} \cdot \beta + \varepsilon_{kk'} + \alpha_{ij} \]

where:

- \( IIT_{kk'} \) – the share of particular types of intra-industry trade in the trade of two countries;
- \( X_{kk'} \) – the set of explanatory variables in the model (Table 3.1.);
- \( \varepsilon_{kk'} \) – the spherical random component;
- \( \alpha_{ij} \) – the random individual effect for a pair of countries \( k \) and \( k' \).

Baltagi (2014) listed some benefits of using panel data sets. One of the most important advantages of panel data sets is their ability to control for individual heterogeneity. Failing to control for these unobserved individual specific effects leads
to bias in the resulting estimates. Panel data also offer more informative data, more variability, less collinearity among the independent variables, more degrees of freedom and more efficiency in estimation. Additionally, panel data sets allow for the identification and measurement of effects that are simply not detectable in pure cross-sectional or pure time-series data.

3.2. Research hypotheses

(Łukasz Ambroziak, Elżbieta Kawecka-Wyrzykowska)

On the basis of the theoretical literature presented in Chapter 1, the factors described below were identified as having an essential impact on the development of intra-industry trade in the EU-10. These only comprise macroeconomic determinants and exclude the industry-specific factors mentioned in Chapter 1, on account of the lack of available statistics illustrating the effects of those factors in the countries under study.

Based on the literature review, the authors of the present analysis formulated several research hypotheses\(^{56}\). Those hypotheses were tested on the basis of estimations of the model parameters. The hypotheses are as follows:

**Hypothesis 1**
The larger the market size of the trading partners, the higher the intensity of both vertical and horizontal IIT between those partners. The market size is measured by the natural logarithm of the absolute value of GDP of the pair of trading partners.

**Hypothesis 2**
The greater the difference in market size between two partner economies, the smaller the share of horizontal IIT and vertical IIT in their total trade. To verify

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\(^{56}\) The hypotheses reflect the relationships between IIT determinants and the direction and intensity of trade changes usually found in other studies. In the case of certain factors, it is also possible to put forward the opposite hypotheses. Thus, for instance, on the basis of theory most authors argue that trade liberalisation has a positive effect on IIT. On the other hand, Krugman (1993) claims that in a free trade area countries may specialise more according to their comparative advantages and, therefore, its impact on IIT should be negative. In addition, most empirical studies found a positive link between regional free trade agreements (FTAs) and intra-industry trade (e.g. Grubel and Lloyd 1975; Balassa and Bauwens 1987). However, the authors of the presented studies disagreed on the direction of the effect of FTAs on trade patterns between economically and geographically diverse countries. Some researchers concluded from their studies that FTAs stimulated IIT between those groups of countries (e.g. Globerman 1992). Others, however, obtained results to the contrary – suggesting that the elimination of tariffs and other trade barriers increased competition among local and foreign businesses and that economically weaker partners of FTAs were not able to exploit the benefits resulting from access to a bigger market. Additional trade flows induced by the elimination of trade barriers were of an inter-industry nature and were based on revealed comparative advantages (e.g. Rodas-Martini 1998, cited from: Dautovic et al., ... op. cit.) (for more, see sub-chapter 1.5).
this hypothesis, the natural logarithm of the absolute difference in GDP between the two trading partners concerned is employed.

**Hypothesis 3**
The higher the difference in per capita income between the trading partners, the higher the intensity of vertical IIT and the lower the intensity of horizontal IIT between those countries. The difference in per capita income is measured as the natural logarithm of the absolute difference in GDP per capita between the two trading partners.

**Hypothesis 4**
*IIT will be greater the closer the countries are geographically.* In our model, geographical proximity is calculated as the natural logarithm of the distance (in kilometres) between the capital cities of the trading partners in question. The other proxy for geographical proximity is the *existence (or lack) of a border* between each pair of trading partners. In this case, the hypothesis is tested by a dummy variable taking the value of 1 (existence of a border).

**Hypothesis 5**
The larger the foreign direct investment (FDI) in the host country (inward FDI), the higher the share of horizontal and vertical IIT. FDI is measured as the the stock of inward FDI.

**Hypothesis 6**
The larger the outflow of foreign direct investment (FDI) to a partner country (outward FDI), the higher the share of horizontal and vertical IIT. FDI is measured as the the stock of outward FDI.

**Hypothesis 7**
An economic crisis reduces the propensity to engage in trade, which leads to a fall in the intensity of horizontal and vertical IIT. The hypothesis was tested using a dummy variable.

**Hypothesis 8**
The lower the level of trade barriers between the trading countries (greater trade liberalisation), the higher the intensity of vertical and horizontal IIT between the countries concerned. In order to test this hypothesis, the authors applied several dummy variables concerning the participation of the country in a preferential trade group, including European Union membership.

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57 Dummy variables allow to take account of factors having positive or negative effects on trade which are difficult to measure with the use of quantitative methods (e.g. the existence of a common border, participation in an integration group).
Hypothesis 9
Monetary integration (a common currency) stimulates HIIT and VIIT. The hypothesis was tested using a dummy variable.

The determinants of intra-industry trade used in the model and their expected effects on the intensity of VIIT and HIIT are presented in Table 3.1.

Table 3.1. Determinants of IIT, the variables used in the model and the expected (based on the theoretical literature and previous research) effect on the intensity of VIIT and HIIT

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Variable</th>
<th>Description</th>
<th>Expected sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Size of country $k$</td>
<td>$\ln(GDP_k)$, where $GDP_k$ – the value of GDP of country $k$ at PPP, in USD billion</td>
<td>$+$ $+$</td>
</tr>
<tr>
<td>2</td>
<td>Size of country $k'$</td>
<td>$\ln(GDP_{k'})$, where $GDP_{k'}$ – the value of GDP of country $k'$ at PPP, in USD billion</td>
<td>$+$ $+$</td>
</tr>
<tr>
<td>3</td>
<td>Difference in size between a pair of countries</td>
<td>$\ln</td>
<td>GDP_k - GDP_{k'}</td>
</tr>
<tr>
<td>4</td>
<td>Difference in per capita income (GDP per capita)</td>
<td>$\ln</td>
<td>GDP_{pc_k} - GDP_{pc_{k'}}</td>
</tr>
<tr>
<td>5</td>
<td>Geographical proximity</td>
<td>$\ln(dist_{kk'})$, where $dist_{kk'}$ – the distance between the capital cities of country $k$ and country $k'$, in km</td>
<td>$-$ $-$</td>
</tr>
<tr>
<td>6</td>
<td>Foreign Direct Investment (inward FDI)</td>
<td>$FDI_{in_{kk'}}$, where $FDI_{in_{kk'}}$ – the stock of inward FDI from country $k'$ in country $k$ in year $t-1$, at PPP, in USD billion</td>
<td>$+$ $+$</td>
</tr>
<tr>
<td>7</td>
<td>Foreign Direct Investment (outward FDI)</td>
<td>$FDI_{out_{kk'}}$, where $FDI_{out_{kk'}}$ – the stock of outward FDI from country $k$ in country $k'$ in year $t-1$, at PPP, in USD billion</td>
<td>$+$ $+$</td>
</tr>
<tr>
<td>8</td>
<td>Economic crisis</td>
<td>Dummy variable taking the value of 1 in the year 2009 and the value of 0 in the other years</td>
<td>$-$ $-$</td>
</tr>
</tbody>
</table>
### Determinant Variable Description

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Variable</th>
<th>Description</th>
<th>Expected sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade liberalisation</td>
<td>( BAFTA_{kk'} )</td>
<td>Dummy variable taking the value of 1 where country ( k ) and country ( k' ) are BAFTA members</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>( CEFTA_{kk'} )</td>
<td>Dummy variable taking the value of 1 where country ( k ) and country ( k' ) are CEFTA members</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>( othFTA_{pre}_{kk'} )</td>
<td>Dummy variable taking the value of 1 where country ( k ) and country ( k' ) belong to the same preferential trade group (other than association with the EU, membership in CEFTA or BAFTA) prior to the EU enlargement in 2004</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>( FTAEU_{kk'} )</td>
<td>Dummy variable taking the value of 1 where country ( k ) and country ( k' ) concluded association agreements with the EU (free trade agreements)</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>( memEU_{kk'} )</td>
<td>Dummy variable taking the value of 1 where country ( k ) and country ( k' ) are EU Member States</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>( FTAPost_{kk'} )</td>
<td>Dummy variable taking the value of 1 where country ( k ) and country ( k' ) belong to the same preferential trade group as a result of the adoption of the common commercial policy of the EU upon EU accession</td>
<td>+</td>
</tr>
<tr>
<td>Adoption of the euro/ Elimination of barriers related to national currencies</td>
<td>( euro_{kk'} )</td>
<td>Dummy variable taking the value of 1 where country ( k ) and country ( k' ) belong to the euro area</td>
<td>+</td>
</tr>
</tbody>
</table>

Source: Own study based on the literature review.

### 3.3. Model estimation results

In order to ensure the robustness of the estimation results obtained, the impact of specific variables on the intensity of horizontal and vertical intra-industry trade of the new Member States (EU-10) in 1995–2014 was analysed with the use of two selected methods, i.e. the random effects panel data Tobit model (hereafter: \( RE \) Tobit) and the \( PPML \) (Poisson pseudo-maximum-likelihood) estimator on cross-sectional data.
First, we present the parameter estimation results with variables influencing the intensity of horizontal and vertical IIT (total VIIT as well as low- and high-quality vertical IIT) for the full sample, i.e. the intra-industry trade of the EU-10 combined. Next, the sample was broken down by groups of major trading partners of the EU-10. Thus, the model parameters were estimated in the mutual trade of the EU-10, in their trade with the EU-15 and with non-EU-25 countries.

3.3.1. Estimation results for the full sample
(EU-10 intra-industry trade combined)
(Wojciech Polan)

**Economic size of the trading countries**
For both horizontal trade and each type of two-way trade in vertically differentiated goods under analysis, the parameters for variables based on the absolute ‘GDP of pairs of countries’ (for the variables $GDP_k$ and $GDP'_k$) were positive and statistically significant at the 10% level (Table 3.2.). The economic size of the trading countries is identified with increasing returns to scale (Krugman, 1980; Lancaster, 1980). Their existence leads each of the two trading partners to specialise in the production of a different set of varieties of a differentiated good. Some of those varieties will be exported, while others will be imported. The results obtained in the case of all the selected estimation methods allowed to confirm the research hypothesis on the positive impact of the economic size of two countries on the level of each type of intra-industry trade.

**Differences in economic size of the trading countries**
The parameters for the variable ‘difference in GDP’ (diffGDP) were statistically significant and negative (for both estimation methods) only for horizontal IIT. Therefore, the obtained results confirmed the hypothesis on the negative impact of differences in economic size between trading countries at the level of horizontal intra-industry trade. The hypothesis refers to considerations of such authors as Dixit and Norman (1980) and Helpman (1981), who pointed out that countries of similar size had similar trade capacities, whereas countries differing in size also differed in their capacity to produce differentiated products.

However, it was not possible to unambiguously verify the hypothesis that rising differences in economic size are accompanied by a decreasing intensity of VIIT. The parameter value for the variable diffGDP was – as expected – negative and statistically significant in the case of the PPML method. But according to the RE Tobit method, the impact of ‘differences in economic size’ on vertical IIT appeared to be statistically significant and – contrary to expectations – positive. In turn, the parameters for the variable in question for both types of VIIT were statistically insignificant.
Differences in per capita income
The parameters for the variable ‘difference in GDP per capita’ (\textit{diffGDPpc}) for horizontal IIT were positive and statistically significant for both estimation methods. This means that widening differences in GDP per capita between trading countries contribute to horizontal IIT growth. That result did not allow to corroborate the hypothesis on an unfavourable effect of increasing differences in per capita income on horizontal intra-industry trade. Therefore, the results obtained were inconsistent with the existing theory. According to Linder (1961), close levels of per capita income in two countries denote the similarity of demand structures, thus of consumer preferences. Countries characterised by similar demand structures will develop the production of similar groups of commodities – both to the domestic and foreign markets. This favours growth in horizontal intra-industry trade.

As regards trade in vertically differentiated products (both for total vertical trade and for high- and low-quality VIIT – Table 3.3.), the parameters for the variable ‘GDP per capita’ were positive and, mostly, statistically significant. This allowed to confirm the research hypothesis that vertical IIT was stimulated by increasing differences in per capita income. One explanation can be that differences in per capita income are positively correlated with dissimilarities in the distribution of consumer preferences in the countries concerned (Falvey, Kierzkowski, 1987). Each of the countries specialises in output demanded at home, with domestic demand being the result of the incomes of the population. At the same time, demand from consumers having preferences similar to the tastes of foreign buyers will be satisfied through imports. Customer preferences in the countries concerned will be sufficiently dissimilar for intra-industry trade in vertically differentiated products to occur.

Geographical proximity
The estimated parameter values confirmed that geographical proximity was a factor stimulating horizontal and vertical intra-industry trade in the EU-10. The parameters for the variables ‘distance’ (\textit{dist}) and ‘border’ (\textit{border}) appeared to be statistically significantly different from zero in the case of both estimation methods (with the exception of parameters for low-quality vertical IIT). An increasing distance between countries hindered intra-industry trade in horizontally and vertically differentiated products, whereas it was facilitated by the existence of a common border. This allowed to corroborate the research hypothesis put forward.

Krugman (1979, 1980) indicated that high transport costs decreased not only IIT but also inter-industry trade. However, Balassa and Bauwens (1987) emphasised that distance influenced IIT more than inter-industry trade since differentiated products had a greater number of domestic substitutes than homogeneous products. Furthermore, the existence of a common border between the trading partners offers opportunities to use production location advantages (Balassa and Bauwens, 1987).
Foreign direct investment

In the case of all the analysed types of intra-industry trade, the parameters for the variable related to trading partners’ ‘investment in the EU-10’ (inward FDI – \( FDI_{inw} \)) were statistically significantly different from zero. However, the sign of estimated parameters was positive in the case of the RE Tobit method and negative for the PPML method. Therefore, the analysis did not unambiguously demonstrate that the stock of inward FDI in the EU-10 stimulated intra-industry trade, whether horizontal or vertical (including low- and high-quality VIIT).

In turn, the study did prove that ‘foreign direct investment from the EU-10’ in their partner countries (outward FDI – \( FDI_{out} \)) had a positive impact on the development of horizontal and vertical IIT. The results obtained were statistically significant (at the level of 1%) only for the PPML method. In the case of the RE Tobit method, the effect of outward FDI on horizontal IIT was found to be statistically significant (but at the level of only 10%). Therefore, it did not allow to confirm the hypothesis on the favourable influence of outward FDI on intra-industry trade.

The difficulty in analysing the impact of FDI on intra-industry trade is the lack of data on the stock of FDI broken down into horizontal and vertical investment. According to theory, horizontal FDI replaces trade, thus impeding the development of intra-industry trade (Markusen, 1984). Vertical FDI is complementary to trade, therefore it stimulates trade flows.

The direction of the impact of FDI on intra-industry trade in horizontally differentiated products does not unambiguously follow from theory. Some theoretical considerations indicate that horizontal FDI replaces trade, thus reducing horizontal intra-industry trade. At the same time, vertical FDI contributes – according to certain concepts – to growth in horizontal IIT. The positive impact of FDI on horizontal IIT is mostly attributable to the indirect effects of foreign capital on trade flows. The inflow of foreign capital in the form FDI to the EU-10 supplemented domestic tangible and intangible resources. It comprised not only capital flows but also the transfer of various production factors, e.g. technological, managerial and marketing skills, playing a vital role in facilitating access to foreign markets. The inflow of foreign capital increased the capital-labour ratio in the domestic resource of factors, which stimulated intra-industry trade, including horizontal IIT – according to the assumption that relatively capital-intensive industries produce more differentiated goods. Foreign businesses introducing production technologies, management methods and marketing techniques could contribute to improved economic efficiency in the host country. Another important aspect was the imitation effect: domestic enterprises implementing solutions introduced by foreign investors. As a result, the enhanced efficiency of production factors accelerated economic growth. The economic size of the trading countries and their economic development levels increased, which had a favourable impact on the intensity of intra-industry trade, in particular of horizontal IIT.
3.3. Model estimation results

The nature of the influence of FDI on the intensity of vertical trade depends on the form of foreign direct investment. Horizontal FDI mostly substitutes trade and has a downward effect on total intra-industry trade, including on trade in vertically differentiated products. Vertical FDI, mainly resulting from the fragmentation of production, creates trade flows between plants making semi-finished products, between plants manufacturing semi-finished products and the factory making the final goods, and between the place of production of the final good and the outlet (Helpman, Krugman, 1985).

The traditional model of vertical FDI (seeking resources for the investing country) has been increasingly shifting towards the so-called export-platform investment (Ekholm et al., 2007). As already mentioned, export-platform FDI is understood as a situation where an enterprise from the home country (the investor’s country of origin) invests in a production plant located in the host country but whose output is largely sold in third countries (rather than in the home- or host-country markets). The impact of export-platform FDI on intra-industry trade depends on the export destination of the goods produced in the subsidiary in question (Ekholm et al., 2007). In a situation where final goods are exported to third countries VIIT diminishes in importance, whereas if finished products are shipped to both the home country and to third countries, the scale of growth in VIIT will depend on the share of final goods exported to the home country.

Owing to the lack of data on the value of horizontal and vertical investment in the EU-10, in was impossible to carry out an econometric analysis of the effects of specific types of investment on vertical and horizontal IIT. The conducted estimation for both types of investment combined did not unambiguously prove that the stock of inward FDI in the countries covered fostered vertical IIT.

**The economic and financial crisis of 2008/2009**

The model estimation of the dummy variable defining the impact of the crisis on the intensity of intra-industry trade unambiguously demonstrated its negative effect on the development of two-way trade in horizontally differentiated products. The parameters for the variable ‘crisis’ for horizontal intra-industry trade – in the case of both estimation methods – were negative and statistically significant at the level of 1%. Therefore, this corroborated the thesis on the negative impact of the crisis on the intensity of horizontal IIT. Simultaneously, the lack of statistical significance of parameters did not allow to unequivocally confirm or reject the thesis concerning the negative influence of the crisis on vertical intra-industry trade\(^{58}\). In this case, the results are ambiguous and may constitute a starting point for further analyses of this research problem.

\(^{58}\) The values of the estimated parameters for VIIT and low-quality VIIT were positive, whereas for high-quality VIIT they were positive in the case of the PPML method and negative for RE Tobit.
According to theory, an economic crisis reduces the propensity to engage in trade. This means that the deeper the economic recession in the trading countries, the more abrupt the fall in intra-industry trade may be. Intra-industry trade mostly concerns differentiated products, i.e. substitutes. Due to this fact shifting some of the consumer demand from imports to similar, but relatively cheaper domestic goods, or even cutting their purchases is easier than in the case of complementary goods.

**Trade liberalisation**

The impact of the ‘association agreements with the then European Communities’ signed by the EU-10 by the mid-1990s and of ‘EU membership of the EU-10’ (the variables $FTAEU$ and $memEU$, respectively) on the intensity of all the analysed types of intra-industry trade was positive and statistically significant at the level of 1% in the case of both estimation methods. This allowed to corroborate the research hypothesis that the liberalisation of EU-10 trade with the EU Member States, in both the pre- and post-accession periods, promoted vertical and horizontal IIT.

An important role in the process of transition, regional integration and trade liberalisation in the EU-10 was also played by two integration groups: the ‘BAFTA’ and ‘CEFTA’. On the basis of theory, the authors put forward the hypothesis on the positive impact of participation in integration groups on the development of intra-industry specialisation of the countries in question (Balassa, 1967). However, the model study with the use of both methods of econometric analysis did not unambiguously confirm this hypothesis. In the case of horizontal trade, the parameter values for both variables ($BAFTA$ and $CEFTA$) were statistically significant (at the level of 1%) and positive for the $PPML$ method, whereas in the $RE$ $Tobit$ method they were negative and statistically insignificant. For vertical trade, the application of the $PPML$ method allowed to corroborate the favourable effect of membership of both integration groups on this type of trade – the parameters for the variables VIIT, VIIT high- and VIIT low-quality were positive and statistically significant. The same results were obtained for the variable $BAFTA$ with the use of the $RE$ $Tobit$ method to study vertical trade. However, in the case of the $RE$ $Tobit$ method with the variable $CEFTA$, the estimated parameters for (both high- and low-quality) vertical trade were negative and statistically significant (with the exception of ‘VIIT low’).

Prior to EU accession, the EU-10 also had preferential trade agreements with partners other than the above-mentioned groups of countries (e.g. with the EFTA, Turkey). Considering that an important result of those agreements was the reduction of trade barriers to bilateral trade, one of the tested hypotheses concerned the favourable effect of being a party to such agreements on each type of EU-10 intra-industry trade. The results obtained for the variable ‘other free trade areas existing in the pre-accession period’ ($othFTApre$) did not unequivocally confirm the hypothesis in question for both of the estimation methods applied. In the case of the $PPML$ method, the estimator values were statistically significant at the level of 1% and
positive for all the types of trade (HIIT, VIIT, VIIT high, VIIT low). As regards the \textit{RE Tobit} method, the estimated parameter values were also positive but only statistically significant for low-quality vertical intra-industry trade.

Upon joining the European Union, the EU-10 countries became members of preferential trade groups resulting from the adoption of the EU common commercial policy. As follows from the analysis of the variable ‘free trade areas resulting from the EU common commercial policy’ (\textit{FTApost}), that factor had a positive impact on the development of intra-industry trade in the countries under study. For horizontal trade, the parameter for the variable in question was positive and statistically significant for both methods of analysis. In the case of vertical trade (combined and broken down into low- and high-quality VIIT), the estimated parameters were positive but only statistically significant for the \textit{PPML} method.

In the light of theory, the favourable effect of the liberalisation of trade barriers (under free trade agreements) on intra-industry trade results from the fact that this type of trade mostly concerns differentiated products, manufactured in industries characterised by increasing returns to scale. This means that the larger the market for the articles produced, the lower the minimum unit cost of production. A lower level of customs barriers determining lower prices of the articles produced will be conducive to market expansion opportunities, thus to increased potential for the development of both vertical and horizontal IIT (Balassa, 1967; Falvey, 1981; Bergstrand, 1990). In most cases, the conducted econometric analysis confirmed the hypothesis that the lower the level of trade barriers between the trading countries, the greater the intensity of vertical and horizontal IIT between those countries.

\textbf{Adoption of the euro}

The model estimation of the dummy variable defining the impact of the ‘adoption of the euro’ by the trading countries on the intensity of intra-industry trade between them demonstrated a positive and statistically significant effect of this factor on horizontal IIT between the trading countries under study. According to the \textit{RE Tobit} method, that impact was negative and statistically significant, whereas in the case of the \textit{PPML} method – positive and statistically insignificant. Therefore, the results obtained only allowed to corroborate the hypothesis on the positive effect of the adoption of the euro on horizontal IIT.

The hypothesis that monetary integration has a favourable influence on intra-industry trade is well-grounded in theory. A number of authors (Mundell, 1961; McKinnon, 1963; De Grauwe, 2000; Baldwin, Wyplosz, 2009)\textsuperscript{59} demonstrated that the positive effects of a common currency on trade (without distinguishing between

\textsuperscript{59} However, the same authors pointed out that, according to the theory of optimum currency areas, the balance of costs and benefits connected with membership of a monetary union may vary. For a monetary union to bring net benefits, certain conditions must be met (cf. sub-chapter 1.5).
### Table 3.2. Results of the estimation of the impact of specific determinants on EU-10 vertical and horizontal IIT in 1995-2014

| Variable          | RE Tobit | PPML |  |  |
|-------------------|----------|------|  |  |
|                   | HIIT     | VIIT | HIIT | VIIT |
| $GDP_k$           | 0.834*** | 2.515*** | 0.310*** | 0.234*** |
|                   | (0.089)  | (0.202) | (0.008)  | (0.004) |
| $GDP_k'$          | 0.866*** | 1.938*** | 0.248*** | 0.295*** |
|                   | (0.073)  | (0.153) | (0.008)  | (0.004) |
| diff GDP $\Delta k$ | -0.190** | 0.271*  | -0.040*** | -0.052*** |
|                   | (0.074)  | (0.150) | (0.007)  | (0.004) |
| diff GDP $\Delta pc k$ | 0.132** | 0.161  | 0.027*** | 0.068*** |
|                   | (0.067)  | (0.113) | (0.008)  | (0.004) |
| dist $\Delta k$   | -1.443*** | -4.118*** | -0.501*** | -0.390*** |
|                   | (0.122)  | (0.289) | (0.012)  | (0.006) |
| border $\Delta k$ | 2.658*** | 2.091**  | 0.375*** | 0.095*** |
|                   | (0.379)  | (0.950) | (0.024)  | (0.013) |
| FDI $\Delta ln k$ | 0.077*** | 0.095*** | -0.003*** | -0.004*** |
|                   | (0.013)  | (0.021) | (0.001)  | (0.001) |
| FDI $\Delta out k$ | 0.144*  | 0.023  | 0.063*** | 0.038*** |
|                   | (0.087)  | (0.132) | (0.009)  | (0.005) |
| crisis            | -0.379*** | 0.114  | -0.155*** | 0.008 |
|                   | (0.141)  | (0.201) | (0.030)  | (0.014) |
| BAFTA $\Delta k$ | -0.533  | 3.081*** | 1.659*** | 1.599*** |
|                   | (0.590)  | (0.884) | (0.070)  | (0.036) |
| CEFTA $\Delta k$ | -0.123  | -2.267*** | 0.853*** | 0.486*** |
|                   | (0.269)  | (0.412) | (0.035)  | (0.019) |
| othFTA $\Delta pre k$ | 0.237  | 0.344  | 0.182*** | 0.304*** |
|                   | (0.223)  | (0.333) | (0.048)  | (0.021) |
| FTAEU $\Delta k$ | 1.032*** | 1.608*** | 0.571*** | 0.516*** |
|                   | (0.196)  | (0.324) | (0.029)  | (0.013) |
| memEU $\Delta k$ | 1.371*** | 2.200*** | 0.854*** | 0.609*** |
|                   | (0.181)  | (0.305) | (0.025)  | (0.012) |
| FTA $\Delta post k$ | 0.576*** | 0.176  | 0.464*** | 0.231*** |
|                   | (0.187)  | (0.285) | (0.033)  | (0.015) |
| euro $\Delta k$  | 1.099*** | -0.946*** | 0.308*** | 0.003 |
|                   | (0.237)  | (0.351) | (0.032)  | (0.018) |
| const.            | 2.877*** | 13.996*** | 0.890*** | 1.602*** |
|                   | (1.117)  | (2.479) | (0.118)  | (0.058) |
| Number of obs.    | 8141     | 8141  | 8141    | 8141     |

Note: (*), (**) and (***), mean statistical significance at the level of 10%, 5% and 1%, respectively. Standard errors are in parentheses.

Source: Own calculations.
Table 3.3. Results of the estimation of the impact of specific determinants on EU-10 vertical IIT by type in 1995-2014

<table>
<thead>
<tr>
<th>Variable</th>
<th>RE Tobit</th>
<th></th>
<th></th>
<th>PPML</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VIIT</td>
<td>VIIT low</td>
<td>VIIT high</td>
<td>VIIT</td>
<td>VIIT low</td>
<td>VIIT high</td>
</tr>
<tr>
<td>GDP&lt;sub&gt;k&lt;/sub&gt;</td>
<td>2.515***</td>
<td>1.406***</td>
<td>1.085***</td>
<td>0.234***</td>
<td>0.263***</td>
<td>0.201***</td>
</tr>
<tr>
<td></td>
<td>(0.202)</td>
<td>(0.137)</td>
<td>(0.119)</td>
<td>(0.004)</td>
<td>(0.005)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>GDP&lt;sub&gt;k'&lt;/sub&gt;</td>
<td>1.938***</td>
<td>1.289***</td>
<td>1.102***</td>
<td>0.295***</td>
<td>0.311***</td>
<td>0.278***</td>
</tr>
<tr>
<td></td>
<td>(0.153)</td>
<td>(0.107)</td>
<td>(0.089)</td>
<td>(0.004)</td>
<td>(0.006)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>diff GDP&lt;sub&gt;k'&lt;/sub&gt;</td>
<td>0.271*</td>
<td>-0.029</td>
<td>0.057</td>
<td>-0.057***</td>
<td>-0.059***</td>
<td>-0.042***</td>
</tr>
<tr>
<td>diff GDP&lt;sub&gt;pck&lt;/sub&gt;</td>
<td>(0.150)</td>
<td>(0.106)</td>
<td>(0.093)</td>
<td>(0.004)</td>
<td>(0.005)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>dist&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>-4.118***</td>
<td>-2.556***</td>
<td>-1.831***</td>
<td>-0.390***</td>
<td>-0.392***</td>
<td>-0.388***</td>
</tr>
<tr>
<td></td>
<td>(0.289)</td>
<td>(0.193)</td>
<td>(0.160)</td>
<td>(0.006)</td>
<td>(0.008)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>border&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>2.091**</td>
<td>0.118</td>
<td>2.126***</td>
<td>0.095**</td>
<td>0.021</td>
<td>0.182***</td>
</tr>
<tr>
<td></td>
<td>(0.950)</td>
<td>(0.625)</td>
<td>(0.525)</td>
<td>(0.013)</td>
<td>(0.017)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>FDIn&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>0.095***</td>
<td>0.025</td>
<td>0.068***</td>
<td>-0.004***</td>
<td>-0.003***</td>
<td>-0.007***</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.016)</td>
<td>(0.015)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>FDOut&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>0.023</td>
<td>0.197**</td>
<td>-0.174*</td>
<td>0.038***</td>
<td>0.039***</td>
<td>0.038***</td>
</tr>
<tr>
<td></td>
<td>(0.132)</td>
<td>(0.097)</td>
<td>(0.095)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>crisis</td>
<td>0.114</td>
<td>0.119</td>
<td>-0.035</td>
<td>0.008</td>
<td>0.005</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>(0.201)</td>
<td>(0.149)</td>
<td>(0.148)</td>
<td>(0.014)</td>
<td>(0.019)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>BAFTA&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>3.081***</td>
<td>1.458**</td>
<td>2.524***</td>
<td>1.599***</td>
<td>1.828***</td>
<td>1.364***</td>
</tr>
<tr>
<td></td>
<td>(0.884)</td>
<td>(0.651)</td>
<td>(0.639)</td>
<td>(0.036)</td>
<td>(0.051)</td>
<td>(0.051)</td>
</tr>
<tr>
<td>CEFTA&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>-2.267***</td>
<td>-0.222</td>
<td>-1.461***</td>
<td>0.486***</td>
<td>0.670***</td>
<td>0.292***</td>
</tr>
<tr>
<td></td>
<td>(0.412)</td>
<td>(0.302)</td>
<td>(0.294)</td>
<td>(0.019)</td>
<td>(0.027)</td>
<td>(0.029)</td>
</tr>
<tr>
<td>othFTApre&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>0.344</td>
<td>0.520**</td>
<td>0.096</td>
<td>0.304***</td>
<td>0.489***</td>
<td>0.111***</td>
</tr>
<tr>
<td></td>
<td>(0.333)</td>
<td>(0.246)</td>
<td>(0.241)</td>
<td>(0.021)</td>
<td>(0.028)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>FTAEU&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>1.608***</td>
<td>1.497***</td>
<td>0.604***</td>
<td>0.516***</td>
<td>0.781***</td>
<td>0.203***</td>
</tr>
<tr>
<td></td>
<td>(0.324)</td>
<td>(0.238)</td>
<td>(0.222)</td>
<td>(0.013)</td>
<td>(0.018)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>memEU&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>2.200***</td>
<td>1.470***</td>
<td>1.222***</td>
<td>0.609***</td>
<td>0.780***</td>
<td>0.434***</td>
</tr>
<tr>
<td></td>
<td>(0.305)</td>
<td>(0.221)</td>
<td>(0.207)</td>
<td>(0.012)</td>
<td>(0.016)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>FTApost&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>0.176</td>
<td>0.126</td>
<td>0.256</td>
<td>0.231***</td>
<td>0.339***</td>
<td>0.127***</td>
</tr>
<tr>
<td></td>
<td>(0.285)</td>
<td>(0.21)</td>
<td>(0.203)</td>
<td>(0.015)</td>
<td>(0.022)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>euro&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>-0.946***</td>
<td>-1.147***</td>
<td>0.211</td>
<td>0.003</td>
<td>0.014</td>
<td>-0.007</td>
</tr>
<tr>
<td></td>
<td>(0.351)</td>
<td>(0.259)</td>
<td>(0.255)</td>
<td>(0.018)</td>
<td>(0.024)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>const.</td>
<td>13.996***</td>
<td>9.116***</td>
<td>4.727***</td>
<td>1.602***</td>
<td>0.434***</td>
<td>1.393***</td>
</tr>
<tr>
<td></td>
<td>(2.479)</td>
<td>(1.679)</td>
<td>(1.439)</td>
<td>(0.058)</td>
<td>(0.081)</td>
<td>(0.082)</td>
</tr>
<tr>
<td>Number of obs.</td>
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<td>8141</td>
<td>8141</td>
<td>8141</td>
<td>8141</td>
<td>8141</td>
</tr>
</tbody>
</table>

Note: (*), (**) and (***) mean statistical significance at the level of 10%, 5% and 1%, respectively. Standard errors are in parentheses.

Source: Own calculations.
particular types of trade) mainly resulted from the elimination of transaction costs related to the exchange of national currencies and from the removal of exchange rate risk (the introduction of a currency peg), which created uncertainty about future exchange rates. Another source of benefits is also greater market transparency, increasing competition and pushing down product prices.

3.3.2. Estimation results of IIT trade changes of the EU-10 with major groups of trading partners (the EU-15, the EU-10 and third countries) (Edward Molendowski)

In order to verify the impact of particular factors on EU-10 vertical and horizontal intra-industry trade in 1995-2014, the regression equation parameters were estimated for three groups of trading partners: the EU-10 (mutual trade), the EU-15 and third (non-EU-25) countries. As in the case of the full sample (total trade), the estimation of parameters was carried out using two methods: RE Tobit and PPML. The results obtained are presented in Tables 3.4. to 3.6.

Economic size of the trading countries

For the purposes of the present analysis, as a proxy for the economic size of the trading countries the authors adopted the ‘value of GDP of the countries concerned’, at the purchasing power parity of the trading country (GDP\(_k\)) and of the partner country (GDP\(_k'\)). The parameters for both variables were positive and statistically significantly different from zero (at the level of 1%) in the trade of the countries in question with all the groups of partners. This concerned trade vertical (VIIT) as well as horizontal (HIIT) in nature. Such results were obtained in both of the methods applied. The results show that as the economic size of a trading country increases, its production and export capacities as well as demand for imports rise, also within intra-industry trade. In addition, the results obtained also mean that the larger the economy of a partner country, the higher the intensity of both vertical and horizontal intra-industry trade.

Those results are consistent with the theory that the economic size of the trading countries has a direct impact on the scale of production and the related increasing returns to scale (Krugman, 1980; Lancaster, 1980; Falvey and Kierzkowski, 1987). Therefore, each of the trading countries may specialise in the production of different varieties of differentiated goods. Some of those varieties will be exported, while others will be imported by the countries concerned.

Thus, the results obtained allowed to corroborate – for all three groups of the trading partners of the EU-10 – the hypothesis that the larger the economies of the trading countries, the higher the intensity of both vertical and horizontal intra-industry trade between them.
3.3. Model estimation results

**Differences in economic size**
The parameters for the variable ‘difference in GDP’ (diffGDP) varied in EU-10 trade with specific groups of trading partners. In the mutual trade of the EU-10 the parameter values were negative for both estimation methods, in the case of vertical (VIIT) as well as horizontal (HIIT) trade, but in the PPML method they were statistically significant (at the level of 1%), whereas in the RE Tobit method — statistically insignificant. Similarly, the parameter values were negative and statistically significant for the variable concerning trade with third (non-EU-25) countries. In turn, in trade with the EU-15 the parameter values for the factor discussed were only statistically significant for the PPML method. Widening differences in economic size had a positive impact on the development of horizontal IIT and a negative effect on vertical IIT. In the case of the RE Tobit method, the parameter values were positive but statistically insignificant.

The results obtained appeared to be consistent with expectations and the hypothesis adopted, but only for the mutual trade of the EU-10 and their trade with non-EU-25 countries. According to the hypothesis, the greater the differences in economic size between the trading countries, the lower the intensity of both vertical and horizontal intra-industry trade between them.

The above hypothesis reflects the theoretical considerations (Helpman, Krugman, 1985) according to which lesser differences in market size between two countries increase the share of intra-industry trade in the mutual trade of the countries concerned. The economic size of a country approximates potential returns to scale, recognised in the literature as the main determinant of intra-industry trade.

As for trade with the EU-15, it was impossible to unambiguously corroborate the above research hypothesis. This is attributable to the fact that, in terms of economic size measured by GDP, basically all of the EU-10 countries are smaller in comparison with any of the EU-15 countries, even one with the least potential.

**Differences in per capita income**
The parameters for the variable ‘difference in GDP per capita’ (diffGDPpc) varied, depending on the group of trading partners. In relations with the EU-15 they were negative and mostly statistically significant for both types of trade. This means that widening differences in per capita income between the trading countries had a downward effect on both horizontal and vertical intra-industry trade. This allowed to confirm the adopted research hypothesis on the negative impact of growing differences in per capita income on horizontal IIT and to reject the hypothesis on the positive influence of rising differences on vertical IIT.

The hypotheses in question reflect theoretical assumptions. Thus, according to Linder (1961), similarity in per capita incomes between the trading countries stimulates horizontal intra-industry trade. The closer the per capita income between the countries participating in trade, the more similar the consumer preferences are.
Falvey and Kierzkowski (1987) point out that widening gaps in per capita income fuel intra-industry trade of a vertical nature, which results from the differences in the distribution of consumer preferences in the countries concerned.

In the mutual trade of the EU-10 and in their trade with non-EU-25 countries, the parameters for the variable \( \text{diffGDPpc} \) took positive and statistically significant values (in most cases, at the level of 1%), both in terms of horizontal and vertical IIT. The results obtained appeared to be consistent with the expectations for vertical IIT. However, it was impossible to confirm the adopted research hypothesis on the negative impact of increasing differences in per capita income on horizontal IIT.

**Geographical proximity**

In the case of trade with all three groups of the trading partners of the EU-10, the parameters for the variable defining the ‘distance between countries’ (\( \text{dist} \)) took negative values, mostly statistically significant (at the level of 1%), both for horizontal and vertical IIT. This means that the greater the distance between the countries under analysis, the less intensive the links of an intra-industry nature between them. In turn, in most cases, the parameters for the variable illustrating the existence of a common border (\( \text{border} \)) took positive values (these values were negative only in trade with the EU-15 in the \text{PPML} method). This means that having a common border had a favourable effect on the intensity of intra-industry trade, both horizontal and vertical in nature.

The results obtained allowed to corroborate the hypothesis that geographical proximity promotes horizontal and vertical intra-industry trade between the countries concerned. Thus, it is consistent with theoretical considerations (Balassa and Bauwens, 1987).

**Foreign direct investment**

The parameter values for the variable concerning the ‘stock of inward FDI from a partner country in the trading country’ as at the end of the previous year (\( \text{FDIin} \)), in all the directions of trade, were positive and statistically significant (in most cases, at the level of 1%), both for horizontal and vertical trade. This means that the inflow of FDI to the EU-10 fostered intra-industry trade in their relations with all the groups of trading partners. This allowed to confirm the research hypothesis that direct investment from a partner country in the trading country contributes to a greater intensity of both horizontal and vertical IIT.

In turn, the parameters for the variable defining the ‘stock of outward FDI in the trading country’ (\( \text{FDIout} \)) took varying values in EU-10 trade with the analysed groups of countries. In the mutual trade of the EU-10, these values were negative with regard to vertical trade and positive in the case of horizontal trade. In relations with non-EU-25 countries, they were positive (and statistically significant) for both horizontal and vertical IIT. At the same time, in relations with the EU-15, for horizontal trade the values were negative (and statistically significant), whereas
for vertical trade – negative or positive (depending on the method), but statistically insignificant. Therefore, it was not possible to unequivocally confirm, for all three groups of the trading partners, the adopted research hypothesis on the positive impact of foreign direct investment made by the EU-10 in their partner countries.

**The economic and financial crisis of 2008/2009**

In general, an economic crisis reduces the propensity to engage in international trade and slows down foreign trade. However, it is difficult to unambiguously identify its effects on the intensity of intra-industry trade on the basis of the analysis conducted.

The parameters for the variable *crisis* were negative and statistically significant (usually at the level of 1%) for horizontal IIT in relations with all the groups of trading partners under study. This means that, in the wake of unfavourable changes in the external environment as a result of the crisis which broke out in late 2007 and its consequences for the economic situation of the countries under analysis, there was a decline in the intensity of horizontal IIT. Such a reaction seems justified since consumers, seeking to limit the adverse effects of their reduced incomes in the crisis period, shifted some of the demand from products previously imported to domestic goods of a similar quality but differing in other characteristics.

In turn, the crisis developments observed in the world economy in late 2007 and in the following years had no significant impact on the dynamics of vertical IIT in the countries under analysis. For this type of trade, the variable *crisis* took positive values in trade with all the groups of countries (with the exception of trade with non-EU countries; the *RE Tobit* method), but the estimated parameters obtained in model were statistically insignificant. This seems to be attributable to the fact that links within vertical intra-industry trade mostly concern multinational corporations (production fragmentation) and are basically rather stable.

**Trade liberalisation**

For the purposes of the present study, the factor in the form of ‘trade liberalisation’ was included in the econometric model with the use of six dummy variables defining different preferential agreements to which the EU-10 countries were parties: ‘BAFTA’ (*BAFTA*), ‘CEFTA’ (*CEFTA*), ‘other free trade areas existing in the pre-accession period’ (*othFTApre*), ‘free trade areas created under the association agreements concluded by the EU-10 countries with the European Communities’ (*FTAEU*), ‘EU membership’ (*memEU*) and ‘free trade areas resulting from the adoption by the EU-10 of the EU common commercial policy’ (*FTApost*).

The estimated variables were frequently statistically insignificant. For EU-10 trade with the EU-15, the parameters for the variables ‘FTAEU’ and ‘memEU’ appeared to be statistically significant only for the *PPML* method and took negative values. This means that association with the Communities, and then EU membership, had a negative impact on the development of EU-10 intra-industry trade with the EU-15.
Table 3.4. Results of the estimation of the impact of specific determinants on vertical and horizontal IIT in the mutual trade of the EU-10 in 1995-2014

<table>
<thead>
<tr>
<th>Variable</th>
<th>RE Tobit</th>
<th>PPML</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HIIT</td>
<td>VIIT</td>
</tr>
<tr>
<td>$GDP_k$</td>
<td>1.405***</td>
<td>3.456***</td>
</tr>
<tr>
<td></td>
<td>(0.259)</td>
<td>(0.503)</td>
</tr>
<tr>
<td>$GDP_k'$</td>
<td>1.553***</td>
<td>3.536***</td>
</tr>
<tr>
<td></td>
<td>(0.265)</td>
<td>(0.512)</td>
</tr>
<tr>
<td>diffGDP $_{kk'}$</td>
<td>-0.053</td>
<td>-0.034</td>
</tr>
<tr>
<td></td>
<td>(0.213)</td>
<td>(0.393)</td>
</tr>
<tr>
<td>diffGDP $ppc_{kk'}$</td>
<td>0.489***</td>
<td>0.143</td>
</tr>
<tr>
<td></td>
<td>(0.131)</td>
<td>(0.19)</td>
</tr>
<tr>
<td>dist $_{kk'}$</td>
<td>-3.369***</td>
<td>-8.117***</td>
</tr>
<tr>
<td></td>
<td>(0.563)</td>
<td>(1.231)</td>
</tr>
<tr>
<td>border $_{kk'}$</td>
<td>2.177***</td>
<td>2.527</td>
</tr>
<tr>
<td></td>
<td>(0.759)</td>
<td>(1.683)</td>
</tr>
<tr>
<td>FDI $ln_{kk'}$</td>
<td>0.537***</td>
<td>0.137</td>
</tr>
<tr>
<td></td>
<td>(0.152)</td>
<td>(0.224)</td>
</tr>
<tr>
<td>FDI $out_{kk'}$</td>
<td>0.677***</td>
<td>-0.483*</td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td>(0.249)</td>
</tr>
<tr>
<td>crisis</td>
<td>-0.710**</td>
<td>0.735</td>
</tr>
<tr>
<td></td>
<td>(0.305)</td>
<td>(0.43)</td>
</tr>
<tr>
<td>BAFTA $_{kk'}$</td>
<td>-0.384</td>
<td>4.137***</td>
</tr>
<tr>
<td></td>
<td>(0.706)</td>
<td>(0.98)</td>
</tr>
<tr>
<td>CEFTA $_{kk'}$</td>
<td>-0.602</td>
<td>-1.580**</td>
</tr>
<tr>
<td></td>
<td>(0.508)</td>
<td>(0.698)</td>
</tr>
<tr>
<td>othFTApre $_{kk'}$</td>
<td>0.207</td>
<td>2.093***</td>
</tr>
<tr>
<td></td>
<td>(0.512)</td>
<td>(0.697)</td>
</tr>
<tr>
<td>FTAEU $_{kk'}$</td>
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<td>-0.14</td>
</tr>
<tr>
<td></td>
<td>(0.6)</td>
<td>(0.847)</td>
</tr>
<tr>
<td>memEU $_{kk'}$</td>
<td>0.224</td>
<td>2.077***</td>
</tr>
<tr>
<td></td>
<td>(0.511)</td>
<td>(0.743)</td>
</tr>
<tr>
<td>FTApost $_{kk'}$</td>
<td>-0.090</td>
<td>0.502</td>
</tr>
<tr>
<td></td>
<td>(0.636)</td>
<td>(0.893)</td>
</tr>
<tr>
<td>euro $_{kk'}$</td>
<td>0.438</td>
<td>0.957</td>
</tr>
<tr>
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<td>(0.675)</td>
<td>(0.965)</td>
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<tr>
<td>const.</td>
<td>8.143</td>
<td>31.335***</td>
</tr>
<tr>
<td></td>
<td>(4.227)</td>
<td>(9.003)</td>
</tr>
</tbody>
</table>

Number of obs. 1375 1375 1375 1375

Note: (*), (**) and (***) mean statistical significance at the level of 10%, 5% and 1%, respectively. Standard errors are in parentheses.

Source: Own calculations.
Table 3.5. Results of the estimation of the impact of specific determinants on vertical and horizontal IIT in EU-10 trade with the EU-15 in 1995-2014

<table>
<thead>
<tr>
<th>Variable</th>
<th>RE Tobit</th>
<th>PPML</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HIIT</td>
<td>VIIT</td>
</tr>
<tr>
<td>$GDP_k$</td>
<td>0.946***</td>
<td>3.532***</td>
</tr>
<tr>
<td></td>
<td>(0.146)</td>
<td>(0.356)</td>
</tr>
<tr>
<td>$GDP_k'$</td>
<td>0.575***</td>
<td>2.624***</td>
</tr>
<tr>
<td></td>
<td>(0.204)</td>
<td>(0.455)</td>
</tr>
<tr>
<td>diff $GDP_{kk}'$</td>
<td>0.070</td>
<td>0.357</td>
</tr>
<tr>
<td></td>
<td>(0.145)</td>
<td>(0.286)</td>
</tr>
<tr>
<td>diff $GDP_{pckk}'$</td>
<td>-0.392**</td>
<td>-0.571*</td>
</tr>
<tr>
<td></td>
<td>(0.173)</td>
<td>(0.325)</td>
</tr>
<tr>
<td>dist $kk'$</td>
<td>-2.052***</td>
<td>-6.999***</td>
</tr>
<tr>
<td></td>
<td>(0.316)</td>
<td>(0.852)</td>
</tr>
<tr>
<td>border $kk'$</td>
<td>2.642***</td>
<td>3.100</td>
</tr>
<tr>
<td></td>
<td>(0.822)</td>
<td>(2.228)</td>
</tr>
<tr>
<td>FDI in $kk'$</td>
<td>0.116***</td>
<td>0.044*</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>FDI out $kk'$</td>
<td>-0.676***</td>
<td>-0.175</td>
</tr>
<tr>
<td></td>
<td>(0.139)</td>
<td>(0.224)</td>
</tr>
<tr>
<td>crisis</td>
<td>-0.508**</td>
<td>0.376</td>
</tr>
<tr>
<td></td>
<td>(0.249)</td>
<td>(0.388)</td>
</tr>
<tr>
<td>FTA EU $kk'$</td>
<td>0.041</td>
<td>-0.215</td>
</tr>
<tr>
<td></td>
<td>(0.565)</td>
<td>(0.889)</td>
</tr>
<tr>
<td>mem EU $kk'$</td>
<td>0.249</td>
<td>-0.155</td>
</tr>
<tr>
<td></td>
<td>(0.569)</td>
<td>(0.895)</td>
</tr>
<tr>
<td>euro $kk$</td>
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<td>-1.433***</td>
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<tr>
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<td>(0.419)</td>
</tr>
<tr>
<td>const</td>
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<td>36.131***</td>
</tr>
<tr>
<td></td>
<td>(3.262)</td>
<td>(7.604)</td>
</tr>
</tbody>
</table>

Number of obs. 2550 2550 2550 2550

Note: (*), (**) and (***) mean statistical significance at the level of 10%, 5% and 1%, respectively. Standard errors are in parentheses.

Source: Own calculations.
Table 3.6. Results of the estimation of the impact of specific determinants on vertical and horizontal IIT in EU-10 trade with third (non-EU-25) countries in 1995-2014

<table>
<thead>
<tr>
<th>Variable</th>
<th>RE Tobit</th>
<th>PPML</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HIIT</td>
<td>VIIT</td>
</tr>
<tr>
<td>GDP&lt;sub&gt;k&lt;/sub&gt;</td>
<td>0.536***</td>
<td>1.874***</td>
</tr>
<tr>
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<td>(0.101)</td>
<td>(0.235)</td>
</tr>
<tr>
<td>GDP&lt;sub&gt;k'&lt;/sub&gt;</td>
<td>0.772***</td>
<td>1.478***</td>
</tr>
<tr>
<td></td>
<td>(0.073)</td>
<td>(0.152)</td>
</tr>
<tr>
<td>diff GDP&lt;sub&gt;k&lt;/sub&gt;'</td>
<td>-0.226***</td>
<td>0.095</td>
</tr>
<tr>
<td></td>
<td>(0.083)</td>
<td>(0.18)</td>
</tr>
<tr>
<td>diff GDP&lt;sub&gt;pck&lt;/sub&gt;'</td>
<td>0.277***</td>
<td>0.357**</td>
</tr>
<tr>
<td></td>
<td>(0.081)</td>
<td>(0.146)</td>
</tr>
<tr>
<td>dist&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>-0.941***</td>
<td>-1.949***</td>
</tr>
<tr>
<td></td>
<td>(0.123)</td>
<td>(0.298)</td>
</tr>
<tr>
<td>border&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>0.238</td>
<td>-0.500</td>
</tr>
<tr>
<td></td>
<td>(0.465)</td>
<td>(1.144)</td>
</tr>
<tr>
<td>FDI&lt;sub&gt;in&lt;/sub&gt;&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>0.125**</td>
<td>0.746***</td>
</tr>
<tr>
<td></td>
<td>(0.057)</td>
<td>(0.092)</td>
</tr>
<tr>
<td>FDI&lt;sub&gt;out&lt;/sub&gt;&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>0.512***</td>
<td>0.520**</td>
</tr>
<tr>
<td></td>
<td>(0.141)</td>
<td>(0.212)</td>
</tr>
<tr>
<td>crisis</td>
<td>-0.112</td>
<td>-0.044</td>
</tr>
<tr>
<td></td>
<td>(0.199)</td>
<td>(0.274)</td>
</tr>
<tr>
<td>CEFTA&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>1.990*</td>
<td>-1.162</td>
</tr>
<tr>
<td></td>
<td>(1.072)</td>
<td>(1.542)</td>
</tr>
<tr>
<td>othFTA&lt;sub&gt;pre&lt;/sub&gt;&lt;sub&gt;kk'&lt;/sub&gt;</td>
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<td>0.491</td>
</tr>
<tr>
<td></td>
<td>(0.272)</td>
<td>(0.416)</td>
</tr>
<tr>
<td>FTAEU&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>4.751***</td>
<td>3.753*</td>
</tr>
<tr>
<td></td>
<td>(1.361)</td>
<td>(1.949)</td>
</tr>
<tr>
<td>memEU&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>0.616*</td>
<td>0.471</td>
</tr>
<tr>
<td></td>
<td>(0.343)</td>
<td>(0.513)</td>
</tr>
<tr>
<td>FTA&lt;sub&gt;post&lt;/sub&gt;&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>0.745***</td>
<td>0.569*</td>
</tr>
<tr>
<td></td>
<td>(0.195)</td>
<td>(0.31)</td>
</tr>
<tr>
<td>euro&lt;sub&gt;kk'&lt;/sub&gt;</td>
<td>1.382*</td>
<td>-0.932</td>
</tr>
<tr>
<td></td>
<td>(0.819)</td>
<td>(1.15)</td>
</tr>
<tr>
<td>const.</td>
<td>-0.418</td>
<td>-0.105</td>
</tr>
<tr>
<td></td>
<td>(1.234)</td>
<td>(2.758)</td>
</tr>
<tr>
<td>Number of obs.</td>
<td>4216</td>
<td>4216</td>
</tr>
</tbody>
</table>

Note: (*), (**) and (***) mean statistical significance at the level of 10%, 5% and 1%, respectively. Standard errors are in parentheses. Source: Own calculations.
In the mutual trade of the EU-10, EU membership had a positive effect on both types of IIT and was mostly statistically significant. The parameters for the variable `othFTApre` were positive and statistically significant in both methods only for vertical IIT. The impact of EU-10 association with the Communities was only positive and statistically significant (in both methods) for vertical IIT. The parameters for the variables `CEFTA` and `BAFTA` took positive (and statistically significant) values only in the PPML method.

In trade with third countries, the parameters for the variables defining participation in preferential trade groups were positive and statistically significant only in the PPML method.

To recapitulate, it can be asserted that being a party to a preferential trade agreement had the most favourable effects on horizontal and vertical trade in EU-10 relations with non-EU-25 countries and in the mutual trade of the EU-10. This factor played a much lesser role in intra-industry trade with the EU-15. One explanation for this can be that barriers to trade with the EU-15 were lifted much earlier than in relations with other countries.

**Adoption of the euro**
The effect of the ‘adoption of the common currency: the euro’ (euro) appeared to be statistically significant in EU-10 trade with the EU-15 (with the exception of VIIT for the PPML method) and for horizontal IIT in trade with non-EU-25 countries. The adoption of the euro by the trading countries contributed to an increased share of horizontal IIT in EU-10 trade with EU-15 and third countries. In turn, a negative impact, and statistically significant in the RE Tobit method, was found in the case of membership of the euro area for vertical IIT of the EU-10 with the EU-15. In most cases, the results obtained were consistent with the research hypothesis put forward.

### 3.3.3. Consistency of the results obtained with the hypotheses
*(Elżbieta Kawecka-Wyrzykowska)*

Observing the results produced by both methods used in our model, one can say that not all of them are consistent with the theoretical assumptions as reflected in our research hypotheses. The directions of the impact of particular determinants on VIIT and HIIT (according to two different methods) as expected and obtained in the model are compared in Table 3.7. The most important conclusions drawn from the comparison can be formulated as follows:\(^\text{60}\)

\(^\text{60}\) It was assumed that the hypothesis in question was confirmed where the estimated effect of the factor in question was statistically significant in at least one of the two estimation methods applied.
Several determinants were found to enhance VIIT as well as HIIT (in both methods): ‘economic size of a pair of trading partners’; ‘border’ (the proximity of partners); ‘outward FDI’; ‘BAFTA’; ‘free trade areas created under the association agreements concluded by the EU-10 countries with the then European Communities’ (FTAEU); ‘free trade areas agreed prior to EU accession with non-EU countries’ (e.g. with the EFTA countries – othFTApre); ‘EU membership’ (memEU); and ‘free trade agreements binding after EU accession’ (FTApost). In all the above cases, the results obtained were consistent with the theoretical assumptions and the hypotheses put forward on their basis.

In turn, the variable ‘distance’ produced a negative impact on both types of intra-industry trade (in both methods). At the same time, the direction of influence was found as expected.

The positive relationship between VIIT and the ‘difference in GDP per capita’ was also consistent with the hypothesis. Contrary to the theoretical indications, the determinant ‘the euro’ was negatively linked with VIIT. In contrast to expectations, the effect of ‘crisis’ on VIIT appeared to be positive (but statistically insignificant in both methods). Ambiguous effects were found for the factors: ‘differences in economic size’, ‘inward FDI’ and ‘CEFTA’.

In the case of HIIT, with the exception of the above-mentioned positive and negative impact of certain variables on both types of IIT, a positive relationship was discovered, in principle, also between this type of IIT and the following determinants: ‘CEFTA’, ‘the euro’. Those results were in line with expectations.

Contrary to expectations, the ‘difference in GDP per capita’ had a positive effect on HIIT. At the same time, the effect was negative but consistent with expectations in the case of the variables: ‘differences in economic size’ and ‘crisis’ (according to both methods, it was also statistically significant). The impact of ‘inward FDI’ on HIIT was ambiguous.

As regards the consistency of the results obtained with the research hypotheses in geographic terms (in EU-10 intra-industry trade with the three groups of partners under analysis, i.e. in the mutual trade of the EU-10, in relations with the EU-15 and with the rest of the world), the most important results were as follows (Tables 3.4. to 3.6.).

The direction of the effect of only two factors, ‘country size’ and ‘distance’, was identical in EU-10 trade with all the three analysed groups of trading partners and consistent with the research hypotheses (positive in the case of the former and negative for the latter).

The aforementioned negative impact of ‘differences in economic size’ on EU-10 HIIT reflected the same direction of the relationship in the mutual trade of the EU-10 as well as in trade with non-EU-25 countries. Those results were consistent with the hypotheses formulated. With regard to trade with the EU-15, the effect of the factor in question was positive. An ambiguous impact of ‘differences in economic
size’ on overall VIIT of the EU-10 reflected the same relationships in EU-10 trade with the EU-15 and with non-EU-25 partners. At the same time, in the mutual trade of the EU-10 this factor had a negative influence on IIT, which was consistent with the theoretical framework.

The effect of ‘differences in per capita income’ on vertical IIT appeared to be consistent with theory, i.e. positive, only in the mutual trade of the EU-10 and in trade with non-EU-25 countries. That factor had a downward influence on VIIT in EU-10 trade with the EU-15, contrary to theory. An impact which was consistent with theory – negative – was found in the case of ‘differences in per capita income’ as a determinant of horizontal IIT in EU-10 trade with the EU-15. In trade with the other groups of countries it was positive, thus inconsistent with theory. Therefore, the impact of the factor described on IIT appeared to be ambiguous in the analysed directions of EU-10 trade.

The existence of a ‘common border’ between the trading countries, which in the light of theory has a positive effect on the intensity of IIT, produced the same sign for most of the geographical directions of EU-10 trade under analysis. One exception was the vertical IIT of the EU-10 with the EU-15, where this impact was negative. The variable ‘outward FDI’ showed a positive effect on the overall VIIT and HIIT of the EU-10 and appeared to have the same sign only in relations with non-EU-25 partners and in horizontal trade among the EU-10. In trade with the EU-15, the negative sign concerned HIIT, whereas in internal EU-10 trade – VIIT, which was not in line with the theoretical assumption. In turn, the variable ‘inward FDI’, having an ambiguous effect on overall VIIT and overall HIIT of the EU-10, appeared to favour both types of IIT with all three groups of partners, except for VIIT with the EU-15 (in one of the methods). The positive sign here was consistent with expectations.

The negative relationship between the ‘crisis’ and HIIT in the EU-10, obtained as a result of the model estimation, reflected an identical sign in EU-10 trade with all three groups of the trading partners analysed (but in trade with non-EU-25 countries it was not statistically significant). Thus, it was found to be consistent with the adopted research hypothesis. Simultaneously, an opposite – positive – effect of the crisis on VIIT in EU-10 trade with the three groups of countries analysed was observed (but it was not statistically significant). The different signs in the case of the impact of the crisis on HIIT and VIIT can be explained, as it seems, by the dissimilar nature of goods traded in both types of trade. In the case of HIIT (exchange of varieties), products sold at the same price are perfect substitutes. Therefore, they are particularly sensitive to prices and to fluctuations in demand. Seeking to curb the adverse effects of their reduced incomes during a crisis by necessarily cutting their purchases, consumers shift some of their demand from imports to similar but relatively cheaper domestic goods or they limit their expenditure (in both cases imports decline). VIIT largely occurs within multinational corporations (as a result
of processes of production fragmentation) which, due to their extensive international links, find it easier to adapt to shrinking demand in a market than traditional exporters (see sub-chapter 1.4).

The impact of all types of ‘FTAs’ on EU-10 vertical and horizontal IIT with non-EU-25 countries was unequivocally positive and consistent with expectations. At the same time, in EU-10 trade with other groups of partners the relationship was not unambiguously positive. In particular, the model showed a negative (contrary to theory) effect of ‘FTAEU’ on VIIT in mutual relations of the EU-10 and on both types of IIT in trade with the EU-15. Such a result in trade within the EU-10 and with the EU-15 might reflect the considerable differences in the level of development between the partners, which did not allow to fully use the advantages of liberalisation (access to a larger market). The variable in question, ‘FTAEU’, involved arrangements with the European Communities (under association agreements), which were implemented in the 1990s. The EU-10 had only started the difficult process of transition of their economies from planned to market economies and it took a long time for many weak producers to undertake the costly adjustments in order to stay in the market. Additional trade that appeared as a result of the elimination of trade barriers mostly reflected basic comparative costs and advantages and was dominated by simple processed goods in which the EU-10 were competitive. This was primarily of an inter-industry rather than intra-industry nature. Surprisingly, however, those agreements – according to the model – had a negative impact on the mutual VIIT of the EU-10. In turn, the CEFTA (Central European Free Trade Agreement) had an ambiguously positive impact on intra-industry trade within the EU-10. These results were obtained despite the fact that the parties to those agreements were more similar in terms of economic development. It seems that in the case of both the association agreements and the CEFTA, making fuller use of the opportunities offered by intra-industry specialisation could be hindered by the relatively low level of the partners’ economic development in the period in which the agreements were in force (i.e. before the parties thereto joined the EU).

In addition, the effect of ‘EU membership’ was equivocal as well. The factor in question showed a positive, and consistent with theory, relationship with the mutual intra-industry trade of the EU-10 and with their trade with non-EU-25 partners. Simultaneously, in relations with the EU-15 this factor had a negative sign for EU-10 horizontal and vertical intra-industry trade. In the case of the determinant concerned, differences in the level of economic development played a lesser role in explaining its negative effect on IIT than in the period of EU-10 association with the Communities. Before acceding to the EU, the countries managed to significantly narrow the distance from the EU-15. What most likely mattered was the elimination of almost all trade (border) barriers to merchandise trade between the EU-10 and the EU-15 prior to EU accession and usually earlier than within other free trade areas. In turn, the impact of free trade areas resulting from the adoption of the EU
common commercial policy when the EU-10 achieved a higher level of economic development was positive.

The elimination of costs related to national currencies (the adoption of the euro) between the trading countries had a positive effect on horizontal IIT, whereas its influence on vertical IIT turned out to be negative. This result is attributable to the fact that most trade in vertically differentiated products occurs within transnational corporations where transfers between subsidiaries are settled in a foreign currency.

To summarise these conclusions, it must be emphasised that in the case of only 9 (out of the 15 analysed) variables the research hypotheses were corroborated in both methods used for EU-10 overall vertical and overall horizontal intra-industry trade (not broken down by group of partners) – see Table 3.7. According to the results of the model applied, intra-industry trade was stimulated by the following determinants: ‘economic size of pairs of trading partners’; ‘border’ (the proximity of partners); ‘outward FDI’; ‘BAFTA’; ‘free trade areas created under the association agreements concluded by the EU-10 countries with the then European Communities’; ‘free trade areas agreed prior to EU accession with non-EU countries’ (e.g. with the EFTA countries); ‘EU membership’; and ‘free trade agreements binding after EU accession’. Simultaneously, the development of both types of IIT was impeded by ‘distance’.

The results presented in Table 3.7. were also consistent with the hypotheses formulated: there was a positive sign – but only for VIIT – of the ‘differences in GDP per capita’, whereas for HIIT – of ‘CEFTA’ and ‘the euro’; a negative impact – only on HIIT – of ‘differences in economic size’ and of the ‘crisis’. Inconsistently with the theoretical assumptions, a positive sign was produced for ‘differences in GDP per capita’ for HIIT, and a negative relationship of ‘the euro’ with VIIT was found. The effect of the ‘crisis’ on VIIT was statistically insignificant.

The influence on both types of intra-industry trade appeared to be ambiguous for ‘inward FDI’, ‘differences in economic size’ as well as for ‘CEFTA’ in the case of VIIT.

We must also note that the estimation results for the impact of specific factors on overall VIIT and HIIT do not properly reflect the results in a breakdown into VIIT and HIIT with the groups of countries under analysis. The most prominent example of this assessment is the relationship between intra-industry trade and EU membership. The data in Table 3.7. indicate a positive and statistically significant impact of this factor on both types of IIT in both the methods that were applied. However, the estimation for groups of countries – partners of the EU-10 – reveals that the effect of this variable on EU-10 trade with the EU-15 was negative in most cases.

Only three factors: ‘country size’, ‘distance’ and ‘BAFTA’ showed the same signs for overall VIIT and HIIT as well as for trade with the three analysed groups of partners. For other variables, the estimation of their impact on both types of IIT broken down by group of major trading partners produced different results.
<table>
<thead>
<tr>
<th>Determinant</th>
<th>Variable</th>
<th>Expected sign</th>
<th>RE Tobit</th>
<th>PPML</th>
<th>VILT</th>
<th>HITT</th>
<th>HITT</th>
<th>VILT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of country $k$</td>
<td>$GDP_k$</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
</tr>
<tr>
<td>Difference in size between a pair of countries</td>
<td>$GDP_{k,k'}$</td>
<td>(–)</td>
<td>(–)</td>
<td>(–)</td>
<td>(–)</td>
<td>(–)</td>
<td>(–)</td>
<td>(–)</td>
</tr>
<tr>
<td>Difference in per capita income (GDP per capita)</td>
<td>$diffGDPP_{k,k'}$</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Geographical proximity</td>
<td>$dist_{k,k'}$</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Foreign Direct Investment (inward FDI)</td>
<td>$FDI_{k,k'}$</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Foreign Direct Investment (outward FDI)</td>
<td>$FDI_{k',k}$</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Economic crisis</td>
<td>$crisis_{k}$</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>(–)</td>
<td>(–)</td>
<td>(–)</td>
<td>(–)</td>
</tr>
<tr>
<td>Adoption of the euro/ Elimination of barriers related to national currencies</td>
<td>$euro_{k,k'}$</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Note: * – statistically insignificant variable (>0.1)
Most generally speaking, the effects of individual variables on VIIT and HIIT are more ambiguous at the level of VIIT and HIIT with particular groups of trading partners under analysis than at the level of the overall vertical and overall horizontal intra-industry trade of the EU-10.

### 3.4. Comparison of the results obtained with findings from other studies

(Elżbieta Kawecka-Wyrzykowska)

Tables 3.8. and 3.9. compare the results of our research study on the determinants of both types of intra-industry trade – VIIT and HIIT – with the findings obtained by other researchers. The tables contain no data on two of the factors analysed by us, i.e. the ‘crisis’ and ‘the euro’, on account of their exclusion from the analyses referred to in the tables in question. For the same reason, the determinant ‘FDI’ is treated as a total value, without distinguishing between ‘inward FDI’ and ‘outward FDI’. In addition, the factor ‘trade liberalisation’ is also presented in the aggregate, which results from the nature of the proxies for the determinant in question included in the model. Those were dummy variables concerning the participation of the countries under analysis in preferential trade groups. In the studies compared, the authors took account of different trade groups.

The comparability of the data presented in Tables 3.8. and 3.9. is also limited for other reasons. First, the data refer to different countries: advanced as well as less developed economies, including the EU-10 analysed in this book. Importantly, certain determinants of IIT may vary in their impact on groups of countries (e.g. the effects of the creation of a free trade area on IIT depend on factors such as differences in per capita income; the impact on IIT may also be different for large versus small economies – cf. sub-chapter 1.4). Second, particular results were obtained by the authors of the studies concerned with the use of various regression equations and different estimation methods. The above also affected their findings. For example, this is reflected in the opposite signs for certain determinants of IIT according to the *RE Tobit* method and the *PPML* method applied in our study. Furthermore, the findings were also influenced by the frequently different periods covered in particular studies. Despite the above methodological reservations, it seems to be worth comparing the results obtained in various studies. They show the range of possible findings and they also indicate which factors usually produce a sign inconsistent with theory, thus suggesting the need for further research and seeking explanations for such inconsistencies. For the purpose of making the results more transparent, the findings regarding the EU-10 (several or all the countries in the region) are marked in grey.
Only the country-specific determinants of IIT (without the industry-specific ones) were compared in Tables 3.8. and 3.9. in order to ensure comparability with the factors analysed in our study.

The variable ‘GDP/country size’ was found to have a positive relationship with VIIT and HIIT, both in our study and in all the works compared here.

In turn, in our estimation the variable ‘differences in country size/GDP’ produced a negative sign in the case of HIIT (in line with theory), which was also corroborated by the results reported by a number of other researchers (Table 3.8.).

The positive sign of the variable ‘differences in per capita income/GDP per capita’ for VIIT obtained by us is confirmed in theory as well as in many empirical studies. However, several authors described findings pointing to the opposite direction of the relationship between the variable in question and VIIT.

In turn, the positive sign of that variable for HIIT, following from our model, appeared to be inconsistent with the adopted hypothesis. In this case, the results of other studies are ambiguous as well. Therefore, the variable ‘differences in GDP per capita’ between pairs of countries does not provide any clear-cut evidence as regards its impact on either VIIT or HIIT. This is attributable to the ambiguous characteristic of this variable, i.e. considerable differences in GDP per capita may have a different impact on trade as compared to small differences. Furthermore, a low average level of GDP per capita will affect trade differently than a high average level of GDP per capita (e.g. owing to dissimilar preferences of both groups of consumers) – see sub-chapter 1.4.

The impact of ‘distance’ on VIIT and HIIT intensity was negative, while the effect of ‘geographical proximity/border’ was positive, according to all the calculations presented. Surprisingly, however, one study revealed a negative impact of the last factor (‘border’).

As already mentioned, our results for the determinants ‘FDI’ and ‘FTAs’ are not fully comparable with the findings of other researchers due to the ambiguous understanding of the factors in question. The variable ‘outward FDI’ produced an expected positive sign in our research, thus confirming the research hypothesis, while the impact of ‘inward FDI’ appeared to have different signs depending on the method applied. Also the results obtained by other researchers were far from unequivocal in the case of FDI. Our study produced an opposite direction of the effect of certain ‘free trade areas’ (FTAs) on VIIT and HIIT. Other research studies also indicate different signs in the case of the variable in question for IIT intensity.

In the light of the results of our research, the impact of ‘EU membership’ was positive, on both the horizontal and vertical IIT of the EU-10. This was consistent with the findings of the vast majority of the works listed in Table 3.9.

The above comparison of the determinants of intra-industry trade indicates that, in the light of all the studies considered, the drivers of growth in intra-industry trade (as expected on the basis of theory) were as follows: the ‘economic size of
3.4. Comparison of the results obtained with findings from other studies

a pair of trading partners’; ‘geographical proximity (border)’; and ‘EU membership’. All the studies found that a factor hampering the development of IIT, in line with the theoretical assumptions, appeared to be ‘distance’. At the same time, the relationships between the determinants: ‘differences in GDP’; ‘differences in GDP per capita’; ‘FDI’; ‘free trade agreements’; and IIT intensity were ambiguous and not always consistent with the research hypotheses put forward. As pointed out earlier, the differences in the results obtained by various researchers with regard to certain determinants are, to some extent, attributable to the application of different estimation methods for specific factors. They also reflected the fact that theory offers no unequivocal indications as to the direction of the impact of those factors (particularly of FDI and FTAs) on intra-industry trade. In the case of FDI, the sign can be either positive or negative due to the very nature of foreign direct investment: horizontal or vertical FDI. However, statistics do not allow for a separation of the two types of FDI, thus a precise assessment of their effect on trade, including on IIT, is not possible. In turn, the opposite directions of the effects of FTAs on trade patterns between countries may result from differences in the level of economic development and the geographic location of partners. However, there are no generally accepted criteria for defining ‘similar’ and ‘diverse’ countries (see sub-chapter 1.4). Furthermore, estimation results may also be affected by the form of variables included in the model concerned and by the application of different transformations thereof. For example, as a proxy for the economic size certain authors applied the trading countries’ GDP at current prices, whereas others – GDP at purchasing power parity. The dependent variable is sometimes an indicator of the share of horizontal and vertical IIT, while at times it is the logit or logarithmic transformation of such a measure.
Table 3.8. Review of the empirical literature on the determinants having a negative impact on intra-industry trade

<table>
<thead>
<tr>
<th>Negative impact</th>
<th>IIT</th>
<th>HIIT</th>
<th>VIIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference in GDP size</td>
<td>Balassa, Bauwens ‘87; Ballance et al., ’92; Greenaway et al. ’94; Nilsson ‘99; Martín, Blanes ’99; Caporale et al. ’14</td>
<td>Kawecka-Wyrzykowska et al., ’17; Greenaway et al. ’94; Martín, Blanes ’99; Ecochard et al. ’05</td>
<td>Kawecka-Wyrzykowska et al., ’17; Ecochard et al. ’05; Toporowski ’10</td>
</tr>
<tr>
<td>Difference in GDP per capita</td>
<td>Culem, Lundberg ‘86; Balassa, Bauwens ‘87; Ballance et al. ’92; Somma ’94; Greenaway et al. ’94; Nilsson ’99; Martín, Blanes ’99; Thorpe, Zhang ’05; Kang ’10; Toporowski ’12</td>
<td>Ambroziak ’12; Greenaway et al. ’94; Martín, Blanes ’99; Greenaway et al. ’99; Thorpe, Zhang ’05; Caetano, Galego ’06; Jámbor ’13</td>
<td>Greenaway et al. ’94; Martín, Blanes ’99; Greenaway et al. ’99; Thorpe, Zhang ’05; Reganati, Pittiglio ’05; Caetano, Galego ’06</td>
</tr>
<tr>
<td>Distance</td>
<td>Culem, Lundberg ‘86; Balassa, Bauwens ‘87; Nilsson ’99; Martín, Blanes ’99; Veeramani ’02; Crespo, Fontoura ’04; Thorpe, Zhang ’05; Kang ’10; Śledziewska, Czarny ’16; Caporale et al. ’14; Gabrisch, Segnana ’03</td>
<td>Kawecka-Wyrzykowska et al., ’17; Stone, Lee ’95; Martín, Blanes ’99; Crespo, Fontoura ’04; Thorpe, Zhang ’05; Ecochard et al. ’05; Gabrisch, Segnana ’03</td>
<td>Kawecka-Wyrzykowska et al., ’17; Stone, Lee ’95; Martín, Blanes ’99; Crespo, Fontoura ’04; Reganati, Pittiglio ’05; Thorpe, Zhang ’05; Ecochard et al. ’05; Gabrisch, Segnana ’03</td>
</tr>
<tr>
<td>Geographical proximity (border)</td>
<td>Gawlikowska-Hueckel, Umiński ’16</td>
<td></td>
<td>Gawlikowska-Hueckel, Umiński ’16</td>
</tr>
<tr>
<td>FDI</td>
<td>Byun, Lee ’05</td>
<td>Kawecka-Wyrzykowska et al., ’17; Byun, Lee, ’05</td>
<td>Kawecka-Wyrzykowska et al., ’17; Byun, Lee ’05</td>
</tr>
<tr>
<td>Trade liberalisation/ free trade areas</td>
<td></td>
<td>Kawecka-Wyrzykowska et al., ’17; Ecochard et al. ’05</td>
<td>Kawecka-Wyrzykowska et al., ’17</td>
</tr>
</tbody>
</table>

* Kawecka-Wyrzykowska et al., ’17 refers to the results of this study presented in sub-chapter 3.3.

Source: Pittiglio (2008) and own compilation.
### Table 3.9. Review of the empirical literature on the determinants having a positive impact on intra-industry trade

<table>
<thead>
<tr>
<th>Positive impact</th>
<th>IIT</th>
<th>HIIT</th>
<th>VIIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GDP size</strong></td>
<td>Ambroziak '12; Kang '10; Śledziewska, Czarny '16; Gabrisch, Segnana '03; Gawlikowska-Hueckel, Umiński '16</td>
<td>Kawecka-Wyrzykowska et al., '17; Ambroziak '12; Ecochard et al. '05; Caetano, Galego '06; Gabrisch, Segnana '03</td>
<td>Kawecka-Wyrzykowska et al., '17; Ambroziak '12; Ecochard et al. '05; Caetano, Galego '06; Gabrisch, Segnana '03; Gawlikowska-Hueckel, Umiński '16</td>
</tr>
<tr>
<td>Difference in GDP size</td>
<td></td>
<td>Jámbor '13</td>
<td></td>
</tr>
<tr>
<td><strong>Difference in GDP per capita</strong></td>
<td>Veeramani '02; Byun, Lee '05; Toporowski '10; Gawlikowska-Hueckel, Umiński '16</td>
<td>Kawecka-Wyrzykowska et al., '17; Crespo, Fontoura '04; Byun, Lee '05</td>
<td>Kawecka-Wyrzykowska et al., '17; Ambroziak '12; Gullstrand '01; Martín, Ríos '02; Veeramani '02; Crespo, Fontoura '04; Byun, Lee '05; Gabrisch, Segnana '03; Jámbor '13; Gawlikowska-Hueckel, Umiński '16</td>
</tr>
<tr>
<td>Average GDP per capita/GDP per capita</td>
<td>Balassa ‘86; Balassa, Bauwens ‘87; Somma ‘94; Nilsson ‘99; Thorpe, Zhang ‘05</td>
<td>Hu, Ma ‘99; Thorpe, Zhang ‘05</td>
<td>Stone, Lee ‘95; Thorpe, Zhang ‘05</td>
</tr>
<tr>
<td>Geographical proximity (border)</td>
<td>Somma ‘94; Byun, Lee ‘05; Kang ‘10</td>
<td>Kawecka-Wyrzykowska et al., ‘17; Byun, Lee ‘05</td>
<td>Kawecka-Wyrzykowska et al., ‘17; Byun, Lee ‘05</td>
</tr>
<tr>
<td><strong>FDI</strong></td>
<td>Ambroziak ‘12; Aturupane et al. ‘99; Kang ‘10</td>
<td>Kawecka-Wyrzykowska et al., ‘17; Ambroziak ‘12; Greenaway et al. ‘99; Aturupane et al. ‘99; Caetano, Galego ‘06</td>
<td>Kawecka-Wyrzykowska et al.,‘17; Ambroziak ‘12; Greenaway et al. ‘99; Hu, Ma ‘99; Aturupane et al. ‘99; Reganati, Pittiglio, ‘05; Caetano, Galego ‘06</td>
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<td>Trade liberalisation/free trade areas</td>
<td>Caporale et al. ‘14; Gawlikowska-Hueckel, Umiński ‘16</td>
<td>Kawecka-Wyrzykowska et al., ‘17; Gawlikowska-Hueckel, Umiński ‘16</td>
<td>Kawecka-Wyrzykowska et al., ‘17; Ecochard et al. ‘05; Gawlikowska-Hueckel, Umiński ‘16</td>
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<td><strong>EU</strong></td>
<td>Ambroziak ‘12; Śledziewska, Czarny ‘16; Toporowski ‘10; Gawlikowska-Hueckel, Umiński ‘16</td>
<td>Kawecka-Wyrzykowska et al., ‘17; Crespo, Fontoura ‘04; Gawlikowska-Hueckel, Umiński ‘16</td>
<td>Kawecka-Wyrzykowska et al., ‘17; Ambroziak ‘12; Gullstrand ‘01; Crespo, Fontoura ‘04; Reganati, Pittiglio ‘05; Toporowski ‘10; Gawlikowska-Hueckel, Umiński ‘16</td>
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Source: Pittiglio (2008) and own compilation.
Concluding remarks
(Lukasz Ambroziak)

The estimation results of our study largely appeared to be consistent with the research hypotheses put forward on the basis of the literature. The size of the trading economies, the existence of a common border, inward foreign direct investment, association with or membership of the European Union all had positive and statistically significant effects on the intensity of both horizontal and vertical intra-industry trade of the EU-10. This corroborates the conclusions drawn from previous studies that the key determinants of growth in EU-10 intra-industry trade, thus of adjustments of their economic structures to those in advanced economies, were the involvement of multinational corporations and integration into the European Union. The impact of outward foreign direct investment also proved to be positive, but statistically insignificant. At the same time, intra-industry trade was hampered by geographical distance and, in the case of horizontal IIT, by the economic crisis as well. The elimination of costs related to national currencies only had a positive effect on horizontal IIT, whereas its influence on vertical IIT turned out to be negative. This is attributable to the fact that most of trade in vertically differentiated products occurs within transnational corporations where transfers between subsidiaries are settled in a foreign currency.
Summary and conclusions

Elżbieta Kawecka-Wyrzykowska, Łukasz Ambroziak

This book used intra-industry (IIT) indices to assess the degree of changes in the nature of trade specialisation and in the economic structures of the EU-10 between 1995 and 2014, in particular the income convergence of the EU-10 vis-à-vis more developed trading partners. In addition, the econometric model used allowed to estimate the determinants of intra-industry trade and the degree of their consistency with the theoretical explanations of IIT sources. The results obtained were compared with the findings from other studies of IIT determinants.

Intra-industry trade was first observed in the 1960s in connection with the integration processes in Europe (in the Benelux countries and in the EEC). The reason why IIT attracted considerable attention was that the identification of this type of trade called for a modification of the existing theory of international trade. It appeared that international trade specialisation took place not only between countries concentrating production in various industries, in line with differences in factor endowments (comparative costs and advantages), but also within industries. The then dominating Heckscher-Ohlin model was not sufficient to explain this phenomenon and a new theoretical framework was required.

The first theoretical models of IIT were developed in the late 1970s and in the early 1980s. The seminal papers by Krugman (1979) and Lancaster (1980) promoted a theoretical framework associating IIT with economies of scale and trade in varieties of differentiated products. That monopolistic competition approach explained trade in horizontally differentiated goods. Later, new models appeared, including those addressing intra-industry trade in vertically differentiated products (these are discussed in Chapter 1).

As regards empirical studies on IIT, the important role of this type of specialisation in the evolution of the integration process (as reflected in trade liberalisation) was discovered and confirmed in many works, primarily relating to the creation of
the customs union and the Single European Market (also referred to as the internal market) in the EEC/EU. However, an unambiguous relationship between the reduction of trade barriers (trade liberalisation) and the intensity of IIT has not been confirmed in the case of other integration blocs (sub-chapter 1.5). Thus, the question remains open: does integration lead to more intra-industry trade or rather to more specialisation between industries? Our research offers a small contribution to this issue. The econometric estimation (Chapter 3) has revealed that the impact of various free trade agreements signed by the EU-10 before EU accession and adopted afterwards was not always positive.

The analysis results corroborated the trend characteristic of present-day international trade, i.e. an increasing role of intra-industry trade in EU-10 trade (as presented in Chapter 2). This was observed in the trade of most of the EU-10 (with the exception of the Czech Republic and Estonia, whose IIT intensity was roughly at the same level in 2014 as it was in 1995). However, inter-industry trade based on comparative advantages still dominates in the trade of all of the EU-10 countries. At the end of the period under study (2014), nearly 67% of EU-10 trade was still of an inter-industry nature (with intra-industry trade representing the remaining 33%), while 20 years ago it was at 76%.

The increase in the intensity of EU-10 intra-industry trade over the rather long period of the 20 years covered (1995-2014) does not seem impressive (an average of 9 pp for the whole group of countries in question). One must remember, however, the special initial situation of the countries under study. The first period analysed (the mid-1990s) still witnessed a radical economic transition in the countries under analysis (albeit it started at different times and varied in pace between individual EU-10 countries). The economic collapse observed at the beginning of the transition in all the countries in question sometimes led to a fall in the trade volume. As the development gap compared to the European Communities (which became the EU in 1993) temporarily widened, it sometimes had a downward effect on IIT intensity, consistently with the theoretical explanations. In the first years of the period under study, the EU-10 were still unable to actually use the opportunities offered by the new determinants of intra-industry trade (including, especially, the free trade area with the European Communities and rising inward FDI). Furthermore, favourable changes in the pattern of IIT specialisation (an increased intensity of high-quality VIIT and of HIIT) occurred much faster than growth in total intra-industry trade. Finally, the initial situation and the scale of changes varied between individual EU-10 countries.

The calculations presented in Chapter 2 reveal that a rise in the intensity of IIT was observed in EU-10 trade with all three groups of the countries under analysis. The highest IIT index was recorded in 2014 in trade within the EU-10 and in trade with the EU-15 (ca. 42% in both cases). In trade with third countries, IIT accounted for a mere 13%. Therefore, the role of IIT in the mutual trade of the EU-10 and in their trade with the UE-15 was much greater than its average proportion in overall foreign trade (33%).
In comparison with the years before accession, the post-accession period witnessed a faster growth in IIT intensity in most of the EU-10. The exceptions were Poland and Slovakia. In the Czech Republic and Estonia the shares of IIT were even slightly lower in 2014 than in 1995.

The decrease in trade caused by the global crisis in the 2000s did not significantly affect the post-accession trends in intra-industry trade, whether in relations with the EU-15 or within the EU-10.

The analysis also revealed (sub-chapter 2.4) changes in the pattern of IIT specialisation. Specifically, a shift towards VIIT in high-quality products (i.e. exports of high-quality articles and imports of low-quality goods within the same industries) was recorded: from 5.3% to 11.5% of the total trade of the EU-10 in 1995-2014 (the share more than doubled!). At the same time, the percentage of low-quality VIIT decreased, albeit insignificantly (from 14.8% to 11.7%, respectively). The increasing share of VIIT in high-quality products in total trade reveals a process of specialisation mainly driven by factor endowment differences (differences in technology and R&D expenses, income levels and endowments in human capital) that is based more on the quality characteristics of products rather than only on price competition. This results in more advantages than inter-industry specialisation mostly based on traditional factor endowments.

A growing role of intra-industry trade in horizontally differentiated products (with the exception of Estonia) was also identified. For the EU-10 as a whole, in 1995-2014 the share of HIIT increased from 3.7% to 8.3%, i.e. it more than doubled. This type of trade is usually typical of more developed countries and implies the structural convergence of economies. In other words, the majority of EU-10 countries managed to modify their production patterns from complementary to competitive and move towards products based on high quality and high value added, thereby accelerating the catching-up process towards the EU-15. Therefore, increasing indices of EU-10 HIIT reflected a narrowing income gap vis-à-vis more developed trading partners.

Thus, both types of changes in the pattern of IIT demonstrated fast and positive developments in trade and in production patterns of the countries concerned. However, due to the considerable differences noted in 1995, the level of economic convergence – as measured by the HIIT index – still varied widely in the EU-10 (in 2014): in trade with the EU-15 it was the highest in the Czech Republic and in Poland, whereas it was the lowest in the Baltic States.

The scale of progress observed in individual EU-10 countries can be assessed using various criteria. If we adopt as benchmarks the average indices of the intensity of the most favourable types of intra-industry trade for the EU-10 as a whole in 2014, above-average indices of horizontal IIT were only noted in three countries: the Czech Republic, Poland and Slovenia. Indices of high-quality vertical intra-industry trade exceeding the average value characterised Hungary, the Czech Republic, Romania
and Slovakia. In turn, above-average indices for total IIT were found for the Czech Republic, Hungary, Poland and Slovenia.

The key success factor in the countries with considerable shares of vertical intra-industry trade seems to have been their significant involvement in the processes of production fragmentation related to FDI. The group of countries with high indices of high-quality VIIT includes no country where FDI activity (in manufacturing) was low (e.g. in the Baltic States and Bulgaria). Neither does Poland belong to the group in question. Although Poland attracted the highest amount of foreign capital among the countries under analysis, the scale of foreign investment was much lower in per capita terms and relative to GDP. Therefore, the impact of FDI on Poland’s foreign trade, including on intra-industry trade, was less pronounced than in other countries analysed, with smaller economies.

In sectoral terms, the greatest IIT indices characterised trade in highly processed goods, e.g. motor vehicles, machinery and appliances, electrical equipment as well as chemicals. Such products were manufactured in industries with strongly internationalised production. This observation confirms the important role played in IIT development by inward FDI and multinational corporations.

The vast majority of the estimates of the impact of particular determinants on IIT – with the use of a regression model – appeared to be consistent with the research hypotheses formulated on the basis of the literature (Chapter 3). As regards the intensity of both horizontal and vertical intra-industry trade in the EU-10, a positive and statistically significant impact, consistent with theory, was found in the case of the following determinants: the economic size of the trading countries; the existence of a common border; outward foreign direct investment; association with and membership of the European Union; and participation of the EU-10 countries in preferential trade groups (with the exception of the CEFTA) prior to joining the EU and after accession. In addition, positive effects, statistically significant and consistent with theory, were noted with regard to differences in GDP per capita driving vertical IIT up, and the adoption of the euro stimulating horizontal IIT. Simultaneously, intra-industry trade (either type thereof) was hindered by geographical distance and, in the case of horizontal IIT, also by differences in GDP between countries and the economic crisis. The impact of inward foreign direct investment on both types of IIT appeared to be ambiguous.

The results obtained by us for the macroeconomic determinants of EU-10 IIT are largely consistent with the findings of other researchers. In the light of all the studies considered, the drivers of growth in intra-industry trade (as expected on the basis of theory) were as follows: the ‘economic size of a pair of trading partners’; ‘geographical proximity (border)’; and ‘EU membership’. All the studies found that a factor hampering the development of IIT, in line with the theoretical assumptions, appeared to be ‘distance’. At the same time, the relationships between the determinants: ‘differences in GDP’; ‘differences in GDP per capita’; ‘FDI’; ‘free trade agreements’; and IIT
intensity were ambiguous and not always consistent with the research hypotheses put forward, whether in our study or in the selected contributions to the literature. We must stress again that the difficulty in establishing the impact of FDI on IIT primarily stemmed from the lack of statistics on FDI broken down into horizontal and vertical investment. Specific types of FDI have different effects on trade flows, thus on the intensity of intra-industry trade.

In several cases, the results obtained led to rejecting a hypothesis formulated on the basis of theory and previous research studies. In our study, this concerned the impact of differences in GDP per capita on horizontal IIT as it appeared to be positive and statistically significant, thus inconsistent with the theoretical assumptions. A negative sign was also produced by the adoption of the euro for vertical IIT. In addition, it was not possible to corroborate the hypothesis on the negative impact of the crisis on vertical IIT. Some of the authors referred to in sub-chapter 3.7 also reported results inconsistent with theory or pointing to the ambiguous effects of particular variables on intra-industry trade.

There may be several reasons for the situation described above. First, the theory of intra-industry trade emerged in the 1970s and in the 1980s, on the basis of experiences of advanced economies, e.g. the EEC countries. A number of research studies, including the study presented in this book, have addressed countries at relatively low levels of economic development, frequently ones in transition from centrally planned to market economies. Second, the discrepancies between the results obtained by various authors are attributable to the fact that theory offers no clear-cut indications as to the direction of the impact on IIT of all the determinants. Third, findings may also be affected by the varying estimation methods employed by the authors, the form of variables included in their models and the different transformations that have been applied. All this points to the need for further research on the significance of various determinants of IIT.

Some of the conclusions from the analysis of EU-10 IIT seem to be useful for the countries applying for EU membership. Our study confirmed the importance of free trade areas (also in the form of association with the European Communities) for the development of IIT and EU-10 preparations for membership. A considerable role was also played by FDI; the highest values of the most favourable IIT indices were found for countries which attracted relatively substantial amounts of FDI.

Our research has also confirmed that an increasing intensity of intra-industry trade over time corresponds to an advanced level of economic development (as reflected in a greater share of high-quality products) and to the catching-up process towards more developed partners (as reflected in the increasing share of horizontal IIT).

The literature on IIT also contains arguments for a positive link between more IIT and the synchronisation of the business cycles of trading countries, which leads to a lower risk of the emergence of asymmetric economic shocks and makes monetary integration easier (sub-chapter 1.5). This conclusion has important implications for
the members of a monetary union (e.g. the euro area): the higher the IIT share in the total trade of those countries, the lower the cost of the lack of an autonomous monetary policy in the case of an asymmetric shock. The share of IIT is also of significance to countries aspiring for the euro area. As intra-industry trade leads to business cycle synchronisation, the costs of joining a currency union in applicant countries will diminish when this type of trade dominates.

Trade integration and liberalisation result in higher or lower trade-induced adjustment costs. In a situation where the reduction of barriers pushes up IIT (rather than inter-industry trade), the adjustment costs are increasingly likely to be lower. However, this must be IIT based on horizontally differentiated products. If vertical differentiation prevails, the adjustment costs associated with the displacement of resources may be significant (sub-chapter 1.5). This conclusion is of crucial importance particularly for catching-up countries, which face more adjustment challenges than highly developed economies.

All the above remarks lead to the conclusion that the development of intra-industry trade is very advantageous. Therefore, economic policy should promote this type of specialisation. Obviously, this must be carried out within market-economy mechanisms.
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References

Ambroziak Ł. (2010), The foreign direct investments (FDI) as a factor of intra-industry trade development in the EU New Member States, paper presented at the conference “ETSG 2010 Lausanne”, HEC Lausanne, September, 9-11.
Aquino A. (1978), Intra-industry Trade and Inter-industry Specialization as Concurrent Sources of International Trade in Manufactures, Weltwirtschaftliches Archiv, Vol. 114, No. 2.
Product Differentiation in North-South Trade, Weltwirtschaftliches Archiv, Vol. 128.
Balassa B. (1966), Tariff Reductions and Trade in Manufactures Among the Industrial Countries. American
Economic Review, Vol. 56, No. 3.
Balassa B. (1967), Trade Liberalisation among Industrialized Countries: Objectives and Alternatives,
European Economic Integration, North-Holland: Amsterdam.
Balassa B. (1986), Intra-industry Specialization: A Cross-section Analysis, European Economic Review,
Vol. 30, No. 1.
Balassa B. and Bauwens L. (1987), Intra-industry Specialization in a Multi-Country and Multilateral
Balassa B. and Bauwens L. (1988), Inter-industry and intra-industry specialization in manufactured goods,
No. 39.
Baldwin R. (2012), Trade and industrialization after globalization’s 2nd unbundling: How building and
joining a supply chain are different and why it matters, CEPR Discussion Paper, No. 8768.
Baldwin R., Skudelny F., Taglioni D. (2005), Trade Effects of the Euro Evidence from Sectoral Data, ECB
Working Paper Series, No. 446.
European Countries, European Economic Review, Vol. 41, No. 3-5.
Bąk H., Maciejewski S. (2015), Endogeneity and Specialization in the European Monetary Union,
Bergstrand J.H. (1990), The Heckscher-Ohlin-Samuelson Model, the Linder Hypothesis and the
Bergstrand J.H., Egger P. (2007), A knowledge-physical-capital model of international trade flows, foreign
Blanes-Cristóbal J. V. (2009), Agglomeration versus dispersion in the European Monetary Union: Evidence
from Intra-Industry Trade, paper presented at Conference on Economics Integration at Universitat de Valencia.
Countries, ECB Working Papers Series, No. 587.
Katedry Ekonomiky Integracji Europejskiej Uniwersytetu Gdańskiego, No. 3.
Brühlhart M. (1994), Marginal Intra-industry Trade: Measurement and Relevance for the Pattern of Industrial
Adjustment, Weltwirtschaftliches Archiv, Vol. 130, No. 3.
Brühlhart M., Elliott R. J.R. (1998), Adjustment to the European Single Market: inferences from intra-
Brühlhart M. (2000), Dynamics of Intra-industry Trade and Labor-Market Adjustment, Review of
Brühlhart M. (2002), Marginal Intra-Industry Trade, Towards a measure of Non-Disruptive Trade Expansion,
Brülhart M. and Elliott R. J.R. (2002), Adjustment to the European single market: inferences from intra-
Issue 3.
Bun M.J.G. and Klaassen F.J.G.M. (2007), The Euro effect on trade is not as large as commonly thought,
Caetano J., Galego A. (2007), In Search for Determinants of Intra-Industry Trade within an Enlarged
Europe, South-Eastern Europe Journal of Economics, No. 2.
Camacho. M., Perez-Quiros. G. and Saiz. L. (2006), Are European business cycles close enough to be just
Papers, Vol. 33, No. 2.
Černoša S. (2007), Horizontal and Vertical Intra-Industry Trade between the Former CEFTA Countries
Cieslik A. (2008), Multinational firms and international fragmentation of production in Poland, Working
Papers of International Business, No. 25.
Clark, D.P. (1993), Recent evidence on determinants of intra-industry trade. Weltwirtschaftliches Archiv,
Vol. 129, No. 2.
Clark D.P. (1998), Determinants of Intra-Industry Trade between United States and Industrial Nations,
International Trade Journal, Vol. 12, No. 3.
Clark D. P., Stanley D. L. (1999), Determinants of Intra-Industry Trade Between Developing Countries and
Commission of the European Communities (1990), One Market, One Money. An Evaluation of the Potential
Benefits and Costs of Forming an Economic and Monetary Union, European Economy, No. 44.
Issue 7.
Crespo N., Fontoura M.P. (2001), Determinants of the Pattern of Horizontal and Vertical Intra-Industry
Trade: What Can we Learn from Portuguese Data?, Working Paper, Department of Economics at the
School of Economics and Management, Technical University of Lisbon, No. 9.
Culem C., Lundberg L. (1986), The Product Pattern of Intra-Industry Trade: Stability among Countries
and over Time, Weltwirtschaftliches Archiv, Vol. 122.
Czarny E. (2002), Teoria i praktyka handlu wewnątrzgałęziowego, Monografie i Opracowania No. 496,
Warsaw School of Economics.
Czarny E., Śledziewska K. (2008), Poland’s Intra-Industry Trade with the European Union at the Beginning
World Economy Research Institute, Warsaw School of Economics, Warsaw.
Czarny, E. and Śledziewska, K. (2009), Poland’s Intra-Industry Trade with the European Union in years
World Economy Research Institute, Warsaw School of Economics, Warsaw.
Dautovic E., Orszaghova L., Schudel W. (2014), Intra-Industry Trade Between CESEE Countries and the


Fidrmuc J. (2001), Intraindustry Trade Between the EU and the CEECs – The Evidence of the First Decade of Transition, Focus on Transition, No. 1.


Fidrmuc J. (2004), The endogeneity of the optimum currency area criteria, intra-industry trade and EMU enlargement, Contemporary Economic Policy, No. 22.


Greenaway D., Milner C. (2003), What Have We Learned from Generation’s Research on Intra-Industry Trade? The University of Nottingham Research Paper, No. 44.
References

Kawecka-Wyrzykowska E. (2014), Experience of Poland’s Association Agreement, [in:] Developing trade and trade policy relations with the European Union, East European Studies, MTA Centre for Economic and Regional Studies, Institute of World Economics, Budapest, No. 5.
Leitão N.C. (2012), The determinants of intra-industry trade in the tourism services, Munich Personal RePEc Archive Paper No. 37444.


Sapir A. (1992), Regional Integration in Europe, Economic Papers, No. 94.


Szczechaniak, I. (2013), Development of Intra-industry Trade as a Measure of Competitiveness of the Polish Food Sector, Oeconomia Copernicana, No. 2.


Zagraniczne inwestycje bezpośrednie w Polsce i polskie inwestycje bezpośrednie za granicą w 2014 roku., Narodowy Bank Polski, Warsaw, 2015.


Zielińska-Głębocka A., Brodzicki T. (2005), Trade in manufactured goods between the EU and selected accession countries: Identifying sectors sensitive to changes in industrial competitiveness of the ‘new’ members Opere et Studio pro Oeconomia, No. 1(3).
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Intra-industry trade is one of the most important subjects in the discourse of international economics. Undoubtedly, there is still a need for studies aimed to systematically analyse changes in the composition and directions of trade. The reviewed book is a meaningful voice in the discussion on the significance of such developments for the economic development of the new EU Member States, including Poland.

(An excerpt from the review by Professor Katarzyna Śledziewska)

The analysis was based on the basic Grubel-Lloyd indices and on measures of vertical trade taking account of unit values of products, important for distinguishing goods differentiated in terms of quality (...) correlated with varying consumer income levels. Such a broad analysis is the value added of the publication, with a very detailed insight into the intensity and structure of the intra-industry trade of the whole group of the 10 countries that joined the EU in 2004 and 2007.

(An excerpt from the review by Professor Anna Zielińska-Głębocka)