

The foreign direct investments (FDI) as a factor of intra-industry trade development in the EU New Member States.

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Abstract

This paper investigates the development of the intra-industry trade (IIT) in eight new EU Member States (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia) in the period 1995-2007. Changes of IIT (disentangled into horizontal and vertical IIT) are presented in trade of the EU-8 countries with their major trading group partners. Then, there is briefly described the multinational companies' activity in those countries. Using a panel data approach, the determinants of vertical and horizontal IIT are also identified. The special attention is paid to the impact of foreign direct investment on the IIT development. FDI have been playing a crucial role in the economic transformation of the EU-8 countries and recently FDI inflow has been connected with the fragmentation of production process. What is very important, the foreign direct investment stock has a positive and statistically significant impact on both types of IIT.

Keywords: intra-industry trade, new EU Member States, foreign direct investment

JEL Classification: F14, F15

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1. Introduction

Foreign direct investments (FDI) have been playing a crucial role in the economic transformation of the CEECs. The need of Central European companies to obtain access to know-how, capital and distribution channels was one of the reasons for dynamic inflow of foreign capital in the 1990s. As a result, the technological gap between CEECs and the EU countries has been decreasing, what positively affected the development of the intra-industry trade between trading partners. Recently the FDI inflow to the NMS, especially to the Central Europe, has been connected with the fragmentation of production process. The best example of this phenomenon is the motor industry. In the former CEFTA countries many car assembly plants were located. Their production was based on imported parts and components, and majority of production was exported to the EU-15. From the literature and many empirical studies it results that an important part of the intra-industry trade flows was driven in the CEECs by FDI. Therefore, a special attention will be paid to the impact of FDI on the two-way trade in the analysed countries.

The aim of this paper is to identify the factors that positively and negatively affect the development of the intra-industry trade in the EU-8 countries (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia) in the period 1995-2007. The econometric analysis follows the description of changes in the IIT development in the analysed countries with their major trading group partners.

The structure of the paper will be as follows. First two sections will review the theoretical framework of intra-industry trade determinants (especially the influence of FDI on intra-industry trade) and present a brief survey of the empirical studies on IIT. Section 4 will discuss the data and methodology of IIT measurement. Sections 5 and 6 will contain an empirical analysis of the developments on the intensity of IIT, HIIT and VIIT by major trading group partners and analysis of the inward stock of the FDI in the EU-8 countries. In section 7 will be explained the nature of a model and the variables used in that model as well as be formulated research hypotheses about the IIT determinants. In section 8, the results obtained from the model will be presented. Final section 9 will contain conclusions.

2. Theoretical framework of intra-industry trade determinants

The theoretical literature on determinants of the intra-industry trade is substantial. According to the literature, the most important factors influencing IIT are e.g. the level of the economic development of two trading partners (measured as GDP level), the differences

between economic potential of those countries, the differences in the level of development between two countries (measured as GDP per capita), the geographical proximity (measured as a distance between capitals of the countries, presence of the common border) and presence of the multinational enterprises. Since the 1980s, the presence of multinational enterprises has significantly influenced the international trade, and as a result also the intra-industry trade. It's necessary to emphasise that the concept of "multinational enterprises" is intrinsically connected with the concept of "foreign direct investment". The multinational firm is an international subject, which leads its own activity in form of foreign direct investment. In the further part of this chapter, the special attention will be paid to the impact of the FDI on IIT from the theoretical point of view.

The pioneering work, which tried to explain the impact of the FDI on the intra-industry trade, was the publication of Krugman and Helpman (1985)¹. The authors found that the emergence of multinational corporations changes in an important way the link between differences in relative factor endowments and the share of intra-industry trade. When the difference in factor composition becomes large enough so as to bring about the emergence of multinational corporations, this association turns positive, as long as the capital-rich country is a net exporter of manufactures. When the difference in composition of factor endowments becomes large enough so that the capital-rich country begins to be a net importer of manufactures, the negative association between factor dispersion and the share of intra-industry trade is restored. Therefore, the larger the involvement of multinational corporations in the world economy, the weaker the effect of changes in the degree of dispersion in income per capita on the share of intra-industry trade. Furthermore, Helpman and Krugman found that the volume of intra-industry trade will depend on how narrow one defines product categories. If in the industrial classification finished products are classified to be different from the intermediate products, then only two-way trade in finished products contributes to the volume of intra-industry trade.

If Helpman and Krugman (1985) has focused in their last model on the vertically integrated enterprises, then Markusen (1984, 2002) and Markusen and Venables (1998, 2000) have focused on the horizontal foreign direct investment. The presence of multinationals unambiguously reduces trade values. However, the presence of multinationals reverses the effects of convergence in country size on trade volumes. Without multinationals, this raises trade volumes. If multinationals are allowed to exist, then as countries converge in size, so an

¹ The first attempt to introduce the foreign direct investment into intra-industry trade model was made by E. Helpman in 1984.

increasing share of world production is undertaken by multinationals. Multinationals substitute for intra-industry trade, so convergence of country size reduces the value of trade. The authors called this phenomenon as “convergence hypothesis”.

The next step in the evolution of the theory was the publication of Markusen and Maskus (2002)². They distinguished three main types of firms: national enterprises, multinational horizontal and vertical enterprises. The existence of them depends only on two variables, i.e. trade costs and investment costs. Trade liberalisation can lead to the increase of the IIT shares between two trading countries. However, investment liberalisation can contribute to decline of the intra-industry trade intensity in case if trade costs are too high or too low. Thus, the IIT index will be high, on the one hand, when two countries are similar to each other or when the small country is skilled-labor abundant, and, on the other hand, when trade costs are low and investment costs are high.

Next, Fukao, Ishido and Ito (2003) made an attempt to answer the question, how trade patterns are influenced by FDI costs, trade costs, and the factor price gap between the two countries. In particular, the authors studied the following three situations: first, zero trade costs coupled with prohibitively high FDI costs; second, zero trade and FDI costs; and third, substantial trade costs and zero FDI costs. The main results of the theoretical analysis were summarised as follows. First, vertical intra-industry trade occurs only when both FDI costs and trade costs are small. If there exist substantial FDI costs, gains from the international division of labour within firms will be surpassed by FDI costs. It means that firms in the developed country will not conduct vertical FDI, which is indispensable for vertical IIT. If it is very costly to trade products from the developed country to the developing country, then firms in the developed country will replace their exports from their home country with local production in the developing country. Because of this horizontal FDI, vertical IIT becomes very small. Second, if there exist substantial costs of FDI, the share of vertical IIT in total trade will depend on the factor price gap between the two countries. If the factor price gap is small, then firms will have limited incentive to engage in the international division of labour through FDI, and vertical IIT will become small.

Okubo (2004) presumed that the currently increasing intra-industry trade is mainly determined by trade between developed (OECD) and developing (non-OECD) countries. This increase cannot be explained by the Helpman-Krugman model. So, the author suggests, that

² The preliminary version of the model was presented by Markusen in 1998, J.R. Markusen, *Trade versus Investment Liberalization*, NBER Working Paper, 1998, No. 6231.

these changes can be explained by the vertical IIT or fragmentation in the production process. Introducing technology transfer through FDI into the model can explain the current IIT well. Favourable circumstances for technology transfer in host countries such as a small difference in educational level enhance FDI, which, in turn, increases re-imports. In the presence of wage and technology gaps, IIT increases when the degree of technology transfer is sufficiently small, but a large degree of technology transfer decreases IIT. Furthermore, if the technology transfer corresponds to production networks, we can suggest that production networks promote IIT.

Recently, in the theoretical literature the special attention will be paid to the modification of traditional model with multinationals in the form of 2x2x2 (2 countries, 2 factors of production and 2 goods). This modification lay in the adding of additional factor of production, additional country or these two variables simultaneously³. Introduction into the model of the third country caused that the model better fulfils the real world economy. The division of multinational enterprises into horizontal and vertical integrated not fully reflects the investment strategies of the enterprises. More and more frequently the multinationals apply complex investment strategies, e.g. export platform FDI⁴.

Their impact on the intra-industry trade intensity depends on the market, where there are exported goods produced in the plant. If final goods are exported to the home country, by the simultaneously import of parts and accessories to host country, there occurs the growth of the IIT. However, if the final goods are exported to the third countries, by the simultaneously import of parts and accessories to host country, there occurs fall of the IIT. Next, if there exists the so-called global platform FDI, the final goods are exported to the third countries as well as to the home countries. The scale of the IIT growth will depend on what part of the final goods export gets on the home market. The increase of the intra-industry trade intensity will be resulted from the vertical IIT, because the differences between unit value in export and import will be significant. It is worth to stress that the intra-industry trade with final and the intermediate goods can only occur, if the final and intermediate goods are defined as the same industry. Vertical FDI can theoretically create the intra-industry trade with horizontally

³ See H. Egger, P. Egger, D. Greenaway, *Intra-industry trade with multinational economies*, "European Economic Review", 2007, vol. 51/8, p. 1959-1984, J.H. Bergstrand, P. Egger, *A knowledge-physical-capital model of international trade flows, foreign direct investment, and multinational enterprises*, "Journal of International Economics", 2007, vol. 73, p. 278-308, B. Baltagi, P. Egger, M. Pfaffermayr, *Estimating models of complex FDI: Are there third-country effects?*, "Journal of Econometrics", 2007, vol. 140, p. 260-281.

⁴ See K. Ekholm, R. Forslid, J. Markusen, *Export Platform Foreign Direct Investment*, "Journal of the European Economic Association", 2007, vol. 5(4), p. 776-795, T. Ito, *Export Platform Foreign Direct Investment: Theory and evidence*, Okinawa University, June 2010.

differentiated goods. It can happen, when between the home and host countries occur simultaneously export and import of intermediated goods, which not significantly differ in the unit value.

3. Review of empirical studies

The empirical literature on the determinants of intra-industry trade is extremely detailed⁵. As was above mentioned, the first studies on the intra-industry trade concerned the trade among EEC countries. Only in the 1990s analyses were conducted to investigate both, changes in IIT of the Central and Eastern European Countries (CEEC) and determinants of IIT growth in these countries. The special interest in such analyses has been usually paid to these countries' trade with the EU Members States, mainly due to the fact that EU countries have had a dominant role in trade of CEECs.

The changes of the IIT intensity in the CEECs were analysed in details by J. Caetano and A. Galego (2006), J. Firdmuc and M. Djablik (2003), H. Gabrisch and M.L. Segnana (2002, 2003), H. Gabrisch (2006), Y. Kandogan (2003), B. Hoekman and S. Djankov (1996), B. Kamiński (2001), I. Ferto and K.A. Soos (2006), while only in case of the Baltic States – M. Tiits and J. Jüriado (2006), D. Bernatonytė and G. Juškienė (2008) and G. Fainštein and A. Netšunajev (2009), only in case of CEFTA countries – Cernosa (2005), only in case of Hungary – J. Gacs (1994), only in case of Poland – J. J. Michałek, K. Śledziwska-Kołodziejska (2000), A. Cieślik (2003), E. Czarny and K. Śledziwska (2008, 2009), E. Molendowski (2007), A. Klimek (2006) and E. Kawecka-Wyrzykowska (2009).

Next, the determinants of the IIT intensity in the CEECs were investigated by J. Caetano and A. Galego (2006), J. Firdmuc and M. Djablik (2003), H. Gabrisch and M.L. Segnana (2002, 2003), C. Aturupane, S. Djankov and B. Hoekman (1999), H. Gabrisch (2002) and Y. Kandogan (2003), E. Czarny, K. Śledziwska, P. Toporowski (2008) and A. Cieślik (2008).

⁵ Generally speaking, we could classify these empirical analyses into studies that consider only *country-specific* variables, only *industry-specific* variables and finally, studies that consider both types of variables. Detailed separation of the studies you can find in: R. Pittiglio, *The intra-industry trade for a high-income country: new empirical evidence for Italy*, Working Paper No. 211, University of Dundee, October 2008.

4. Measurement and data

The intra-industry trade in this paper is measured by the Grubel-Lloyd (GL) index which is based on the concept of “trade overlap” and represents the share of the absolute value of intra-industry trade in trade turnover in a particular industry i , that is:

$$GL_{i,t}^{kk'} = \frac{(X_{i,t}^{kk'} + M_{i,t}^{kk'}) - |X_{i,t}^{kk'} - M_{i,t}^{kk'}|}{(X_{i,t}^{kk'} + M_{i,t}^{kk'})} = 1 - \frac{|X_{i,t}^{kk'} - M_{i,t}^{kk'}|}{(X_{i,t}^{kk'} + M_{i,t}^{kk'})}$$

where $X_{i,t}^{kk'}$ and $M_{i,t}^{kk'}$ refer to country k 's exports and imports respectively, to/from country k' over one particular year t , in a particular industry i (here: 4-dig. HS). This measure takes values between zero (exclusive inter-industry trade) and one (exclusive intra-industry trade).

GL indices can be aggregated across N industries, as a trade-weighted average of the industry indices:

$$GL_t^{kk'} = \sum_{i=1}^N w_{i,t}^{kk'} GL_{i,t}^{kk'} = 1 - \frac{\sum_{i=1}^N |X_{i,t}^{kk'} - M_{i,t}^{kk'}|}{\sum_{i=1}^N (X_{i,t}^{kk'} + M_{i,t}^{kk'})} \quad \text{and} \quad w_{i,t}^{kk'} = \frac{X_{i,t}^{kk'} + M_{i,t}^{kk'}}{\sum_{i=1}^N (X_{i,t}^{kk'} + M_{i,t}^{kk'})}$$

or can be aggregated across K' partner countries and across N industries:

$$GL_t^k = 1 - \frac{\sum_{k'=1}^{K'} \sum_{i=1}^N |X_{i,t}^{kk'} - M_{i,t}^{kk'}|}{\sum_{k'=1}^{K'} \sum_{i=1}^N (X_{i,t}^{kk'} + M_{i,t}^{kk'})}$$

or can be aggregated across K' partner countries, across K reporter countries and across N industries:

$$GL_t = 1 - \frac{\sum_{k=1}^K \sum_{k'=1}^{K'} \sum_{i=1}^N |X_{i,t}^{kk'} - M_{i,t}^{kk'}|}{\sum_{k=1}^K \sum_{k'=1}^{K'} \sum_{i=1}^N (X_{i,t}^{kk'} + M_{i,t}^{kk'})}$$

where $w_{i,t}^{kk'}$ denotes share of trade in product i in the total trade between k and k' trading partners, N could be denote a number of industries in the total trade (or in the trade section) between k and k' trading partners, K' – a total number of trading partners or group of trading partners (here: EU-15, EU-10, extra EU) and K – a number of reported (analysed) countries (here: EU-8).

According to the Greenaway, Hine and Milner (1994) methodology, the total intra-industry trade has been divided into its two types – horizontal and vertical intra-industry trade using the so-called “product similarity criterion”. This criterion is based on the ratio between the unit value in exports and the unit value in imports in trade between two trading partners. Horizontal IIT is defined to exist for trade in industry i between two trading partners that satisfies the criterion:

$$1 - \alpha \leq \frac{UV_{i,t}^{kk',x}}{UV_{i,t}^{kk',m}} \leq 1 + \alpha,$$

and vertical IIT when such criteria are satisfied:

$$\frac{UV_{i,t}^{kk',x}}{UV_{i,t}^{kk',m}} \leq 1 - \alpha \quad \text{or} \quad \frac{UV_{i,t}^{kk',x}}{UV_{i,t}^{kk',m}} \geq 1 + \alpha,$$

where $x = \frac{UV_{i,t}^{kk',x}}{UV_{i,t}^{kk',m}}$ - relative unit values of exports and imports (the ratio between exports and imports unit value); α - dispersion factor. The parameter α is arbitrarily fixed. In general, α assumes the value 0.15⁶.

The above-presented methodology is based on the assumption that differences in quality are reflected in price differences (with prices as unit values of analysed goods). The relation price-quality is supported by the idea that in a perfect information context a certain variety of a product can only be sold at a higher price if its quality is superior. However, even in a context of imperfect information, the quality will always reflect on the prices⁷.

According to the presented methodology, in this paper the intra-industry trade will be divided into four types of trade:

- a) VIIT low quality – low quality vertical intra-industry trade when $x < 0.85$; it means that unit value of exports is relatively lower than unit value of imports (country k exports low-quality goods and imports high-quality ones);
- b) HIIT – horizontal intra-industry trade when $0.85 \leq x \leq 1.15$; it means that country k exports and imports goods within the same industry, which are the same price (quality) but differ in some other features, such colours, country of origin, etc.
- c) VIIT high quality – high quality vertical intra-industry trade when $x > 1.15$; it means that unit value of exports is relatively high in comparison with unit value of imports (country k exports high-quality goods and imports low-quality ones);

⁶ Some authors assume the value of 0.25, i.e. Fontagne, Freudenberg (1997).

⁷ Stiglitz 1987

- d) IIT not allocated – it means that relative unit value of exports and imports is impossible to be computed. There can be some reasons of it, i.e. lack of export quantity, lack of import quantity, lack of both export and import quantity. This phenomenon is more visible recently.

All trade data used in the paper are taken from the World Integrated Trade Solution (WITS) database, jointly developed by the World Bank and UNCTAD. The basic information source is the United Nation Statistical Division's Commodity Trade data base (COMTRADE). I retain all bilateral imports and exports in value terms (current US dollars).

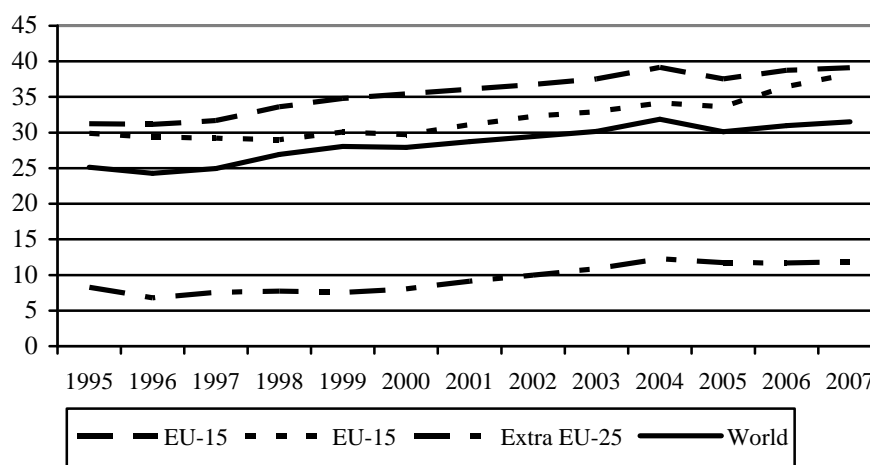
The IIT indices were computed at the four-digit HS for eight EU countries: the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia in years 1995-2007. Then the indices were aggregated across industries (to the level of total trade or individual divisions of ISIC) and across trading partners (to the EU-15, EU-10, non-EU countries or to the trade with all partners) and sometimes also across reporter countries (to the level of the EU-8 countries).

5. Empirical analysis of the developments on the intensity of IIT

The intensity of the intra-industry trade in the EU-8 countries has been generally increasing in the analysed period (1995-2007) – Graph 1. Especially faster growth of the IIT indices was noticed from 1996 to 2004. After the EU accession (in 2005), there took place a decline of IIT shares in total trade, and then renewed their increase. As a result, in 2007 the IIT share in total trade of the EU-8 countries was higher by 6.3 p.p. than in 1995 and lower by 0.4 p.p. than in the accession year and amounted to 31.5%.

Let's notice that similar trends (except for some differences) were observed in the EU-8 trade with the major trading partners group. First, the upward trends of the IIT indices in relation with the EU-15 were almost identical like those in total trade, due to the fact that trade with the EU-15 accounted for about 60% of the analysed countries' trade. Second, the level of the IIT in relations with the EU-10 was relatively stable in years 1995-2000, and then increased much faster, especially after the EU accession. Third, the IIT indices in trade with non-EU countries was increased in years 1996-2004, and especially rapid growth was noticed after 2000. Since the accession, these indices were stable but on the lower level than in 2004.

Graph 1. The IIT indices in trade of EU-8 countries with the major trading group partners in years 1995-2007, in per cent

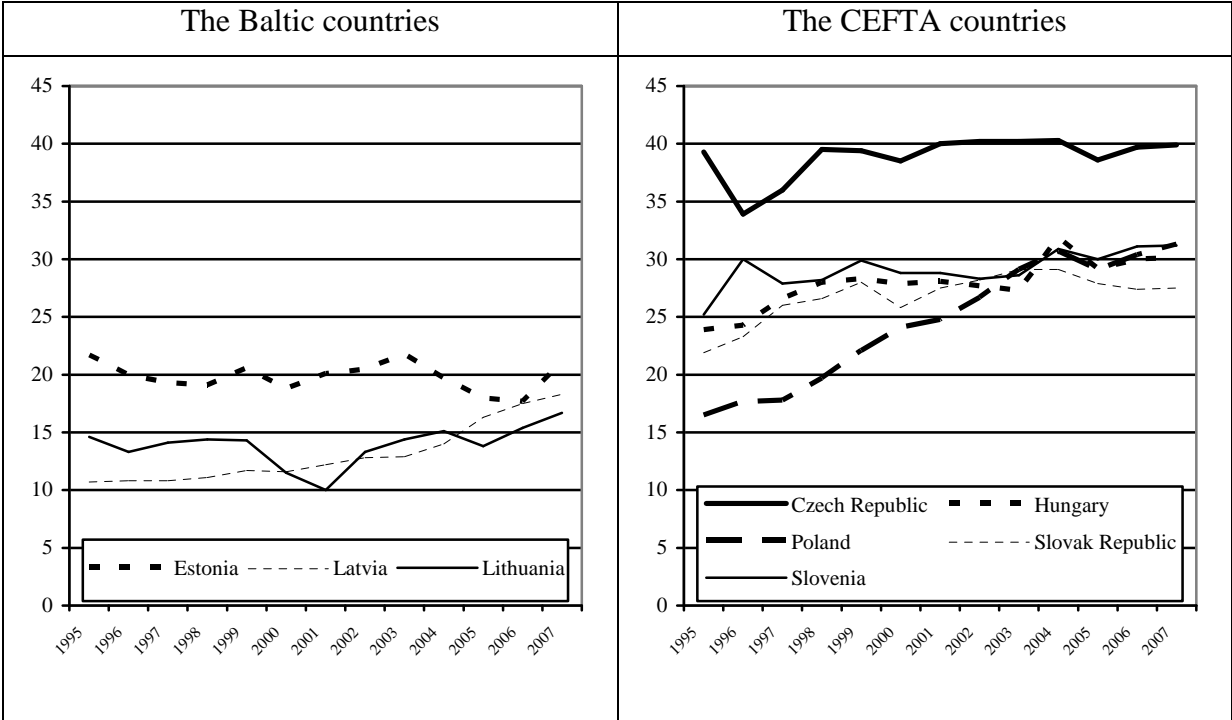


Source: Own calculations based on WITS-Comtrade data.

As a result of these changes, the highest level of the IIT intensity was noticed in the EU-8 trade with the EU-15 (39.1% in 2007) and it was by 7.8 p.p. higher than at the beginning of the analysed period (Graph 1). Next, in trade with the EU-10 the IIT index grew in years 1995-2007 by 8.3 p.p. and amounted to 38.2% in 2007. Although the share of IIT in total trade with the non-EU countries almost has doubled in the analysed period, still it was above three times lower than in relation with EU countries. In 2007, only 11.8% of trade with non-EU countries was determined by intra-industry trade specialisation. Such differences in the level of IIT intensity between EU and non-EU countries seem to be consistent with the theory. They can be explained by different economic potential of trading partners from listed two groups of countries, differences in their income level *per capita*, geographical distance and level of the trade barriers.

With regard to the IIT intensity of individual EU-8 countries, the lowest indices of IIT recorded the Baltic countries (Lithuania – 16.7%, Latvia – 18.3% and Estonia – 21.1%) and the highest – the Czech Republic (39.9%) – Graph 2. In other countries, the IIT intensity was about 30% (Slovakia – 27.5%, Hungary – 30.2%, Slovenia – 31.2% and Poland – 31.3%).

Graph 2. Indices of the IIT in the individual EU-8 countries in years 1995-2007, in per cent



Source: Own calculations based on WITS-Comtrade data.

Taking into account the changes of IIT indices in the analysed period, these countries can be divided into four groups:

- a) clear upward trend on the low level of IIT intensity – Latvia,
- b) clear upward trend on the high level of IIT intensity – Poland, Hungary and partly Slovakia,
- c) relatively stable high level of IIT intensity – the Czech Republic and Slovenia,
- d) relatively unstable low level of IIT intensity – Lithuania and Estonia.

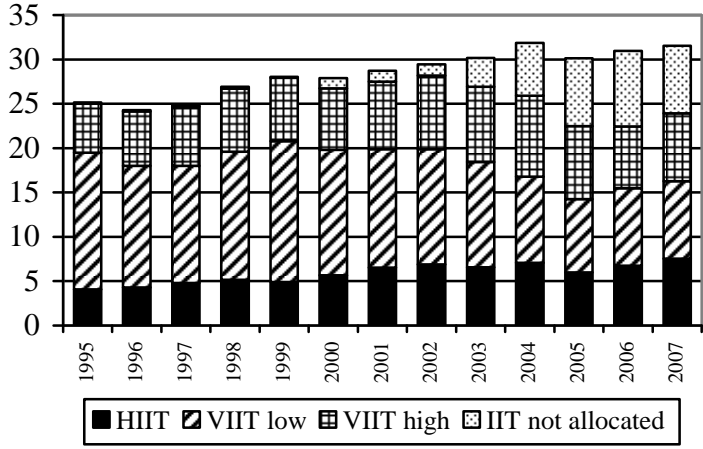
In all the analysed countries and all the time (except for the second half of 1990s in Lithuania and Latvia), the lowest IIT indices were noticed in trade with non-EU countries – Graph A1 (annex I). In some countries like the Czech Republic, Hungary, Poland and Slovenia the highest IIT intensity was observed in the relation with the EU-15, however, Latvia, Lithuania and Slovakia – in trade with the EU-10. In case of Estonia, there is no evident tendency (i.e. in 2007 the IIT index was higher in trade with the EU-10 than with the EU-15). The relatively large differences in significance of this type of trade with two groups

of the EU countries were observed in Latvia and Lithuania. In 2007, the IIT indices in trade with the EU-10 were larger than in trade with the EU-15 by, respectively, 20 p.p. and 15 p.p.

Of great importance is also separation of the intra-industry trade into horizontal and vertical IIT. According to the methodology by Greenaway, Hine and Milner, the basis for it is an assumption that price changes reflect quality changes of trading goods. The criterion for this separation is based on the ratio between the unit value in export and the unit value in import in trade between two trading partners. In situation when it is impossible to compute this ratio, there is not any possibility to make a separation. This empirical analysis shows that in the recent years the defects of trade data significantly grew, in contrary to the 1990s. This is a serious problem in the analyses like this, because there is not another way to estimate a relative unit value of exports to imports. Especially large defects of this ratio were registered after the last but one EU enlargement, mainly in trade with the EU-15.

Taking this above-mentioned limitation into consideration, one may say that in the EU-8 countries intra-industry trade was dominated all the time by trade in vertically differentiated products (VIIT) – Graph 3. Its share in the total IIT in the recent years has been gradually decreasing because of (a) growth of horizontal IIT and (b) increase of IIT shares so-called as IIT not allocated (in 2007 it was 8% of total trade and nearly one fourth of total IIT). Simultaneously big changes took place in the structure of VIIT in the analysed period. A positive trend has been a declining significance of low quality VIIT (countries exported mainly low-quality products and imported high-quality ones) to high quality VIIT's advantage (countries exported mainly high-quality products and imported low-quality ones). At the beginning of the analysed period, the latter accounted for about one fourth of total VIIT, while in 2007 it was nearly a half. These changes reflect structural transformation of EU-8 countries' economies. Another positive trend has been a slow but gradual rise of horizontal IIT: on average, its share in total trade of the analysed countries almost doubled, and grew from 4% to nearly 8% in the period 1995-2007.

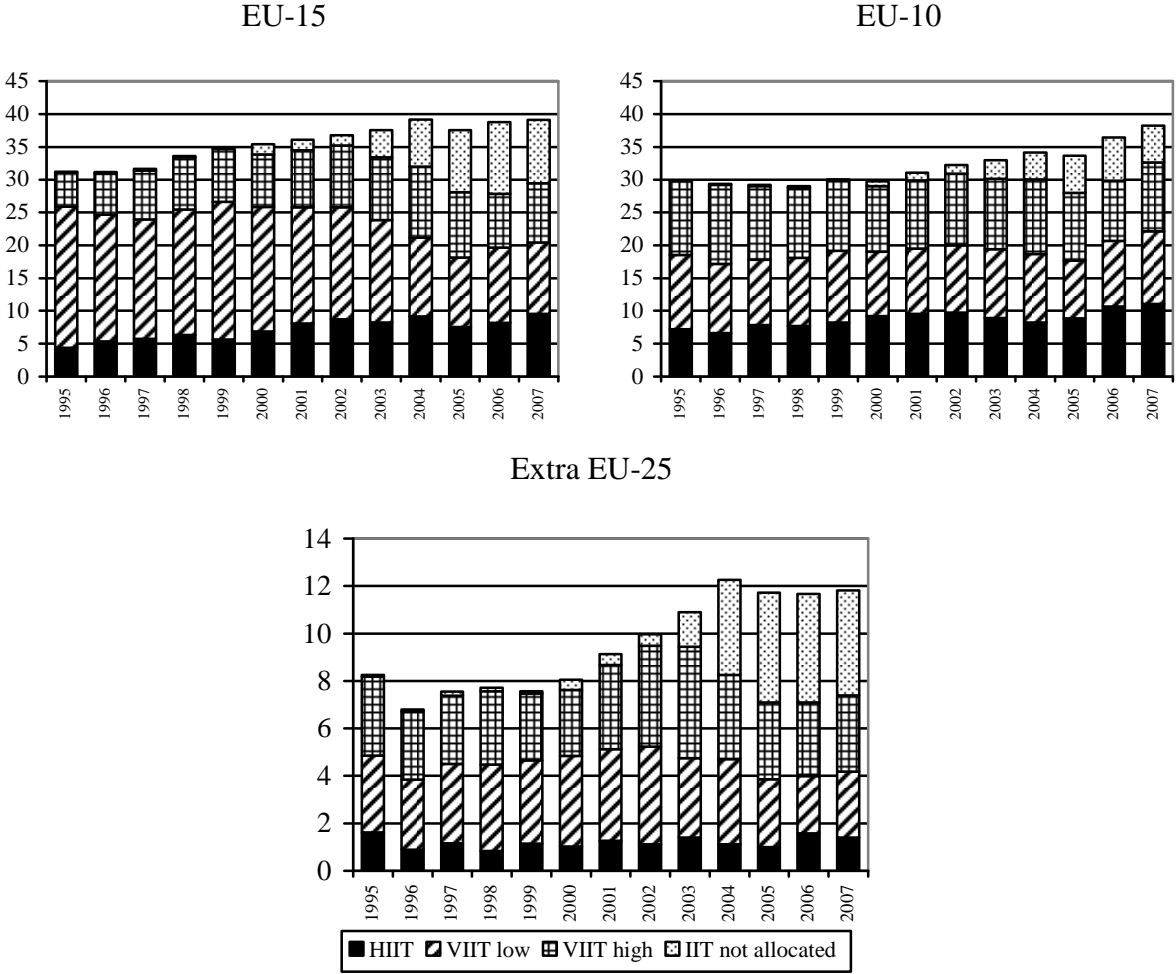
Graph 3. The pattern of the IIT in the EU-8 countries (as a whole) in years 1995-2007, in per cent



Source: Own calculations based on WITS-Comtrade data.

From the analysis of the IIT pattern in the EU-8 trade with their major partner groups there have resulted some conclusions. First, the level of the HIIT intensity was all the time higher in trade with the EU-10 countries than with the EU-15 countries: in 2007, it amounted to, respectively 11.1% and 9.5% of total trade. It seems to be consistent with the theory. On average the EU-8 countries are more similar between each other (as measured for example by pattern of production and the level of GDP *per capita*) than as compared with the EU-15. In relation with the non-EU countries this type of IIT was of marginal importance (only 1.4% in 2007). Second, the pattern of VIIT with two groups of the EU countries was quite different in the analysed period. The shares of high and low quality VIIT in trade with the EU-10 were stable all the time and accounted for about 10%-11%, while in trade with the EU-15 there have been ensured more clearly changes of VIIT structure: in the analysed period, the share of low quality VIIT has declined twice (from 22% to 11%) and the share of high quality VIIT has nearly doubled (from 5% to 9%). It reflects positive changes in EU-8 trade pattern in relation with the EU-15: the exported goods are of better and better quality, which means the progressive specialization of the EU-8 in more advanced products. Third, the problem of the not allocated IIT was observed after the EU accession in relation with all groups of EU-8 trading partners. In 2007, the share of this type of trade in total trade ranged from 9,7% (EU-15) to 5,6% (EU-10) and 4,4% (extra-EU), while measured as a share of total IIT it was, respectively 25%, 15% and 37%.

Graph 3. The pattern of the IIT in trade of the EU-8 countries (as a whole) with major trading group partners in years 1995-2007, in per cent



Source: Own calculations based on WITS-Comtrade data.

6. The foreign direct investment in the EU-8 countries

First investment activities by foreign corporation in the analysed new EU Member States date back to the early 1960s. A large-scale inflow of foreign direct investment (FDI) to the EU-8 economies was observed in the 1990s. The transition to market economies was accompanied by a growing demand for foreign capital, in connection with changes in the type of ownership of industrial enterprises. In the yearly 1990s, FDI inflows to these countries mostly concerned takeovers of existing plants by foreign investors with the view of restructuring and joint venture investment. Central and Eastern Europe as an investment destination offered multinational corporations a number of advantages such as workforce skills, relatively low labour costs and favourable tax system for new investors. Investment

inflow to CEECs was also driven by economic cooperation of those countries with the European Union, initiated in the 1990s, and prospects for future EU membership.

A vital role in foreign direct investment inflow to the analysed countries was played – apart from brownfield investment – by greenfield investment. Those mainly consisted in creating a business manufacturing in the host country from scratch. Their advantage over the former was that the location was not determined by an existing production plant, there was full freedom of choice. Investors took account of factors such as the availability of labour, the proximity of suppliers and outlets as well as transport infrastructure.

As a result, as at the end of 2008, the stock of foreign direct investment in the eight new EU Member States was circa EUR 326 billion. The largest recipients of FDI among the EU-8 countries were Poland, the Czech Republic and Hungary. They have attracted above 75% of the total FDI inflows to the analysed countries.

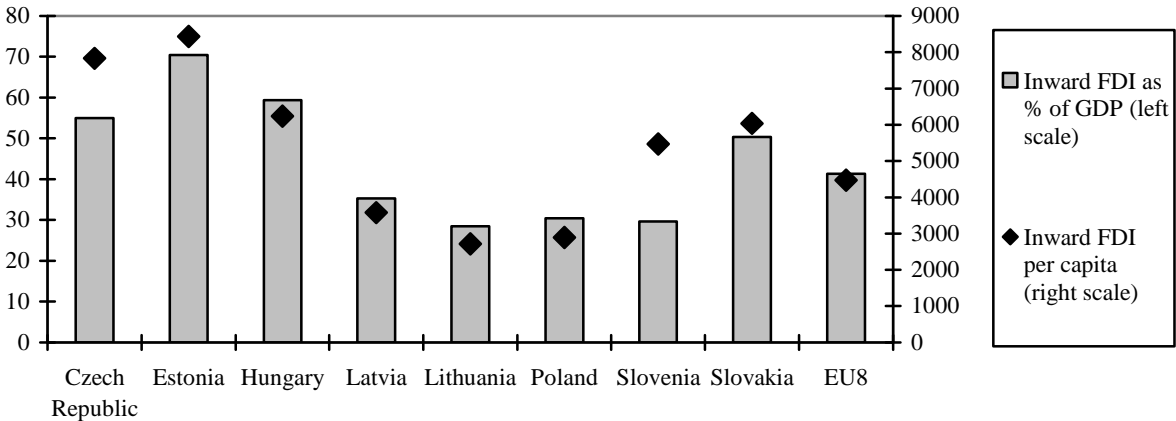
Table 1. Inward foreign direct investment stock in the EU-8 (in EUR billion)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Czech Republic	23.3	30.7	36.9	35.9	42.0	51.4	60.6	76.3	81.3
Estonia	2.8	3.6	4.0	5.6	7.4	9.6	9.7	11.4	11.3
Hungary	24.6	31.0	34.6	38.3	45.9	52.4	61.8	67.0	62.7
Latvia	2.2	2.6	2.7	2.6	3.3	4.2	5.7	7.5	8.1
Lithuania	2.5	3.0	3.8	4.0	4.7	6.9	8.4	10.3	9.1
Poland	36.8	46.7	46.1	45.9	63.3	75.2	91.1	116.0	110.2
Slovenia	3.1	2.9	3.9	5.0	5.6	6.1	6.8	9.8	11.0
Slovakia	5.1	6.5	8.6	12.6	16.1	20.0	25.5	29.1	32.6
EU-8	100.5	127.1	140.6	149.9	188.3	225.8	269.5	327.3	326.4

Source: Own study based on data of The Vienna Institute for International Economic Studies (WIIW).

The comparison of the stock of inward FDI in the new EU Member States fails to reflect its full role in the economies of those countries. A more reliable measure is FDI *per capita*, as well as the ratio of the FDI stock to GDP. Graph 4 shows that in terms of the FDI stock *per capita* Estonia and the Czech Republic are the leaders in the EU-8 (with EUR 8.4 thousand and EUR 7.8 thousand *per capita* as at the end of 2008 respectively). The worst performers were Lithuania and Poland – with EUR 2.7 thousand and EUR 2.9 thousand *per capita* respectively. These above expressed conclusions confirm the analysis based on the ratio of the FDI stock to GDP.

Graph 4. The stock of inward FDI in the EU-8 countries *per capita* (EUR, left scale) and relative to gross domestic product (% of GDP, right scale)



Source: Own study based on WIIW data.

7. Specification of the model and research hypotheses

In this part of the paper, we analyse determinants of the intra-industry trade (both types of IIT) in trade of eight new EU member states (Czech Republic, Estonia, Latvia, Lithuania, Poland, Slovakia and Slovenia) in the period 1995-2007. The choice of the EU-8 trading partners and the years was determined by the availability of data, especially the availability of FDI data. Country considered in the econometric analysis accounts for about 70%-80% of individual EU-8 countries’ total volume of trade. In the analysis, there will be used an unbalanced panel data with 3380 observations. To address the problem of censored data (the IIT indices range from 0% to 100%), the following study has adopted the Tobit model. For these reasons the Tobit model is the most appropriate for this type of study. To compare the estimated results there will be also used *random effects* model. All of the equations and diagnostic tests were estimated with STATA 9.

Consistent with the literature on the determinants of IIT, a regression model was estimated of the following form:

$$IIT_{ij} = \beta_0 + \beta_1 * \ln(GDP_{i,tot}) + \beta_2 * \ln(GDP_{j,tot}) + \beta_3 * \ln(GDP_{i,tot}) + \beta_4 * \ln(GDP_{j,tot}) + \beta_5 * \ln(ED_{ij}) + \beta_6 * \ln(FDI_{ij}) + \beta_7 FTA_{ij} + \beta_8 UE_{ij} + \beta_9 contig_{ij} + \beta_{10} * \ln(dist_{ij})$$

IIT_{ij} means the index of intra-industry trade in trade between country *i* and country *j*. The independent variables were presented in Table 4.

Table 2. Variables and data sources

Variable	Description	Data source*	Expected change		
			IIT	HIIT	VIIT
GDPitot	gross domestic product of country <i>i</i> (reporter) – PPP, in bln USD;	WDI database	+	+	+
GDPjtot	gross domestic product of country <i>j</i> (partner) – PPP, in bln USD;	WDI database	+	+	+
GDPi_pc	gross domestic product of country <i>i</i> (reporter) <i>per capita</i> – PPP, in USD <i>per capita</i> ;	WDI database	+	+	+
GDPj_pc	gross domestic product of country <i>j</i> (partner) <i>per capita</i> – PPP, in USD <i>per capita</i> ;	WDI database	+	+	+
EDij	ED _{ij} - „economic distance” computed by $\frac{\max(GDP_i - pc, GDP_j - pc)}{\min(GDP_i - pc, GDP_j - pc)}$, (gdp_per_capita in USD <i>per capita</i> , PPP)	WDI database	-/+	-	+
FDIij	foreign direct investments stock from country <i>j</i> in the country <i>i</i> , in bln USD	WIIW database on FDI	-/+	-/+	+
FTAij	dummy variable with value 1 if country <i>i</i> and country <i>j</i> have preferential trade agreement (otherwise 0);		+	+	+
UEij	dummy variable with value 1 if country <i>i</i> and country <i>j</i> are the EU member states (otherwise 0);		+	+	+
contigij	dummy variable with value 1 if country <i>i</i> and country <i>j</i> have the common contig (otherwise 0);	CEPII database	+	+	+
distij	distance between capitals of country <i>i</i> and country <i>j</i> , in km;	CEPII database	-	-	-

*WDI database – World Development Indicators database by the World Bank, <http://www.worldbank.org>; WIIW database on FDI – the FDI database of the Vienna Institute of International Economic Studies, CEPII database – the French Research Center in International Economics database, <http://www.cepii.fr/anglaisgraph/bdd/distances.htm>.

According to the majority of the previous studies, the following research hypotheses seem warranted:

- a) *Intra-industry trade among countries is intense if their market sizes are large.* In this analysis, the market sizes are measured as the gross domestic products (at purchasing power parity – PPP, in bln USD) of two trading partners (*i* and *j*).
- b) *Intra-industry trade among countries is intense if their levels of development are high.* The gross domestic products per capita of country *i* and *j* (at PPP, in USD *per capita*) is taken to indicate the development stages of these countries.
- c) *The smaller the difference in the level of development between two countries, the higher the degree of horizontal IIT and conversely for vertical IIT.* In this empirical analysis, the differences in development stage of the countries are measured as the so-called “economic distance” computed as a ratio of the higher value of GDP *per capita* of these countries to the lower value (GDP_{i,j_pc} in USD *per capita*, PPP).

- d) *The larger the stocks of the foreign direct investment in the host country, the higher the share of vertical IIT, while the influence of this variable on horizontal IIT is ambiguous.* The stocks of inward FDI (from the major investor countries) in analysed countries (FDI_{ij}, in bln USD) is used to test this hypothesis⁸.
- e) *The share of intra-industry trade will be higher when trading partners are geographically close.* The distance between capitals of two trading partners *i* and *j* (*dist*_{ij}, in km) and dummy variable *contig*_{ij} with value 1 if a reporter country *i* borders with a partner country *j* (otherwise 0) are used to test this hypothesis.
- f) *The lower the barriers to trade, the higher the share of both types of the intra-industry trade.* In this empirical analysis, the level of trade liberalization is measured as *EU*_{ij} dummy variable with value 1 if two trading partners are EU member states and free trade area dummy variable *FTA*_{ij} with value 1 if two trading partners are members of the same free trade area.

8. Regression results

As discussed earlier, two models have been estimated: the *random effects* model (*re* model) and the Tobit model. The results of both applied estimation methods are not the same because not only value of coefficients and level of statistical significance differ but also sometimes the sign of coefficient. In case of random effects, the fit of the estimation for all dependent variables (IIT, HIIT and VIIT) is relatively high and the R² amounted respectively to 0.582, 0.497 and 0.563.

Starting with the estimated models for the total IIT, the obtained results are generally consistent (but *economic* distance) with expectations. The only two variables (the Tobit model) and one variable (*re* model) producing a negative impact on intra-industry trade were the distance (both models) and economic distance (only the Tobit model). It is worth to notice that the coefficient of economic distance in the Tobit model was statistically not significant.

⁸ The choice of the inward FDI stock as a variable reflecting inflow of foreign capital to the home economies was determined only by the availability of FDI data. A measurement of FDI impact on the intra-industry trade seems to be quite complicated. There doesn't exist a perfect FDI variable, which could be without problems adopted into the model. On the one hand, the intra-industry trade intensity has been influenced by FDI inflows in the analysed year, on the other hand also by FDI cumulated to this year, which has come in the analysed economy. The division of the two types of impact is practically impossible. The usage of the FDI inward stock could entail some problems. The FDI inward stocks adopted in the next years reflect every time a whole cumulated value of FDI. Thus it could influence estimation results (in plus). These above mentioned problems will be considered in the further research.

In this model, not significant was also $GDPj_{pc}$, while in the re model there were $FTAij$ and $UEij$ (although have a positive sign).

Table 3. Estimation results

Variable	<i>re</i> model			Tobit model		
	IIT	HIIT	VIIT	IIT	HIIT	VIIT
gdpi	1.956*** (0.360)	0.448*** (0.103)	1.020*** (0.250)	1.368*** (0.168)	0.632*** (0.080)	0.711*** (0.124)
gdpij	1.439*** (0.231)	0.053 (0.066)	1.053*** (0.160)	1.255*** (0.110)	0.378*** (0.055)	1.06*** (0.082)
gdpi_pc	1.111* (0.671)	0.083 (0.276)	-1.863*** (0.491)	4.49*** (0.537)	0.538** (0.257)	1.827*** (0.398)
gdpij_pc	2.481*** (0.552)	0.400** (0.185)	0.814** (0.394)	0.515 (0.328)	0.369** (0.159)	0.031 (0.244)
edij	0.261* (0.136)	0.206*** (0.051)	-0.110 (0.101)	-0.008 (0.092)	0.238*** (0.044)	-0.307*** (0.075)
fdij	0.501*** (0.091)	0.175*** (0.041)	0.463*** (0.069)	1.295*** (0.079)	0.164*** (0.038)	0.93*** (0.059)
ftaij	0.657 (0.520)	0.179 (0.248)	1.432*** (0.395)	3.479*** (0.489)	0.762*** (0.234)	3.104*** (0.362)
ueij	0.657 (0.623)	0.070 (0.300)	-0.476 (0.474)	2.42*** (0.602)	0.684** (0.285)	-0.007 (0.445)
contigij	7.063*** (1.397)	2.827*** (0.390)	3.558*** (0.969)	6.579*** (0.619)	2.71*** (0.290)	3.303*** (0.457)
distij	-4.909*** (0.432)	-0.964*** (0.136)	-3.457*** (0.304)	-4.291*** (0.240)	-1.414*** (0.118)	-3.25*** (0.178)
cont R ²	-27.783*** (6.785) 0.582	-2.299 (3.019) 0.497	18.017*** (5.062) 0.563	-39.582*** (5.917) -	-9.896*** (2.842) -	-9.224** (4.381) -

*** significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level;

Then the model was re-estimated using HIIT as a dependent variable. The fit of the estimation for HIIT in the re model was less good than that for IIT as a whole: as many as 4 coefficients were not significant. Contrary to this estimation method, in the Tobit model all coefficients were highly significant (in most cases, significant at the 1 per cent level). Except for these above-mentioned differences, the signs of the coefficients in both applied methods were the same. For all variables (but *distance*), the estimates were positively correlated with the HIIT. Also the *economic distance* measured as a difference between GDP *per capita* of trading partners has a positive impact on the intensity of the HIIT. It seems to be not consistent with the theory and the previous empirical studies. It comes out that differences in the level of income per capita have negative impact on horizontal IIT.

The model was also re-estimated using VIIT as the dependent variable. The results obtained from both applied methods were similar to each other. The signs of the coefficients on variables *distance* and *economic distance* were negative, but only in the Tobit model were both statistically highly significant, while in the *re* model significant was only the coefficient on *distance*. Contrary to expectations, the membership in the EU was negative even when its coefficient was not statistically significant in both empirical tests. From the *re* model resulted also a negative impact of the *GDP per capita* of reporter country (EU-8 countries) on VIIT, while this coefficient is highly significant. This relationship was not confirmed in the Tobit method, in which the respective coefficient was positive and also highly significant.

It is important to notice that estimated impact of *FDI* on all type of IIT was positive and highly significant in both applied methods⁹. It appears to be in contrast to the results obtained from some other studies, in which the revealed relationship between the *FDI* and all type of IIT was unambiguous. One may say that FDI have been playing a crucial role in the economic transformation of the CEECs. The need of Central European companies to obtain access to know-how, capital and distribution channels was the reason for dynamic inflow of foreign capital in the 1990s. As a result, the technological gap between CEECs and the EU countries has been getting smaller, what positively affects the development of the intra-industry trade between these trading partners. Recently the FDI inflow to the new EU member states, especially to the Central Europe has been connected with the fragmentation of production process. The best example of this phenomenon is the motor industry¹⁰. In the former CEFTA countries many car assembly plants were located, whose production was based on the imported parts and components and majority of their production was exported to the EU-15.

9. Conclusions

In this study, were analysed evolving patterns of the intra-industry trade in eight new EU member states during the period 1995-2007. This analysis generally consisted of three parts: description of changes in the IIT pattern in the EU-8 countries, a brief survey on the

⁹ As mentioned above, the positive impact of FDI on intra-industry trade could be quite overestimated due to the type of variable, which was adopted into the model as a FDI variable (FDI inward stock). This problem will be considered in the further research.

¹⁰ More about specialisation changes in the motor industry in Central Europe see: E. Kawecka-Wyrzykowska (2009).

inward FDI in those countries and estimation of determinants of the EU-8 intra-industry trade in horizontally and vertically differentiated goods.

The intensity of the intra-industry trade in the EU-8 countries has been generally increasing in the analysed period. Especially faster growth of the IIT indices was noticed since 1996 to 2004. After the EU accession (in 2004), a decline of IIT shares in total trade took place, and then this trend was reversed. As a result, in 2007 the IIT share in total trade of the EU-8 countries was higher by 6.3 p.p. than in 1995 and by 0.4 p.p. lower than in the accession year and amounted to 31.5%.

The highest level of the IIT intensity was noticed in the EU-8 trade with the EU-15 (39.1% in 2007) and it was by 7.8 p.p. higher than at the beginning of the analysed period. Next, in trade with the EU-10, the IIT index grew in years 1995-2007 by 8.3 p.p. and amounted to 38.2% in 2007. Although the share of IIT in total trade with the non-EU countries has almost doubled in the analysed period, still it was above three times lower than in relation with EU countries. In 2007, only 11.8% of trade with non-EU countries was determined by intra-industry trade specialisation.

Recently, big changes took place in the structure of IIT. First, a gradual rise of horizontal intra-industry trade can suggest the decreasing differences in the development level between EU-8 countries and their trading partners, especially EU-15 and EU-10 countries. Second, diminishing significance of vertical intra-industry trade and its changing patterns (drop of low quality VIIT and growth of high quality VIIT) reflect structural transformation of EU-8 countries' economies. Third, this empirical analysis shows that in the recent years the defects of trade data significantly grew, contrary to the 1990s. This is a serious problem because there is no other way to estimate a relative unit value of exports to imports, and as a result to disentangle IIT in HIIT and VIIT, which is very important from the point of view of economic interpretation.

As at the end of 2008, the stock of foreign direct investment in the eight new EU Member States was circa EUR 326 billion. The largest recipients of FDI among the EU-8 countries were Poland, the Czech Republic and Hungary. They have attracted above 75% of the total FDI inflows to the analysed countries.

Finally, in this study, also the determinants of EU-8 intra-industry trade in horizontally and vertically differentiated products were analysed. To address the problem of censored data (the IIT indices range from 0% to 100%), the present study adopted the Tobit model. Additionally, also the *random effects* model was adopted.

Furthermore, the analysis has highlighted how determinants of horizontal intra-industry trade differ from those of vertical intra-industry trade, both in signs and significance of variables. In this specific case, the vertical intra-industry trade grows with the level of GDP and GDP *per capita* of trading partners, stock of foreign direct investments, FTA membership and neighbourhood of partner countries. On the other hand, the VIIT has decreased with an increase of economic and geographical distance and also with the EU membership (this coefficient was statistically not significant). In relation to the horizontal intra-industry component, the level of GDP and GDP *per capita*, stock of foreign direct investments, the EU and FTA membership, neighbourhood of trading partners and also economic distance have positive impact on the intensity of HIIT in the EU-8 countries. The positive relationship between the latter variable and HIIT does not confirm the forecast. Only one variable – geographical distance – negatively affects the horizontal intra-industry trade.

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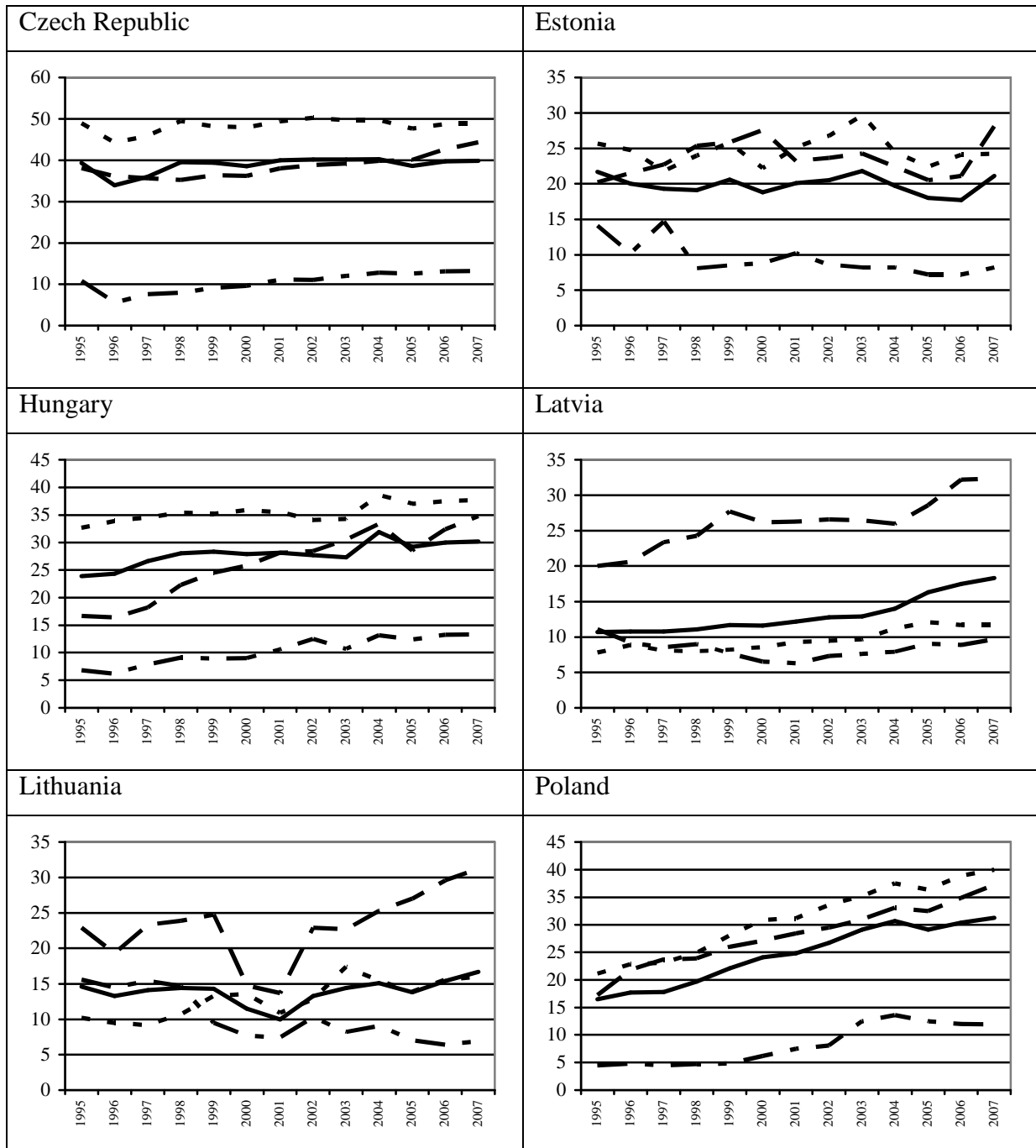
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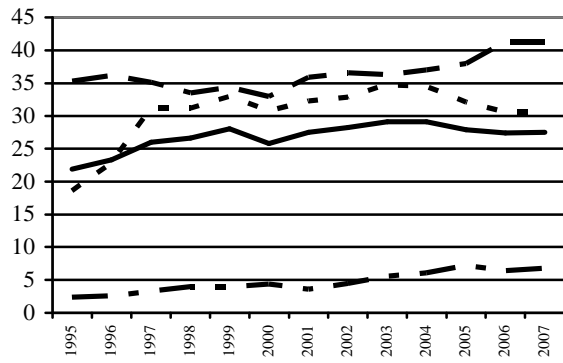
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Annex I

Graph A1. Indices of the IIT in the EU-8 countries with their major group of trading partners in years 1995-2007, in per cent



Slovakia



Slovenia

