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INTRA-INDUSTRY TRADE AND FOREIGN DIRECT INVESTMENT: THE CASE OF POLAND

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ABSTRACT

Intra-industry trade (IIT) has been widely investigated among developed countries. Main factors influencing the simultaneous flows of exports and imports were also identified for the group of advanced economies. Less attention was paid to the trade of emerging countries. Therefore, the author analysed bilateral trade between Poland and its main trading partners over the period 2000-2007. The analysis of IIT was conducted at the five-digit SITC products. Among factors influencing intensity of IIT the role of FDI was placed in the centre of the investigation.

Keywords: *Intra-Industry Trade, Foreign Direct Investment, Poland*

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INTRODUCTION

The phenomenon of intra-industry trade (IIT) has been widely investigated in respect of developed countries. Less attention has been paid to analysing levels of IIT and their determinants in emerging countries. Poland was chosen as an example of a country, which belongs to the group of New Member States of European Union (EU). IIT was revealed for the first time among the countries belonging to European Economic Community, therefore it is expected that membership of Poland in EU will have a positive influence on the level of IIT of this country.

According to a general presumption, level of IIT should be positively correlated with a similarity in incomes of trading countries. Poland, as a fast developing country, steadily closes the income gap with advanced Europe. This should noticeably help achieving higher levels of IIT.

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Further factor taken into analysis is the position of the economy of Poland in the region. The potential market of over 38 million people and lower than Western Europe labour costs attract significant flows of foreign direct investment. Central location in Europe is then used to place export platforms of multinational corporations. Poland can be treated as a bridge between western and eastern parts of the continent. It means that goods of different qualities are traded over borders. These conditions enhance the total volume of trade, but should also increase level of IIT.

On the other hand firms originating in Poland are particularly active investors in the region of Central and East European Countries. Therefore, this paper will both focus on activities of foreign based multinationals in Poland and international performance of Polish-based companies. As a proxy for international production, inward and outward FDI will be analysed. The significance of FDI in the Polish economy is reflected by the ratio of FDI to the value of GDP (Table 1). Much faster rising pace of outflows to inflows of FDI denotes increasing role of Polish-based multinationals in the economy.

Table 1: Ratio between Stock of FDI and GDP of Poland – 2000-2007 [%]

Type	Year							
	2000	2001	2002	2003	2004	2005	2006	2007
Inward FDI	19.81	22.05	21.82	24.01	31.06	31.37	35.07	38.61
Outward FDI	0.59	0.62	0.66	0.89	1.20	2.17	4.00	4.25

Source: Own calculations based on Eurostat data.

The issue of FDI and IIT has not been intensively addressed in the literature, especially in a case of emerging countries. Nonetheless, the role of foreign direct investment in trade is ambiguous. Investment in foreign production can occur as a substitute for exporting goods from home country and thus to decrease the level of trade both of inter and intra-industry type. It can also lead to the industry specialization what can support inter-industry trade. However, in the light of literature, flows of FDI support creating new firms, which provide vast variety of products to the market. In addition, trade of intermediary goods within the same industry is the result of international production fragmentation conducted by multinational corporations.

Similar levels of investment flows/stocks between countries are expected to have comparable impact on IIT intensity as similar incomes. Less difference in capital endowment should positively influence horizontal intra-industry trade. At the same time may decrease the level of vertical intra-

industry trade because of less difference in production costs between countries.

The main aim of the paper is to provide an empirical contribution of intra-industry trade of Poland in its early years of EU membership.

LITERATURE REVIEW

The first backgrounds for intra-industry trade theory were developed by Balassa (1966), Grubel (1967) and Grubel and Lloyd (1975). They examined the trade flows between industrialized countries with similar factor endowments. Since then, the theory of IIT has been enriched and proliferated. New parameters were also added to the analysis of intra-industry trade determinants, both on the level of countries and industries.

One of the main challenges during investigation of IIT is to distinguish whether it takes a horizontal (HIIT) or vertical form (VIIT). The first type appears when export and import flows take place in products similar in quality, but different by attributes and further characteristics. The models of HIIT were developed by Lancaster (1980), Krugman (1981), Helpman (1981) and Bergstrand (1990). Helpman and Krugman (1985) showed that when countries become more similar in their level of development, more HIIT is conducted between them. Horizontal intra-industry trade is a result of product differentiation and scale economies; the smaller minimum efficient scale of production, the greater number of firms in the industry, which deliver more varied products to the market.

The latter type of intra-industry trade arises when customers with different incomes demand different quality of products. Falvey (1981) showed that vertical intra-industry trade occurs when large number of firms produces goods of different qualities, but there is no scale production. VIIT is typically described as a trade based on traditional factor endowment of countries. Nations relatively abundant with labour exports lower quality products and nations relatively abundant with capital exports higher quality goods. Distinguishing between HIIT and VIIT is also essential in the scope of analysing impact of multinational corporations on levels of IIT.

Multinational corporations can serve foreign market either by importing goods or by producing them in the country of their consumption. A firm will locate the production in the foreign market when net benefits will overpass costs of setting-up business abroad.

Multinational corporations play important role in the exchange of goods between countries. There are many contributions suggesting that trade and FDI are highly correlated (Eaton & Tomura, 1994). But the issue of IIT and FDI has not been widely investigated. Therefore, special attention should be paid to the role of MNC in the IIT.

The literature provides support that VIIT and inward FDI are positively correlated because multinational corporations can produce variety of goods in host country using its abundant resources and then export to the foreign markets. Then again, FDI can influence the level of HIIT by replacing home production of goods for their exporting (Markusen & Vanables, 1996). Important analysis of the relations between trade and FDI was made by Markusen and Maskus (2001). They employed firm-level data and confirmed that intra-industry affiliate sales rises relative to the IIT index as countries become richer and more similar in size and relative endowments.

DATA AND MEASUREMENT

Data on trade flows were collected from ComExt database of Eurostat. Levels of IIT between Poland and its fifteen main trading partners by value were calculated for the period 2000-2007 at the 5-digit SITC products. Fifteen largest trade partners embrace over 80% of trade of Poland in 2007. The products taken into calculation were for 5-8 categories, what represents only manufactured goods. Levels of IIT are vulnerable to aggregation of data; therefore highly disaggregated figures were calculated.

IIT was calculated according to adjusted Grubel-Lloyd (1975) index:

$$IIT_{ijk} = \left\{ 1 - \frac{\sum_i |x_{ijk} - m_{ijk}|}{\sum_i |x_{ijk} + m_{ijk}|} \right\} * 100 \qquad (1)$$

where: i referred to the industry defined as 5-digit SITC product; j and k denoted countries.

Horizontal and vertical IIT were calculated using method developed by Greenaway, Hine and Milner (1995).

Horizontal IIT was defined as follows:

$$1 - \alpha \leq \frac{exportUV_i}{importUV_i} \leq 1 + \alpha \qquad (2)$$

Vertical IIT comprised trade where:

$$\frac{exportUV_i}{importUV_i} < 1 - \alpha \quad \text{or} \quad \frac{exportUV_i}{importUV_i} > 1 + \alpha \qquad (3)$$

where: *i* denoted 5-digit SITC product and α was a dispersion factor with values 0,15 or 0,25.

Disentangling HIIT from VIIT used relative unit values of exports and imports. The relative price should reflect differences in qualities. According to the quotations above, the HIIT was defined as the simultaneous exports and imports of a 5-digit SITC product where relative unit value between exports and imports was within a range of +-15%. If the relative unit values were outside this range IIT was considered to be of vertical type. In addition, a range of +-25% was calculated to check the robustness of the model.

The values of intra-industry trade of Poland presented in the table 2 fall into two groups. First group consists of European Union countries and the latter two non-member states: Russian Federation and Ukraine. The levels of IIT are evidently different between these two groups. IIT among EU countries is three- to fivefold higher comparing to non-member states. However, the level of IIT among EU countries is not homogeneous. Values for Czech Republic and Germany stand out of the rest EU countries.

Table 2: Mean Shares of Intra-Industry Trade between Poland and Main Trade Partners [%]

	Year							
Country	2000	2001	2002	2003	2004	2005	2006	2007
Austria	22.8	21.1	19.8	21.4	24.1	22.0	24.4	28.1
Belgium	16.4	18.9	22.2	26.4	26.5	23.0	24.1	24.0
Czech Republic	32.7	34.0	36.6	38.2	38.8	41.3	40.2	42.9
Denmark	21.9	22.2	21.0	29.5	37.1	28.6	30.7	33.2
France	25.7	24.6	25.0	25.3	31.4	31.4	33.3	33.1
Germany	35.7	36.8	38.8	40.5	43.0	42.4	43.0	44.7
Hungary	26.7	30.1	28.7	31.8	27.7	25.2	37.7	38.3
Italy	27.9	27.2	26.5	27.3	26.1	26.8	29.3	30.5
Netherlands	20.7	21.3	22.8	26.7	27.7	24.1	25.0	27.5
Russian Federation	7.8	8.0	7.6	9.3	6.8	7.3	8.6	8.3
Spain	25.8	21.6	23.0	23.2	26.4	32.2	32.7	32.5
Sweden	22.1	23.8	21.0	25.9	26.2	28.5	28.0	29.4
Slovakia	20.5	22.2	20.5	21.0	23.3	25.1	26.3	26.2
Ukraine	6.3	7.2	6.4	5.8	5.7	6.5	6.0	7.7
United Kingdom	19.4	22.5	20.1	22.0	29.0	28.1	27.0	26.5

Source: Own calculations based on Eurostat data.

Important conclusion coming out of the data is the rising significance of IIT in bilateral trade between Poland and other member countries. In most cases, the values over analysed period increased of around 10 percentage points. The values of trade between Poland and Ukraine and Russia changed only slightly in the same period.

Table A1 presents the values of horizontal and vertical intra-industry trade. The main conclusion drawn from the data is that Polish trade is predominantly of vertical type. There was only one exception. The value of horizontal trade with Spain in 2005 was higher than of vertical type. The ratio between horizontal and vertical trade tends to vary significantly during the analysed period. The high value of VIIT may be the effect of difference in factor endowments and different consumption structure in examined countries. In order to check the robustness of the calculations also +-25% range was evaluated in the table A2. For this wider range horizontal trade excesses the values of VIIT in cases of Spain, Czech Republic, Hungary and Slovakia

The values of GDP and GDP per capita were collected from the National Accounts Main Aggregates Database delivered by UN Statistical Commission for the same period of 2000-2007.

Values of stocks of inward and outward FDI of Poland were collected from the Eurostat database and National Bank of Poland for the period of 2000-2007. Stock values were chosen instead of flows, because established investment may participate in trade flows with time lag.

Distance was used as a proxy for transportation cost. It was measured as a road distance between Warsaw and a respective capital city of trading partner using ViaMichelin navigation system.

ESTIMATION

In order to investigate the impact of the factor endowments, foreign direct investment and distance the model (4) was constructed. The base of the model was developed by Helpman and Krugman (1985).

The analysis uses panel data obtained by pooling cross-sectional and time series data from 15 countries over the period 2000-2007, resulting in a panel set of 120 observations. The author chose the panel data because of its advantages compared to the pure time series or cross section data. The advantages of panel data include their ability to control individual heterogeneity and estimate effects not detectable in pure cross-section of time-series data (Koutsoyannis, 1977).

$$IIT_{ijk} = \alpha_j + \alpha_1 lnGDP + \alpha_2 lnGDP\_min + \alpha_3 lnGDP\_max + \alpha_4 lnGDP\_c + \alpha_5 lnFDI\_in + \alpha_6 lnFDI\_out + \alpha_7 lnDIST + \varepsilon_{ijk} \quad (4)$$

where:

- **lnGDP** – logarithm of the average GDP of Poland and trading partner. The variable is used to present the size of the trading economies. Following Greenaway et. al., (1994) the positive sign is expected.
- **lnGDP_min** and **lnGDP_max** – logarithm of the lower/higher GDP value in the pair of Poland and trading partner. The measurement is included to control for the relative size effects. Following Helpman (1987), Hummels and Levinsohn (1995) the positive sign of lnGDP_min is expected for IIT and VIIT; lnGDP_max – negative sign is expected.
- **lnGDP_c** – logarithm of the difference in GDP/capita between Poland and its trading partner. The parameter is applied to measure the difference in factors endowments between trading partners. The underlining hypothesis is that the more similar are incomes in two countries, the higher value of IIT is expected (Falvey and Kierzkowski, 1987; Helpman, 1987, Hummels and Levinson, 1995). The value is also used to test the effects of factors endowments on HIIT and VIIT. According to Greenaway et. al. (1994) the differences have negative impact on the HIIT; VIIT is expected to be positively affected by the difference as products of different qualities are traded.
- **lnFDI_in** – logarithm of the stock of inward FDI in Poland from the trading partner country. Positive sign is expected.
- **lnFDI_out** – logarithm of the stock of the outward FDI of Poland in the trading partner country. Positive sign is expected.
- **lnDIST** – logarithm of a road distance between Warsaw and capitals of trading partners. The value is expected to have negative effect on levels of IIT.

The results of estimation are presented in the Table 3. The values from column 1 with the dependant variable total IIT have strongest explanatory power. The model explains over 70 percent of the variation of IIT shares. The statistical significance of the coefficients is also at high 1% level. The fit of the estimation for vertical and horizontal IIT separately is less good than that for IIT as a whole.

The strongest impact on the IIT intensity has the average size of markets of both trading partners. Surprisingly the value is negative what can be explained by the fact that most of IIT is of vertical type.

The difference in factor endowments measured by differences in value of GDP per capita behaves as expected. As most of the trade is of vertical type the higher difference in incomes leads to higher level of IIT. When horizontal and vertical trade are analysed separately, the coefficient for horizontal trade is negative (thus, not statistically significant) and for vertical trade positive and significant.

The coefficients explaining FDI have expected signs. Both outward and inward FDI positively influence the value of IIT and are statistically significant. It means that FDI supports development of intra-industry trade between Poland and its partners. What is important not only inward FDI, which may be driven by lower production costs in Poland and geographic position, but also outward FDI plays positive role in improving levels of IIT.

Table 3: Estimation Results

	IIT (1)	HIIT (+-15%) (2)	VIIT (+-15%) (3)	HIIT (+-25%) (4)	HIIT (+-25%) (5)
$\alpha_1$lnGDP	-5.021 (1.308)***	-5.655 (2.105)***	-3.467 (2.026)*	-6.910 (1.910)***	-2.837 (2.059)
$\alpha_2$lnGDP_min	0.692 (0.300)***	1.687 (0.483)***	1.009 (0.465)***	2.031 (0.438)***	0.890 (0.472)*
$\alpha_3$lnGDP_max	4.479 (1.121)***	4.576 (1.804)***	2.591 (1.736)	5.619 (1.637)***	2.048 (1.765)
$\alpha_4$lnGDP_c	0.854 (0.097)***	-0.258 (0.157)	0.260 (0.151)*	-0.138 (0.142)	0.380 (0.153)***
$\alpha_5$lnFDI_in	0.203 (0.069)***	0.206 (0.111)*	0.126 (0.107)	0.238 (0.101)***	-0.092 (1.109)
$\alpha_6$lnFDI_out	0.190 (0.065)***	-0.069 (0.105)	-0.038 (0.101)	-0.027 (0.095)	0.067 (0.123)
$\alpha_7$lnDIST	-0.346 (0.074)***	-0.546 (0.119)***	-0.553 (0.114)***	-0.694 (0.108)***	-0.493 (0.116)***
adj. R2 Observations	0.717 120	0.269 120	0.320 120	0.398 120	0.300 120
Note: standard errors in parentheses, ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.					

Source: Own calculations.

The value for distance between countries comes as expected. What's more it is significant in all five columns, which confirms the negative impact on every type of IIT.

CONCLUDING REMARKS

The paper provided an overview of changes in IIT of Poland and its trading partners. The indexes of IIT for bilateral trade of Poland showed the tendency of significant improvement over the analysed period. It can be related with the closing gap in the incomes between Poland and its main trading partners from advanced Europe. Regional integration contributes essentially in constant income rise and improvement of trade relations of Poland.

Key country-specific determinants of IIT were analysed in this paper. The author focused on the role of FDI as the issue has not been widely addressed, especially in a case of emerging countries. For years, Poland was only a beneficiary of capital flows in the form of foreign direct investment. But since a few years ago many companies originating in Poland have focused on international production and serving foreign market via affiliates located close to customers. The level of total IIT is positively related to the flows of FDI. It denotes that activity of multinational corporations supports overall IIT of Poland. On the other hand, such unequivocal conclusion cannot be drawn from the econometric estimation when dependent variables are indexes of VIIT and HIIT. In this situation only inward FDI has a positive impact and is statistically significant for HIIT.

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APPENDIX

Table A1: Mean Shares of Horizontal and Vertical Intra-Industry Trade between Poland and Main Trade Partners +-15% Range [%]

Country	Type	Year							
		2000	2001	2002	2003	2004	2005	2006	2007
Austria	HIIT	4.1	4.6	5.4	4.7	5.1	2.7	4.8	4.0
	VIIT	18.7	16.4	14.4	16.8	19.0	19.3	19.6	24.1
Belgium	HIIT	4.4	7.3	4.0	3.9	11.6	6.4	3.6	8.5
	VIIT	12.0	11.6	18.2	22.5	14.9	16.6	20.5	15.5
Czech Republic	HIIT	12.4	14.9	14.4	17.9	15.2	13.5	11.6	15.7
	VIIT	20.2	19.1	22.3	20.3	23.5	27.7	28.5	27.2
Denmark	HIIT	4.5	2.7	2.9	9.2	17.2	4.3	5.5	8.7
	VIIT	17.5	19.4	18.1	20.3	19.9	24.3	25.1	24.5
France	HIIT	3.4	3.7	6.5	9.0	4.2	9.7	9.8	10.2
	VIIT	22.3	20.9	18.5	16.3	27.2	21.7	23.5	22.9
Germany	HIIT	4.8	5.1	6.5	15.1	8.5	12.6	12.2	16.2
	VIIT	30.9	31.7	32.3	25.4	34.6	29.8	30.7	28.6
Hungary	HIIT	8.0	12.3	11.7	12.8	8.5	5.9	5.3	7.9
	VIIT	18.7	17.8	17.0	19.0	19.2	19.4	32.4	30.4
Italy	HIIT	11.8	10.7	9.8	10	8.4	10.5	3.4	10.2
	VIIT	16.0	16.5	16.7	16.9	17.7	16.3	25.9	20.3
Netherlands	HIIT	4.7	5.8	5.1	3.0	6.1	4.2	4.3	7.8
	VIIT	16.0	15.5	17.7	23.7	21.6	20.0	20.7	19.7
Russian Federation	HIIT	0.5	0.6	0.6	2.7	0.6	1.4	0.9	2.3
	VIIT	7.3	7.3	7.0	6.6	6.2	5.9	7.7	5.9
Spain	HIIT	3.1	3.0	4.0	9.1	13.1	17.5	4.2	4.3
	VIIT	22.7	18.6	19.0	14.2	13.3	14.7	28.5	28.3
Sweden	HIIT	3.8	5.3	3.5	7.6	2.2	4.4	7.1	7.2
	VIIT	18.3	18.5	17.5	18.3	24.0	24.0	21.0	22.2
Slovakia	HIIT	7.1	9.5	5.8	6.9	7.5	6.4	8.0	9.2
	VIIT	13.5	12.7	14.7	14.2	15.8	18.7	18.2	17.0
Ukraine	HIIT	0.7	0.6	0.3	0.4	0.7	1.2	0.9	0.8
	VIIT	5.6	6.6	6.2	5.3	5.1	5.2	5.1	6.9
United Kingdom	HIIT	5.3	4.7	4.8	6.5	4.1	4.0	3.3	3.8
	VIIT	14.1	17.8	15.3	15.5	24.9	24.1	23.7	22.7

Source: Own calculations based on Eurostat data.

Table A2: Mean Shares of Horizontal and Vertical Intra-Industry Trade between Poland and Main Trade Partners +-25% Range [%]

Country	Type	Year							
		2000	2001	2002	2003	2004	2005	2006	2007
Austria	HIIT	7.3	7.0	6.3	6.1	6.5	8.1	6.4	6.2
	VIIT	15.6	14.1	13.5	15.3	17.7	13.9	17.9	22.0
Belgium	HIIT	6.3	8.8	13.2	16.5	14.1	9.3	6.7	11.6
	VIIT	10.2	10.1	9.0	9.8	12.4	13.6	17.4	12.4
Czech Republic	HIIT	17.7	20.8	19.5	22.8	22.7	21.0	18.2	24.1
	VIIT	15.0	13.3	17.1	15.4	16.1	20.2	22.0	18.8
Denmark	HIIT	6.4	4.4	6.7	12.8	20.5	8.6	9.3	13.1
	VIIT	15.5	17.7	14.3	16.7	16.6	19.9	21.4	20.1
France	HIIT	6.9	9.0	10.0	11.2	10.1	13.7	14.5	15.8
	VIIT	18.8	15.6	15.0	14.1	21.3	17.7	18.8	17.4
Germany	HIIT	10.4	11.1	12.9	19.1	16.1	17.7	17.2	22.4
	VIIT	25.3	25.7	25.8	21.3	27.0	24.7	25.7	22.3
Hungary	HIIT	12.8	18.1	16.1	17.8	14.1	7.9	11.2	11.3
	VIIT	13.8	12.0	12.5	14.1	13.6	17.3	26.6	27.0
Italy	HIIT	15.3	14.4	14.2	13.9	11.7	12.9	10.1	14.1
	VIIT	12.6	12.8	12.3	13.4	14.4	13.9	19.2	16.4
Netherlands	HIIT	6.9	8.3	8.9	7.3	8.4	7.5	6.2	10.8
	VIIT	13.8	13.0	13.9	19.4	19.3	16.6	18.8	16.7
Russian Federation	HIIT	0.9	1.5	1.2	3.4	0.9	2.0	1.2	2.8
	VIIT	7.0	6.5	6.4	5.9	5.9	5.3	7.4	5.5
Spain	HIIT	7.4	8.3	12.0	13.3	15.0	19.0	17.0	15.9
	VIIT	18.4	13.3	11.0	9.9	11.5	13.2	15.7	16.7
Sweden	HIIT	5.7	10.0	7.8	9.4	4.6	9.1	10.5	9.5
	VIIT	16.4	13.8	13.1	16.5	21.6	19.3	17.5	19.9
Slovakia	HIIT	9.1	11.0	8.7	9.3	10.5	9.6	12.6	13.2
	VIIT	11.4	11.2	11.8	11.7	12.9	15.6	13.6	13.0
Ukraine	HIIT	1.2	0.9	0.4	1.1	1.1	1.6	1.3	1.3
	VIIT	5.1	6.3	6.0	4.7	4.6	4.9	4.7	6.4
United Kingdom	HIIT	7.9	6.9	7.1	9.4	13.1	13.0	6.7	5.5
	VIIT	11.5	15.6	13.0	12.6	15.9	15.0	20.3	21.0

Source: Own calculations based on Eurostat data.