

# MATERIAŁY I STUDIA

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## Development of the trade links between Poland and the European Union in the years 1992–2002

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## Introduction

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The analysis of the trade between the European Union and Poland within the last ten years reveals three characteristic phenomena: high dynamics of trade volume, deterioration of the negative trade balance, as well as considerable changes in the commodity structure of trade, especially as regards the structure of Polish exports. Since the beginning of the 1990s, both the dynamics of trade volume and structural changes in trade with the EU countries have been considerably influenced by the mutual liberalisation of trade under the Association Agreement and the structural transformation of the Polish economy, in particular the inflow of foreign direct investment.

In light of the above considerations it seems that the quantitative analysis of the factors influencing the volume and prices of Polish trade with the European Union should be a very interesting area of studies. One of the fundamental and generally recognised trade theories is the so-called imperfect substitutes model. According to this model the basic factors determining the volume of exports and imports are price competitiveness and demand. In the case of prices, these determinants include exchange rate, domestic and foreign prices. The results of the estimation of the parameters of this model for the Polish economy, which are presented further in the paper, show that Polish exports and imports boast high elasticity vis-a-vis external and domestic demand respectively. Although the estimated price elasticities are lower than the income elasticities, they nevertheless fulfil the Marshall-Lerner condition, according to which an exchange rate depreciation contributes to an improvement in the trade balance. Moreover, the estimation results prove that imports and export prices are determined in approx. 60% to 70% abroad, while domestic factors account for 30% of their level.

The paper has been composed in the following way. Section One discusses the modifications to the commodity structure of the trade between Poland and the EU and the most crucial factors influencing the modifications discussed. Section Two describes issues concerned with the econometric modelling of trade. It also presents the theoretical form of the imperfect substitutes model. Moreover, it includes a discussion of the problems connected with the estimation of model parameters. Finally, the paper quotes parameter estimations for equations of volume and prices of Polish trade with the EU together with the interpretation of the results obtained. The paper ends with a recapitulation of the conclusions of the issues discussed.

JEL Classification:

F12 - Models of Trade with Imperfect Competition and Scale Economies

F15 - Economic Integration

F16 - Open Economy Macroeconomics

Keywords:

Economic Integration, Foreign Trade, Imperfect Substitutes Model, Cointegration.

## 1

## Dynamics of trade between Poland and the European Union as well as the changes in its structure

### 1.1. Main tendencies

In 2002 the value of Polish exports to the European Union totalled EUR 28 billion, while the value of imports reached EUR 37 billion. At that time, Poland ranked seventh among the suppliers of goods to the EU market in terms of exports value, and was the fourth largest recipient of EU exports. The dynamics of trade with Poland, similar to other Central and Eastern European countries, considerably outpaced the growth rate of the EU's external trade. As a result, Poland has regularly increased its share of EU trade, both as regards EU imports (from 1.5% in 1992 to 2.9% in 2002), and exports (from 1.9% to 3.8% respectively).

A higher growth in imports from the EU than in exports to the EU over the 1990s led to a fast increase in the negative balance of Polish trade with the EU countries. In 1998 its value exceeded EUR 12 billion. At that time it was the highest negative balance recorded by third countries in trade with the EU. However, in the next years the tendency of growing surplus of imports over exports was suppressed. In the period from 1999 to 2001 the negative balance in trade with the EU decreased by a cumulative amount of EUR 3 billion. In 2002 the negative balance of trade with the EU amounted to EUR 9 billion. At that time the EU recorded a higher positive balance only in trade with the US, Switzerland, United Arab Emirates and Hong Kong. Simultaneously, the positive balance of trade with the remaining seven Central and Eastern European countries (EUR 4.8 billion) was almost two times lower than in trade with Poland.

While for the EU the trade with Poland accounts for a mere 3% of external trade, in case of Poland the EU is the dominant trading partner. In 2002 the EU's share in Polish trade amounted to 68.7% of exports and 61.7% of imports. The high disparity of the mutual trade dependence is a result of varying roles that trade plays for the economies of the EU and Poland. While in the EU the value of per-capita exports amounts to EUR 6.8 thousand, in Poland the same figure is six times lower.

Analysing the trade between the EU and Poland in the last ten years one can point to three characteristic phenomena: high dynamics of trade volume, deterioration of the negative trade balance, as well as considerable changes in the commodity structure of trade, especially as regards the structure of Polish exports. Since the beginning of the 1990s, both the dynamics of trade volume and structural changes in trade with the EU countries have been considerably influenced by the mutual liberalisation of trade under the Association Agreement<sup>1</sup>, to be known as European Agreement and the structural transformation of the Polish economy, in particular the inflow of foreign direct investment.

Apart from FDI inflows and trade liberalization, the value of Polish trade with the EU was determined by changes of domestic final demand (imports), external demand (exports) and real exchange rate.

In years 1992–1993 robust domestic consumer demand, which was accumulated during the years of shortages, contributed to a significant growth of both production and imports. In this

<sup>1</sup> In years 1993–1996 Polish authorities introduced import tax, which increased protection of domestic market and therefore limited expansion of imports. This tax, which was consistent with GATT's balance of payments clause, was aimed to decrease Polish external disequilibrium. The tax base was the value of imports including custom duties. The tax rate, which initially amounted 6%, was gradually lowered to 5% in 1995 and 3% in 1996. Finally, in 1997 the tax was lifted.

**Table 1**  
Polish trade with the EU in years 1999–2002

	EU-12				EU-15						
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
EXPORTS											
Value (EUR m)	7,081	7,583	9,107	12,256	12,249	14,228	16,176	17,582	23,307	26,624	28,267
Previous year = 100	114	107	120	121a	100	116	114	109	133	114	106
1992=100	100	107	129	154a	154	178	203	220	292	334	354
Polish share in EU's extra imports (%)	1.45	1.56	1.69	2.25	2.11	2.12	2.28	2.25	2.26	2.59	2.86
Poland's rank in the EU's extra imports	16	16	13	7	8	8	8	10	9	7	7
IMPORTS											
Value (EUR m)	8,154	9,984	10,975	15,315	19,971	25,081	28,207	28,973	33,810	35,682	37,328
Previous year = 100	104	122	110	124a	130	126	112	103	117	106	105
1992=100	100	122	135	166a	217	272	306	314	367	387	405
Polish share in the EU's extra exports (%)	1.87	2.05	2.03	2.67	3.19	3.48	3.85	3.81	3.59	3.62	3.75
Poland's rank in the EU's external exports	12	11	10	7	4	5	4	4	4	4	4
BALANCE											
Value (USD m)	-1,073	-2,400	-1,868	-3,058	-7,722	-10,852	-12,030	-11,391	-10,503	-9,058	-9,061
Change (USD m)	590	-1 327	532	-868a	-4 664	-3,130	-1,178	639	889	1,444	-2
Coverage ratio <sup>b</sup>	86.8	76.0	83.0	80.0	61.3	56.7	57.3	60.7	68.9	74.6	75.7

<sup>a</sup> EU accession of Austria, Finland and Sweden – changes are presented on a comparable basis.

<sup>b</sup> exports/imports\*100.

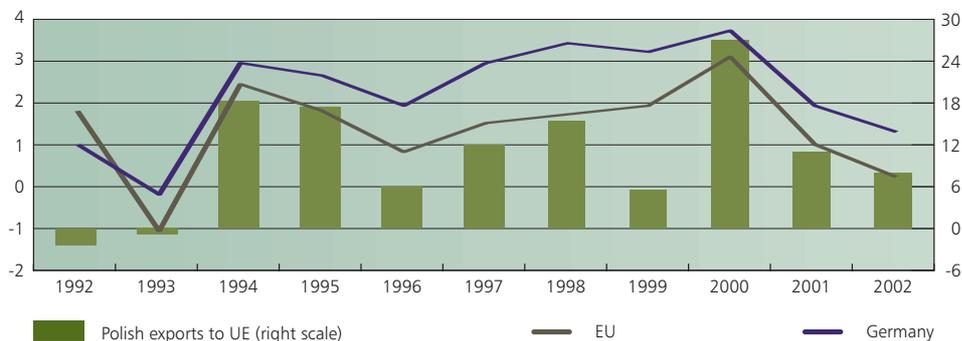
Source: Own calculations on the basis of EUROSTAT-Comext data.

period the expansion of imports enabled to meet consumer needs. Moreover, it also increased an offer of available goods on the Polish market. Strong domestic demand combined with falling demand in the EU had a negative impact on Polish exports' dynamics.

Subsequently, in years 1994–1997, Polish domestic demand was fueled by investments. In this period imports made possible to meet demand for both investment and intermediate goods. Simultaneously, external recovery resulted in a relatively high growth of Polish exports to the EU.

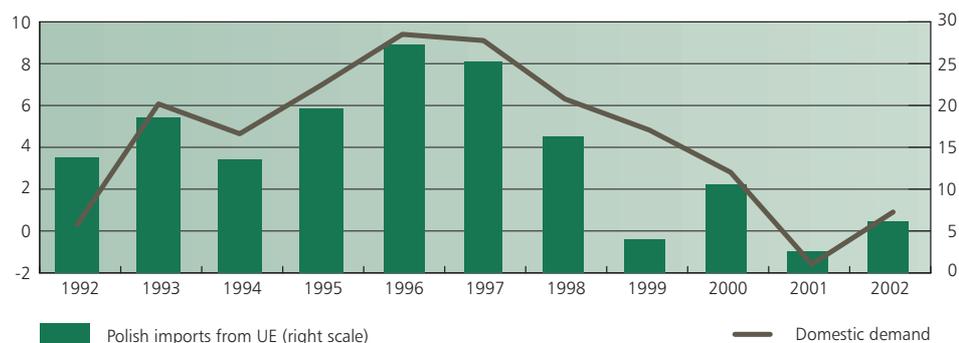
In years 1998–2002 a decline of the GDP as well as domestic demand dynamics contributed to a fall of imports annual growth rate to the lowest level since the beginning of the transformation. Initially, the Polish exports accelerated due to relatively strong external demand. In years 2001–2002, however, an economic slowdown in Germany and other EU countries led to a lower dynamics of Polish exports.

**Chart 1**  
GDP growth in Germany and other EU countries and the dynamics of Polish exports to the EU in years 1992–2002 (at constant prices, % change over previous period)



Source: Eurostat and CSO.

**Chart 2**  
**Domestic demand growth and the dynamics of Polish imports from the EU**  
**in years 1992–2002 (at constant prices, % change over previous period)**



Source: CSO.

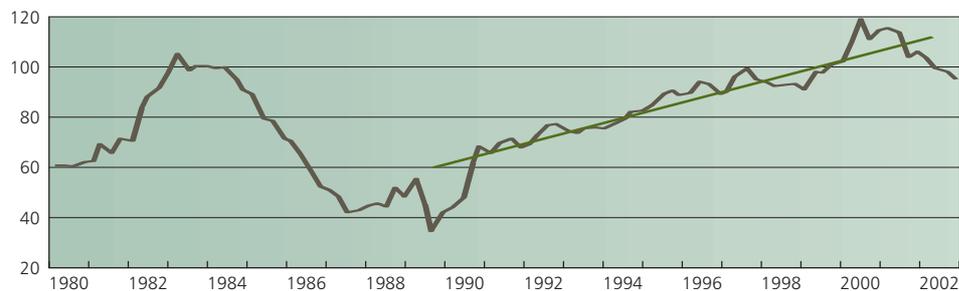
The profitability of imports and exports, and hence also their volumes, depends on the level of exchange rate. For this reason, we presented below a short description of the evolution of exchange rate regime in Poland during the last decade. At the beginning of the transformation period, the main purpose of the exchange rate policy was to stabilize the economy by supporting monetary policy in a fight against inflation. For this reason, in January 1990 the zloty was devalued by 46.2% and the rate was established at a level of 9500 zlotys per US dollar in the system of fixed exchange rate. On the same day, the zloty became an internally convertible currency. In this time, inflation counteracting<sup>2</sup> was based on reconstructing confidence in the domestic currency. According to the stabilization scheme, it was assumed that the rate of 9500 zlotys per US dollar would be valid for the first quarter of 1990 only. However, due to a sustainable positive current account balance it was changed after a year and a half. That took place in May 1991 when the zloty was devalued by nearly 17%, due to excessive real appreciation and a loss of price competitiveness of Polish products. In addition, from that moment the zloty was pegged to the basket consisting of the five currencies: the US dollar (45%), the German mark (35%), the pound sterling (10%), the French franc (5%) and the Swiss franc (5%). The fixed exchange rate regime lasted till October 1991, when the system of crawling peg was implemented. It was supposed to constitute a compromise between the anti-inflationary policy and a reinforcement of the competitiveness of Polish goods on the international market. However, as the rate of inflation was higher than the rate of parity devaluation the real exchange rate was still appreciating. This entailed two devaluations, in February 1992 and August 1993. A breakthrough in the exchange rate policy took place in May 1995, when the Polish authorities introduced the system of crawling band. This was a big step towards floating the zloty's exchange rate and making exchange rate policy more flexible. The excessive inflow of foreign capital put pressure on exchange rate appreciation. The zloty's rate stuck to the lower limit of admissible fluctuations and therefore in December 1995 monetary authorities were forced to revalue the zloty's rate. In 1998–1999 the fluctuation bands were several times expanded and finally, in April 2000 the exchange rate of the zloty was free-floated. This had an impact on the currency risk and therefore reduced the susceptibility of the Polish economy to currency speculations.

In years 1990–2003 real effective exchange rate of the Polish zloty was steadily appreciating. At the initial period of 1990–1992 substantial strengthening of Polish zloty was mainly due to the self-correction after a significant depreciation of 1989<sup>3</sup> and reorientation from planned into market economy. Subsequently, in years 1993–2003 average annual real appreciation amounting 2% resulted from the following reasons (see Chart 3):

<sup>2</sup> In that period exchange rate was an anti-inflationary anchor.

<sup>3</sup> From the 1st quarter 1989 to the 1st quarter 1990 the real effective exchange rate deflated by the consumer price index (CPI) weakened by 33%.

**Chart 3**  
Real Effective Exchange Rate of Polish Zloty in years 1980–2003



Source: IMF, IFS.

**Chart 4**  
Profitability (ratio of gross profits to turnover)



Source: CSO.

- The productivity in Poland grew faster than in its main trade partners. That is, the so-called Balassa-Samuelson<sup>4</sup> effect appeared.
- There occurred gradual liberation of administratively controlled prices and an increase of the rate of indirect taxes, which contributed to an increase in the *CPI*, without influencing the nominal exchange rate.
- The high potential rate of return on investment in Polish assets was reflected in the inflow of foreign capital. This inflow created appreciation pressure on the nominal exchange rate.
- There was an improvement in the terms of trade resulting from better quality and more effective methods of marketing in the tradable goods sector.

On the one hand, the part of the zloty's upward trend that was justified by macroeconomic fundamentals have not harmed the competitiveness of Polish products on international markets. On the other, the zloty's deviation from the equilibrium path could have influenced both competitiveness and profits of Polish companies. According to Rubaszek's<sup>5</sup> estimates, in years 1995–1999 zloty's rate was very close to its equilibrium level. Then, in years 2000–2001 it was overvalued by about 10–15% and after a considerable depreciation of 2002 it was brought back to the equilibrium level. We can extrapolate an analysis and conclude that the depreciation of 2003 led to an undervaluation of the zloty. This undervaluation was welcomed by Polish companies, especially exporters, as it significantly increased their profitability.

<sup>4</sup> Balassa B., 1964, The Purchasing Power Parity Doctrine: A Reappraisal, *Journal of Political Economy*, vol. 72, pp. 584–94.

<sup>5</sup> Rubaszek M., 2004, A Model of Balance of Payments Equilibrium Exchange Rate, Application to the Zloty, *Eastern European Economics*, vol. 42, p. 5–23.

## 1.2. Liberalisation of trade between Poland and the EU

The objective of the trade chapter of the Association Agreement was the establishment of a free trade area between Poland and the European Union for trade in industrial products. The gradual trade barriers reduction was based on the principle of asymmetry, consisting in the fact that the EU, being an economically stronger partner, commenced the opening of its market earlier<sup>6</sup>.

According to the above principle, the Community abolished customs duties on a substantial portion of Polish industrial exports as early as on March 1, 1992. With respect to the remaining goods a gradual reduction in customs duties was introduced, limited in the case of sensitive products only to pre-determined exports volumes within the agreed tariff quotas<sup>7</sup>. Since the beginning of 1995 virtually the entire Polish exports to the EU (excluding textiles and clothing) enjoyed a duty-free access to the EU market.

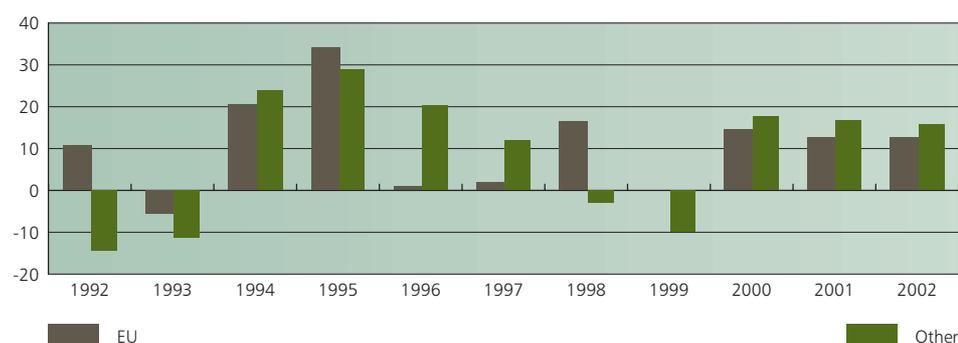
In Poland the process of liberalisation of access to the market of industrial goods imported from the EU started practically at the beginning of 1995. Customs duties on investment equipment and raw materials were lowered or completely abolished as early as in 1992. The main objective of fast liberalisation of these groups of products was the acceleration of the modernisation effort of the Polish economy. The liberalisation of imports of other industrial products was carried out with some exceptions until 1999 (customs duties on imports of petrochemical and metallurgical products were removed in 2000, and on cars in 2002).

Contrary to industrial products, the trade in agricultural products was subject to limited and selective liberalisation. This means that liberalisation in case of agricultural products covered only some products and consisted in an only partial reduction of trade barriers.

The process of establishing a free trade area for trade between Poland and the European Union did not evolve without having an impact on the Polish foreign trade. The well known effects of foreign trade creation and shift described in the theory of trade integration emerged in this process. These effects contributed to a faster increase in trade with the EU in comparison to other countries.

The confirmation of the fact that the Association Agreement contributed to the creation of new trade streams between Poland and the European Union might be found in a higher dynamics

**Chart 5**  
**Dynamics of Polish exports to the EU and other countries in years 1992–2002**  
(in EUR, % change over previous year)



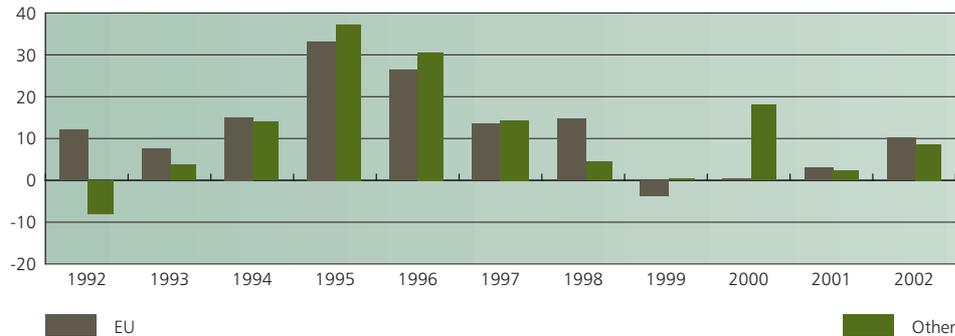
Source: Own calculations on the basis of Eurostat data.

<sup>6</sup> The asymmetry principle was supposed to make it easier for Polish exporters to export their goods on to the Community market during the first stage of legal effectiveness of the trade chapter under the Association Agreement, while simultaneously granting Polish manufacturers a longer period (by 3 years, i.e. until the commencement of the proper opening of the Polish market on to Community goods in January 1995) during which to prepare for the market entry of foreign suppliers.

<sup>7</sup> This applied to these groups of products, for which Member State manufacturers could offer little competition compared to imports, and simultaneously with respect to which Poland had the highest potential and comparative advantage. The relatively long period of liberalisation (compared to other goods), as well as its limited extent in the said fields caused that Polish exporters were unable to fully use their comparative advantage.

**Chart 6**

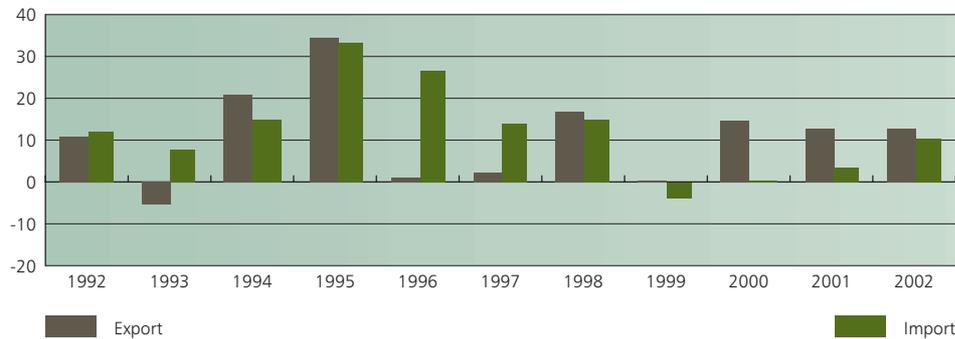
**Dynamics of Polish imports from the EU and other countries in years 1992–2002**  
(in EUR, % change over previous year)



Source: Own calculations on the basis of Eurostat data.

**Chart 7**

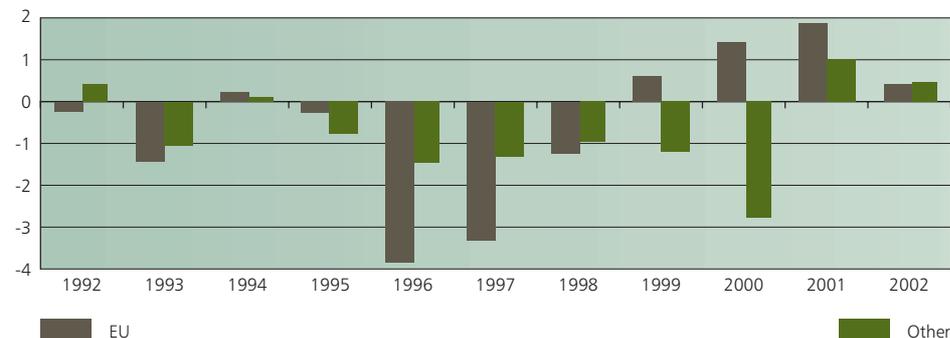
**Dynamics of Polish trade with the EU in years 1992–2002**  
(in EUR, % change over previous year)



Source: Own calculations on the basis of Eurostat data.

**Chart 8**

**Changes in the balance of trade with the EU and other countries in years 1992–2002**  
(in EUR billion compared to previous year)



Source: Own calculations on the basis of Eurostat data.

of trade with the EU countries compared to trade volume with other countries during the period of bilateral trade liberalisation (period from 1992 to 1999). In this time the exports to the EU countries rose at an annual rate of 9.4%, which figure was twice as high as in the case of other countries (4.6%). Simultaneously the imports from the EU rose by 14.4% annually, while from other

countries by 11.2%. A higher dynamics of imports from the EU compared to exports to the EU during the period of liberalisation provides also the evidence that the EU exporters have made better use of the preferences stipulated under the Association Agreement.

However, the shift (a reorientation of the geographical structure from East to West) in Polish trade occurred earlier (at the turn of 1980s and 1990s), which is attributable to the political and economic changes in the USSR and other COMECON countries, which considerably limited the import absorption capacity in these countries.

After one year from the entry into force of the Interim Agreement on Trade Issues, Polish exports to the EU countries grew by 11%. In the next year the exports dipped, which was a result of a decline in the domestic demand in the European Union (a GDP decline of 0.3%). However, in the following two years there was a substantial rise in exports which was triggered by the acceleration of the liberalisation process<sup>8</sup> (1994) and the abolishment of tariff quotas for the so-called sensitive products (1995). Thus in the years 1992–1995 as the reduction of EU customs duties on Polish imports progressed, the value of Polish exports to the EU increased on average by 14% annually. In the same period exports to other countries rose by 5% per annum.

In the following years (1996–1999), when the majority of Polish exports products benefited from a zero-rate customs duties in the EU, the exports dynamics experienced a considerable decline. Meanwhile, in the years 1996–1997 there was a fast growth in the exports to other countries, mainly as a result of high exports dynamics to the CIS countries. Owing to the occurrence of these tendencies, the EU's share in Polish exports shrank from 70% in 1995 to 64% in 1997. However, due to a collapse of exports directed to the Eastern markets in 1998, some of these exports were redirected to the EU countries. A formidable rise in exports to the EU in that year alleviated the negative consequences for the Polish foreign trade, brought about by the Russian crisis.

In 1992, the year in which there was a one-off reduction in the customs duties on some imports, the value of imports from the EU swelled by 12% compared to the previous year, while the imports from other countries fell by 8%. In the years 1993–1994, when the customs duties on EU imports remained unchanged, the imports dynamic diminished slightly. The average dynamics both of exports and imports in EU trade for this period were fairly similar, and the Polish – EU trade was relatively balanced (exports value accounted for approx. 90% of imports value).

The commencement of the second stage of liberalisation of imports in 1995 caused a considerable (threefold) acceleration in the dynamics of imports from the EU. Jointly in the years 1995–1998 imports from the EU rose by an annual average of 22%, which was a much faster rate than the one posted before the outset and following the completion of the customs duties reductions for Polish imports. In the same period there was also a significant growth in imports from other countries (an average increase of 21%). The general liberalisation under the WTO that began in 1995 and the implications of other free trade agreements concluded by Poland in that period made a contribution to this phenomenon. Increased inflow of foreign investment both from the EU and other countries further reinforced the rise of imports. The high dynamics of imports was supported by a high rate of economic growth (in years 1995–1998 Poland recorded the highest average GDP growth rate, and its dynamics exceeded 6% at that time).

The high correlation with the trade liberalisation schedule is further confirmed by the growing negative balance of trade with the EU. In the years when Poland reduced customs duties on the access of goods from the EU to its market, there was also a considerable worsening of the deficit.

However, following the completion of the liberalisation process, i.e. since 2000 trade (both exports and imports) with other countries recorded a higher dynamics. A significantly faster increase in exports to the EU compared to imports from the EU in that period (in the years 2000–2002) is primarily related to the weakening of the domestic demand in Poland, which not only had an impact on the lowering of the imports dynamics, but also propelled exports by shifting a part of production from the domestic market onto the exports markets. Moreover, foreign

<sup>8</sup> At the Copenhagen Summit in June 1993, the European Council took a decision on accelerating the liberalisation of imports from Poland compared to the time schedule specified in the Association Agreement.

investment recorded over that period also had an effect on the acceleration of exports. This led to a substantially faster growth of exports, which coupled with the sustained tendency of stagnating imports (in the years 2000–2001 the average growth in imports amounted to a mere 2% per annum), contributed in consequence to a considerable reduction of the negative balance.

### 1.3. Inflow of foreign direct investment

Alongside the trade liberalisation, progress was also made in the liberalisation of capital flows, and the Polish economy was gradually reintegrated into the global financial system. The system of tax relieves and exemptions, new legal regulations, implementation of the principle of national treatment of investors and prominently the high GDP growth rate in the mid-1990s, coupled with a relatively stable economic situation, fostered the inflow of foreign direct investment.

The growing share in exports and imports taken by companies with foreign capital provides evidence for the significant importance of such enterprises. Until 1999 these companies were responsible mainly for the worsening of the negative trade balance; however, currently this group generates the majority of the increases in Polish exports. In 2001 the exports of companies with foreign capital accounted for 57% of total Polish exports to the EU. A higher propensity of companies with foreign capital to export their products compared to the enterprises with solely Polish capital is primarily linked to the utilisation of foreign distribution channels. Simultaneously, the companies with foreign capital participation accounted for 65% of imports from the EU in 2001.

Companies from the EU countries rank on top of the list of foreign investors in Poland. According to the data of the Polish Foreign Investment Agency, over 70% of capital invested in Poland in the form of foreign direct investment originated in the EU countries. From a list comprising nearly 980 foreign companies, whose capital investment in Poland exceeded EUR 1 million, more than 730 were enterprises from EU member states (of which 230 were German firms).

### 1.4. Changes of the commodity structure of Polish exports to the EU

Since the beginning of the 1990s there have been significant changes in the commodity structure of exports to the European Union, with an increase in the share of higher processed goods and the adjustment of exports structure towards the replication of the structure of internal trade within the EU. The second aspect of structural changes is especially significant in relation to the rank that Poland will take up on the European Single Market. While in the first half of the 1990s there was a growth in the share of industrial products in Polish exports (at the cost of agricultural and mineral products), in the following years, and especially at the beginning of the 21<sup>st</sup> century, there have been substantial modifications within this group of goods. The fact that in the last year the dynamics of exports of machinery and transport equipment was more than twice as high (the value of exports increased cumulatively by 19% in both groups) as in the case of other commodity groups resulted in an increase in their share in Polish exports up to 42%.

On the other hand, one can observe the declining significance of the groups that determined the strength of Polish exports at the beginning of the EU integration process, and these groups included metallurgical products, wood manufactures, textiles and clothing, as well as chemical products. The above mentioned four groups accounted for as much as 45% of total exports to the EU in 1994. At the outset, the growth in exports was driven by lower labour costs and cheaper raw materials than in the EU. Increasing labour costs, slower opening of the EU market for these products, as well as a small participation of foreign investors in the generation of exports with respect to the above mentioned industries brought about a systematic decline in the importance of these products in the exports to the EU. Owing to a significant decline of the dynamics, the share taken by these groups in exports to the EU fell to 26% in 2002. Simultaneously, these products turned out to be very sensitive to the shrinking of import demand in the EU countries. In the years 2001–2002 the cumulative value of their exports rose only by 5%.

The most important group in the structure of Polish exports to the EU is currently constituted by **machinery and equipment** (SITC 71–77). In 2002 it made up as much as 1/4 of total exports of goods to the EU, a figure three times higher than at the beginning of the 1990s. A fast increase in the importance of machinery and equipment was the effect of high growth dynamics, which was almost two times higher than for the total Polish exports to the EU (on average in the years 1992–2002 at 24%). The major contribution to this effect has been made to a large extent by foreign investments in the electrical machinery and car industries. The inflow of capital into these industries caused a deep modification of their offer of export goods. The high growth dynamics in the years 2001 and 2002 indicates that these products turned out to be less sensitive to the weakening of the economic situation in the exports markets. A significant role in the exports of machinery and equipment is played by the exports of various types of spare parts, elements and subcomponents. This points to the high importance of intra-firm trade carried out within international corporate structures of multinational companies which created a globally or regionally integrated production network. The highest share in this trade was taken by combustion engines, parts to electrical appliances and electrical wiring. Television sets had a major part in the trade of finished products (parts imported from abroad are of substantial importance to their manufacturing).

**Table 2**  
**Change in the commodity structure of exports to the EU according to the SITC sections**

SITC-Rev. 3 division	Value (EUR m)		Share (%)		Average annual change (%)			
	1992	2002	1992	2002	92–95	96–99	00–02	92–02
<b>Total (0-9)</b>	<b>7,081</b>	<b>28,267</b>	<b>100.0</b>	<b>100.0</b>	<b>12.8</b>	<b>9.4</b>	<b>17.1</b>	<b>12.7</b>
<b>Primary goods (0-4)</b>	<b>2,028</b>	<b>3,711</b>	<b>28.6</b>	<b>13.1</b>	<b>4.5</b>	<b>0.7</b>	<b>12.9</b>	<b>5.3</b>
Food and live animals (0+1)	859	1,556	12.1	5.5	-2.9	5.9	11.8	4.2
Crude materials, except fuels (2+4)	636	763	9.0	2.7	1.1	-2.2	10.1	2.2
Fuel products (3)	533	1,392	7.5	4.9	17.1	-2.8	16.0	9.1
<b>Manufactured goods (5-8)</b>	<b>4,876</b>	<b>24,227</b>	<b>68.9</b>	<b>85.7</b>	<b>17.2</b>	<b>11.5</b>	<b>18.0</b>	<b>15.3</b>
Chemical products (5)	490	1,144	6.9	4.0	-2.2	0.9	16.9	3.9
Machinery, transport equipment (7)	891	10,832	12.6	38.3	26.6	23.7	26.5	25.5
Other manufactured articles (6+8)	3,495	12,251	49.4	43.3	17.6	7.2	12.1	12.2
Other (9)	177	225	2.5	0.8	-7.3	-2.5	14.2	0.0

Source: Own calculations on the basis of EUROSTAT-Comext data.

Similar tendencies were observed in the exports of **transport equipment** (SITC 78–79). In the years 1992–2002 the exports of products classified in this section rose on average by 29% annually (which is an even higher growth rate than in the case of machinery) and by consequence their share in exports to the EU increased from just under 6% in 1992 to over 13% in 2002. The high dynamics of exports in this group, especially in the first half of the 1990s was the effect of the launch of industrial assembly of cars in Poland. In the following years the number of car makers present in Poland increased rapidly, and new models were introduced into assembly. The slump on the European car market brought about a visible weakening of the growth of passenger car exports in the years 2001–2002 (the year 2001 saw even a decline of exports). At the same time, the production of car components started to develop as the scale of finished cars production increased. It was the fast growing exports of car parts and accessories that contributed in the last years to the continuation of the high dynamics in this group. The scale of this phenomenon is illustrated by the fact that the value of car parts exports is now similar to the value of exports of new cars.

The recent years have seen a systematic decline in the share of **metallurgical products** (SITC 67–69) in the exports to the EU. This was a result of a decline in absolute terms in the exports of metallurgical products in the second half of the 1990s, as well as of a significantly lower exports dynamics for this group compared to other industrial products in the recent years. The falling importance of metallurgical products was caused, among other factors, by the situation on the world metal markets – primarily on the copper market, a limitation of the production capacity of

Polish steel works – on the basis of the restructuring scheme for the domestic steel industry agreed with the EU, as well as frequent protectionist actions taken by the EU with respect to imports from Poland (consisted in application of anti-dumping procedures). Moreover, the demand for Polish products shrank in the years 2001–2002 as a consequence of the weakening economic situation in the EU countries, and especially in Germany. Owing to the above tendencies there was a substantial change in the structure of exports of the metallurgical products; the share of iron, steel and aluminium products increased, while the role of copper, iron and steel diminished.

**Table 3**  
**Change in the commodity structure of exports to the EU according to the SITC sections with the highest share in the value of exports in 2002**

SITC-Rev. 3 division	Value (EUR m)		Share (%)		Average annual change (%)			
	1992	2002	1992	2002	92–95	96–99	00–02	92–02
Road vehicles (78)	312	3,140	4.4	11.1	50.1	21.3	20.7	30.9
Furniture, bedding, mattresses (82)	354	2,503	5.0	8.9	24.4	15.1	18.0	19.2
Electrical machinery (77)	189	2,236	2.7	7.9	26.3	23.4	17.0	22.7
Power generating machinery, equipment (71)	82	2,035	1.2	7.2	9.9	23.8	80.7	31.4
Clothing and clothing accessories (84)	979	1,733	13.8	6.1	18.4	2.7	-1.4	6.9
Manufactures of metal (69)	325	1,521	4.6	5.4	16.3	10.8	17.4	14.5
Telecommunication, sound, TV, video (76)	11	1,223	0.2	4.3	28.7	51.9	25.9	35.9
Coal, coke and briquettes (32)	461	1,032	6.5	3.7	17.4	-1.4	11.8	8.7
General industry machinery and equipment (74)	103	898	1.5	3.2	9.7	20.8	24.4	17.6
Cork and wood manufactures (63)	207	842	2.9	3.0	21.1	11.4	5.9	13.3

Source: Own calculations on the basis of EUROSTAT-Comext data.

Among the groups of products exported to the EU characterised by the high labour intensity, the highest dynamics was recorded in the exports of **furniture** (SITC 82). In the years 1992–2002 its exports rose on average by 19% (which was a considerably higher rate of growth than in the case of total exports of processed goods). In 2002 the growth rate of furniture exports managed even to accelerate, despite a lowering of the EU imports demand. The relatively high dynamics of exports in this industry is primarily the effect of investments carried out by the EU countries. Western European companies contributed in this way to the modernisation of the Polish furniture industry. Due to their activities, the furniture manufactured in Poland was introduced into their own distribution networks. It is worth mentioning here that this group has posted the highest share of foreign investment in exports among all the labour intensive and raw materials intensive industries.

In recent years a spectacular decline in the share of exports to the EU has been noted in the case of **textiles** (SITC 84). At the beginning of the 1990s they made up 16% (1993) of the value of goods exported to the EU markets, while in 2002 this figure dwindled to a mere 6%. The high share at the beginning of transition was a result of the high importance of refining processing in the textiles industry. Over 80% of apparel exports were carried out under this form of cooperation. The refining processing in the first half of the 1990s was the decisive factor for the dynamic expansion of textiles exports. Together with the rising labour costs, which are the decisive factor in this activity, the contractors from the EU countries shifted an ever larger portion of the contracts executed so far in Poland, to other countries that were more competitive in this respect. The limitation of the role of this kind of processing had its first negative effect by translating into a dramatic lowering of the exports dynamics, and starting from 1999 through the decline in exports value.

Despite considerable changes in the structure of Polish exports to the EU countries, which evolved towards the replication of the exports structure of Member States (the best proof of which is the growing share of machinery and transport equipment), the share of **chemicals and related products** (SITC 5) remains very low. Moreover, since the second half of the 1990s a tendency for this share to decline further has been noticeable. This disparity depicts the grave technological gap

between the Polish economy and the economies of the EU countries. There are also significant differences in the product assortment; with total Polish exports being dominated primarily by raw materials intensive products, while in the trade with the EU the focal point of this domination are high technology products. The reason for the diminishing share of chemicals in Polish exports in recent years has been, *inter alia*, the steep decline in the exports of chemical fertilizers (by nearly 40% in the years 2001 and 2002), which ranked among the most important group of chemicals exported (mainly due to application of anti-dumping measures and duties). A similar tendency can be also observed in the case of chemical raw materials (especially organic ones). Conversely, in the recent years there has been an increase in the exports of cosmetics and cleaning agents – as the effect of the activities undertaken by companies with foreign capital.

The relatively high exports dynamics of **cork and wood** (SITC 24) and **cork and wood manufactures** (SITC 63) in 2002 offset the drop in the exports of this group that was recorded in the previous year. Despite a 6% growth in the value of exports in 2002, similarly to other groups of raw materials intensive and labour intensive products, the significance of wood manufactures in exports to the EU has become marginalized in the recent years. The tendency of stagnating exports for this group, which has been recorded since 1996, stands in stark contrast to the exports dynamics that characterised wood exports in the first half of the 1990s (an annual average of nearly 21%). A significant role in the expansion of exports was attributed then to the competitive advantage of Poland as a manufacturing location. However, the declining importance of this group in exports was caused, *inter alia*, by the anti-dumping customs duties imposed by the EU on imports from Poland, and in recent times by a slump on the construction markets in Western Europe. The most significant recipient of Polish wood is the construction industry, especially in Germany. Huge declines in this market negatively affect the volume of Polish exports.

The **paper industry** (SITC 64) is without a doubt an example for a fast expanding export industry. To take an example, at the beginning of the 1990s products originating from this sector accounted for as little as 1% of Polish exports to the EU. Over a period of ten years their share tripled, owing to a high dynamics of paper product exports (an average annual rate of 22%, similar to machinery and equipment) compared to total exports. Foreign investors, including investors from countries outside the EU, contributed to the fast growth in exports of this industry. This indicates that Poland may be a starting point for the expansion of exports to the European markets for companies from other regions of the world.

Mineral fuels (SITC 3) also fall into the category of product groups, whose share in Polish exports to the EU has diminished significantly. A high importance of mineral fuels at the beginning of the 1990s resulted from the significant role that Poland had played as the supplier of coal to Western European countries. On the one hand, the limits on coal extraction following from the adopted programme of mining industry restructuring, coupled, on the other hand, however, with a growth of exports recorded by countries boasting considerably lower extraction costs, caused a speedy reduction of the size of coal supplies, despite the fact that the EU countries increased imports of coal from third countries over the same period (mainly through the limitation of own production). As a result the value of Polish exports also fell (although in the years 2000 and 2001, the growing coal prices on the global markets caused a growth in the value of exports). Recent years have witnessed a substantial increase in the exports of oil refining products, which currently account for 25% of mineral fuel exports.

**Agricultural products** (SITC 0+1) remain the only group of goods in Polish trade with the EU, in the case of which the customs duties will be entirely lifted only following the Polish accession to the EU. Thus the removal of customs duties, which in the case of industrial products brought about the creation of new trade streams, was in general less significant for the development of trade in agricultural products. In the years 1992–2002 the exports of agricultural products to the EU rose by an annual average of 4.2%, while in the case of industrial products this figure stood at 14% per annum. It is worth stressing that over this period the value of Polish agricultural exports to the EU increased by just under EUR 700 thousand even despite an enlargement of EU by the addition of three new members. The

expansion of exports took off only after 2000 and was related mainly to the increased exports of processed goods. These products, covered by high level of protection on the EU market, accounted for merely of agricultural products exports at the beginning of the 1990s. In years 2001–2002 the scale of preferences in the trade in agriculture products was further extended in comparison to the European Agreement<sup>9</sup>. Nevertheless, the general pattern of liberalization had not changed as most of the preferences were controlled by tariff quotas.

### 1.5. Changes in the commodity structure of Polish imports from the EU

Changes in the commodity structure of imports have been lesser than in the case of exports. The groups of products that dominated the imports from the EU at the beginning of the 1990s continue to play a significant role in imports today (though there have been some changes within these groups). The reshuffle of priorities that has taken place in the structure of imports has resulted to a large extent from the ever increasing role of companies with foreign capital in Polish trade, as well as the from the development tendencies observed in the Polish economy.

Since the beginning of the 1990s the commodity structure of imports has been dominated by **machinery and equipment** (SITC 71–77). A high share of these products in the imports to Poland is a consequence of the domestic economy's investment requirements, as well as of the fact that a large proportion of products classified under this category is constituted by spare parts and components of products destined for exports. The increased scale of this phenomenon leads to a situation where the changes in exports and imports have become almost parallel (this phenomenon relates also to other product groups). In the years 2000–2002 the shrinking domestic demand in Poland, in particular the reduction of investment and partially procurement demand had an impact on a considerable slow-down of the imports in this group. As a result, the share of machinery and equipment has fallen to just under 30%.

**Table 4**  
**Changes in the commodity structure of imports from the EU, according to SITC sections**

SITC-Rev. 3 division	Value (EUR m)		Share (%)		Average annual change (%)			
	1992	2002	1992	2002	92–95	96–99	00–02	92–02
<b>Total (0-9)</b>	<b>8,154</b>	<b>37,328</b>	<b>100.0</b>	<b>100.0</b>	<b>11.7</b>	<b>17.3</b>	<b>8.8</b>	<b>12.9</b>
<b>Primary goods (0-4)</b>	<b>1,504</b>	<b>2,959</b>	<b>18.4</b>	<b>7.9</b>	<b>5.9</b>	<b>5.2</b>	<b>7.8</b>	<b>6.2</b>
Food and live animals (0+1)	780	1,622	9.6	4.3	2.3	4.4	8.8	4.8
Crude materials, except fuels (2+4)	244	904	3.0	2.4	21.3	4.6	16.8	13.8
Fuel products (3)	481	434	5.9	1.2	5.1	8.1	-6.9	2.7
<b>Manufactured goods (5-8)</b>	<b>6,395</b>	<b>33,525</b>	<b>78.4</b>	<b>89.8</b>	<b>13.2</b>	<b>18.7</b>	<b>9.1</b>	<b>14.0</b>
Chemical products (5)	1,065	6,082	13.1	16.3	18.1	18.9	12.9	16.9
Machinery, transport equipment (7)	2,780	15,760	34.1	42.2	7.5	21.6	8.8	12.8
Other manufactured articles (6+8)	2,551	11,684	31.3	31.3	18.7	15.2	7.7	14.3
Other (9)	254	252	3.1	0.7	-1.7	-6.2	3.7	-1.9

Source: Own calculations on the basis of EUROSTAT-Comext data.

<sup>9</sup> An agreement signed on September 26, 2000, which came into effect on January 1, 2001, further liberalized the trade in agriculture products between Poland and the EU. According to this agreement the scale of liberalization was dependent on the sensitivity of products. Both sides lifted custom duties on low sensitive products (e.g. horse meat, mushrooms) for which the external EU tariff was lower than 10%. For some of products (e.g. berries, plums, fresh and pickled cucumbers) Poland was granted unilateral concessions including an elimination of tariffs without any quotas. Other products (e.g. powdered milk, fresh beef, molasses) were allowed to be exported to the EU within duty-free quotas. In return, Poland lifted tariffs on goods not produced at home (melons and watermelons, kiwi fruits, almonds). Sensitive goods for the EU (pork, poultry, cheese) were liberalized according to the "double zero" method, which meant elimination of custom duties by increasing tariff quotas by 10% annually and elimination of export subsidies (also in the non-quota trade). Another agreement, which was signed on October 16, 2002, came into effect on February 1, 2003 and concerned bilateral liberalization of trade in the processed agricultural products.

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A fast growth in the imports of **transport equipment** (SITC 78–79) is a reflection, on the one hand, of the growing consumer demand (imports of cars), on the other hand, however, of the procurement imports (parts to vehicles assembled in Poland). The expansion of the industrial assembly of cars triggered a large increase in the imports of car parts; however, in the years 1999–2002 their import stabilised. On the one hand, this was a consequence of the increase in their domestic production, but on the other hand, it resulted from a lowering of the demand for new cars both domestically, and on the major exports markets. The year 2002, however, saw another considerable growth in the imports of passenger cars – especially used ones (by almost 10% compared to the previous year), as well as of utility vehicles. It resulted, among other things, from the removal of customs duties in the wake of the completion of the liberalisation of the access to the Polish car market under the Association Agreement. A substantial rise in passenger car imports brought about the fact that in 2002 the imports of consumer goods posted the highest growth dynamics across all the major categories of imports sections.

Apart from machinery and transport equipment, the **chemicals** (SITC 5) are the most important group of imports to Poland. In 2002 they constituted 16% of total imports from the EU. Over the last ten years their share in imports has remained at a comparable level, though in the years 2000–2001 there was a clear decline in the imports dynamics of chemicals. This group has been dominated by pharmaceuticals, which account for 1/4 of chemical industry's imports. At the same time, it was also pharmaceuticals which posted the highest average dynamics (15%). Conversely, in recent years there has been a considerable fall in the share of chemical raw materials in favour of finished goods. The relatively high dynamics of plastics imports was upheld in 2002. In this case the imports involve primarily the basic forms of products.

In the years 1992–2002, the imports of **metallurgical products** (SITC 67–69) from the European Union grew on average by 18% per annum, thus the imports dynamics for this group was higher than for total industrial products. This has led to a systematic increase in the share of metallurgical products in the imports from the EU. A fast growth in imports in this case was a result of at least two factors; first of all, there was a high demand for higher quality products, which the domestic manufacturers were unable to satisfy, and secondly, there was a reduction in the output of the Polish metallurgical industry as a consequence of the implementation of the programme of restructuring of this sector. The imports dynamics for metallurgical products is also considerably higher compared to the respective exports dynamics. As a result, while in the mid-1990s Poland recorded a high positive balance in trade with the EU (EUR 1 billion in 1995) in this group, currently the deficit widens as each year progresses (EUR 220 million in 2002).

**Table 5**  
**Changes in the commodity structure of the imports from the EU, according to the SITC sections with the highest share in the value of imports in 2002**

SITC-Rev. 3 division	Value (EUR m)		Share (%)		Average annual change (%)			
	1992	2002	1992	2002	92–95	96–99	00–02	92–02
Road vehicles (78)	646	4,455	7.9	11.9	2.1	20.7	11.2	11.1
Electrical machinery (77)	371	2,804	4.6	7.5	24.0	25.2	9.8	20.3
General industry machinery and equipment (74)	604	2,549	7.4	6.8	13.1	17.9	7.2	13.2
Textile yarn, fabrics and related products (65)	779	2,031	9.6	5.4	19.6	6.5	3.3	10.2
Machinery specialized for particular ind. (72)	459	1,685	5.6	4.5	9.7	16.0	2.2	9.8
Manufactures of metal (69)	228	1,524	2.8	4.1	20.4	22.6	10.6	18.4
Medicinal and pharmaceutical products (54)	217	1,489	2.7	4.0	17.4	19.7	19.6	18.8
Paper, paperboard and articles thereof (64)	158	1,361	1.9	3.6	34.6	14.6	11.3	20.6
Telecommunication, sound, TV, video (76)	226	1,266	2.8	3.4	9.3	31.6	1.2	14.5
Iron and steel (67)	153	1,112	1.9	3.0	19.1	14.9	15.7	16.6

Source: Own calculations on the basis of EUROSTAT-Comext data.

One of these groups of products in the case of which a significant decline in its share in the imports from the EU has been observed are **textiles** (SITC 65). Such a considerable fall has been caused by the value of textiles procurement destined for refining processing in Polish enterprises, which has diminished since 1998 – this was also reflected on the part of exports. Finished clothing classified under apparel (SITC 84) is of significantly lesser importance for imports, but also in this case a tendency of the falling value of imports can be noted. This results from the weakening of the domestic consumer demand and the substitution of Western European clothing for Asian imports.

Similarly to exports, also in the case of imports there has been a significant disparity between the dynamics of **agricultural products** (SITC 0+1) and industrial products. While in the years 1992–2002 the imports of agricultural products grew on average by 4.8%, the imports of industrial products increased at an annual rate of 14%. As a consequence, the share of agricultural products in the imports from the EU shrank from nearly 10% at the beginning of the 1990s to just over 4% in 2002. Following a considerable decline in its dynamics in the second half of the 1990s, the growth in imports has accelerated since 2001, which is probably a result of further liberalisation of the agricultural trade.

## 1.6. The assessment of changes in the commodity structure of Polish trade with the EU

When performing an assessment of the structural changes that have taken shape in Polish trade with the European Union over the last ten years one can use the ‘contribution to trade balance’<sup>10</sup> indicator that shows the industries in which Poland has achieved the highest specialization in exports. This indicator also reflects the changes in the revealed comparative advantages. In 1992 the highest specialization (competitive advantages) indicators were recorded for the exports of other industrial products (SITC 6+8) and agricultural products (SITC 0+1), as well as raw materials (SITC 2+4), while the highest rate of de-specialisation (negative values of the indicator) were found in the case of machinery and transport equipment (SITC 7)

**Table 6**  
**Specialisation of Poland in relation to EU: “contribution to trade balance” index in thousandths of GDP**

10 top performers in 1992	1992	2002	10 top performers in 2002	1992	2002
Clothing and clothing accessories (84)	23.9	7.9	Furniture, bedding, mattresses (82)	8.1	12.7
Non-ferrous metals (68)	13.0	2.4	Clothing and clothing accessories (84)	23.9	7.9
Coal, coke and briquettes (32)	12.8	5.8	Power generating machinery, equipment (71)	-0.1	7.0
Furniture, bedding, mattresses (82)	8.1	12.7	Coal, coke and briquettes (32)	12.8	5.8
Metaliferrous ores and metal scrap (28)	5.7	1.1	Cork and wood manufactures (63)	5.3	3.8
Vegetables and fruit (05)	5.5	1.8	Other transport equipment (79)	0.4	2.4
Cork and wood manufactures (63)	5.3	3.8	Non-ferrous metals (68)	13.0	2.4
Iron and steel (67)	5.1	-1.3	Manufactures of metals (69)	3.5	2.1
Live animals (00)	4.7	0.4	Vegetables and fruit (05)	5.5	1.8
Cork and wood (24)	4.5	1.1	Rubber manufactures (62)	0.2	1.8

Source: Own calculations on the basis of EUROSTAT-Comext data.

<sup>10</sup> “Contribution to trade balance” indicator: in order to measure the comparative advantages of Poland in relation to the EU, a “contribution to trade balance” indicator was calculated (See CEPIL, “La mesure des avantages comparatifs révélés, Lafay 1997, Economie Prospective Internationale”). The indicator compares, in thousandths of GDP, the trade balance recorded for a product in relation to a theoretical trade balance that would exist if there were no comparative advantage or disadvantage. The theoretical balance (the case when there is no specialisation) is calculated according to a specific product’s share in total trade. Without specialisation, the trade balance for a product should correspond to the product’s share in total trade. The theoretical balance is obtained by multiplying the product’s percentage share in total trade by the total trade balance. The difference between the recorded and theoretical balances, expressed in thousandths of GDP, is calculated as follows:

$$(X_p - M_p) - [(X - M) * ((X_p + M_p) / (X + M))] * 1000 / \text{GDP}, \text{ where } X_p \text{ and } M_p \text{ are exports and imports of product "p".}$$

and chemicals (SITC 5), which are technologically intensive goods. In 2002 the highest specialisation indicators were found in the exports of other industrial products and agricultural articles, however, in most cases their values have declined substantially compared to their 1992 levels. In some cases Poland has lost its comparative advantages. This is true, *inter alia*, for iron and steel products. Simultaneously, the lowering of the specialisation indicators has been accompanied by the reduction in the de-specialisation indicators for groups consisting of capital intensive processed goods. Some industries classified under machinery and transport equipment have even gained specialisation advantages. The highest change in the value of the indicator was recorded for power generating machinery and telecommunications equipment. Despite far-reaching changes that have taken place in the commodity structure of Polish exports to the EU, the highest levels of the indicator continue to be recorded primarily for the exports of labour intensive products (such as furniture or apparel).

What follows from the above presented tendencies is that at the beginning of the 1990s Polish trade with the EU countries was based primarily on the classical model of foreign trade, which centres on the comparative advantages. This resulted from the complementarity of Polish economy with respect to the EU market, which had been proven by the indicators of revealed comparative advantages, with the highest value obtained by unprocessed and low processed products. Poland enjoyed (and continues to enjoy) comparative advantages in trade with the EU mostly in the group of labour intensive and raw materials intensive goods. There was, however, no such advantage in case of high technology products. The Polish economy, being relatively rich in labour, specializes primarily in the manufacturing of labour intensive products that are sold in exchange for goods requiring relatively higher human and physical capital inputs.

The structure of Polish exports, in which the low processed raw materials, supplies and consumer (raw materials intensive and labour intensive) products still play a significant role, makes exports extremely sensitive to the state of the economic situation in the EU, as well as to the exchange rate fluctuations. However, the major barrier to the expansion of Polish exports still remains the relatively low share of high processed and technology intensive goods in the array of exports products on offer.

The entry into force of the European Agreement and the inflow of foreign direct investment fostered the increase in the share of processed goods, in particular of machinery and transport equipment. A strong rise in trade in this group has contributed in a fundamental way to the increase in the importance of the intra-industry trade between Poland and the EU. Currently approximately half of the foreign trade with the European Union consists of the trade within the same product groups.

**Table 7**  
**Changes in the share of intra-industry trade and inter-industry trade in the trade between Poland and the EU in the years 1992–2002**

	Total	Intra-industry trade		Inter-industry trade
		Horizontal	Vertical	
1992	24.0	2.5	21.5	76.0
1993	29.0	2.4	26.6	71.0
1994	27.4	4.3	23.1	72.6
1995	30.1	4.1	26.1	69.9
1996	37.0	4.7	32.3	63.0
1997	40.2	4.8	35.4	59.8
1998	42.4	7.6	34.9	57.6
1999	44.2	7.4	36.8	55.8
2000	44.2	7.6	36.6	55.8
2001	43.3	7.7	35.6	56.7
2002	44.3	9.4	34.8	55.7

Source: Own calculations on the basis of EUROSTAT-Comext data.

Although in the years 1999–2002 the share of intra-industry remained stable, the process of further structural changes manifests itself in that the importance of horizontal<sup>11</sup> trade increases at the expense of the dominant vertical trade.

The improvement in the intra-industry index<sup>12</sup> in the years 1992–2002 provides evidence for the real integration of the Polish economy into the European Union; however, the relatively low level of this indicator – compared to the EU member states, confirms the existing asymmetry of demand (disparities in the GDP *per capita*) and supply (the technological gap) factors driving the intra-industry division of labour.

The accession to the European Union will contribute to the unification of the quality, safety and environmental requirements in force in Poland and in the EU, which, according to the integration theory, should foster further creation of bilateral trade streams. It is expected that along the EU accession there will be an increase in the inflow of foreign direct investment, which will further spur the expansion of trade. One can also expect that, as the foreign direct investment grows, there will be a rise in the transposition of ever more modern technologies. The transfer of more modern technologies compared to the ones transferred up-to-date, would enable a fast technological modernisation of the economy. This, in turn, would bring about an upward shift of Poland's position with respect to its technological advancement and, in the end effect, it would trigger a growth in the share of high processed products in Polish exports.

<sup>11</sup> The horizontal (non-quality) differentiation of a product takes place when its individual variations are of the same quality, but differ with respect to other features. In case of vertical differentiation, the differences relate to quality, which is mainly attributable to the production technique, and thus to the supply side of the market. Usually an improvement in quality involves incurring additional expenditures. Thus, as the quality enhances, the unit price of the product increases (and it is not true, as is most often the case with horizontal differentiation, that all the variations are manufactured using a similar technique and sold at comparable prices).

<sup>12</sup> The estimation of the share of intra-industry trade in the total trade between Poland and the European Union has been performed on the basis of the intra-industry exchange indicator adjusted for the trade balance:

$$\frac{\sum (X_i + M_i) - \sum |X_i - M_i|}{\sum (X_i + M_i) + \sum |X_i - M_i|} \times 100$$

where  $X_i$  denotes exports of industry  $i$ ,  $M_i$  – denotes imports of industry  $i$ . The calculations have been performed according to the 5-digit SITC classification. The delineation of intra-industry trade into horizontal and vertical trade has been conducted using criteria adopted by D. Greenaway, Hine and C. Milner (1994 and 1995), where horizontal trade is any trade that fulfils the following condition:

$$1 - \alpha \leq \frac{xUV_i}{mUV_i} \leq 1 + \alpha$$

while for vertical trade this condition is as follows:

$$\frac{xUV_i}{mUV_i} < 1 - \alpha \quad \text{or} \quad \frac{xUV_i}{mUV_i} > 1 + \alpha$$

where  $UV$  denotes a unit value of a given product, and  $\alpha$  – the dispersion indicator for the unit values (assumed at the level of 15%).

## 2

## An econometric model of Polish trade with the European Union

## 2.1. Issues concerning the modelling of trade flows

The selection of the proper model explaining the variation in exports and imports should be preceded by a qualitative analysis of traded goods. This is due to the entirely different characteristics of trade in homogenous goods, such as crude oil, copper or wheat than in the case of highly diversified consumer goods. The market for homogenous goods can be likened to a fully competitive free market, where the demand is characterised by an infinite price elasticity. Conversely, the market for heterogeneous goods might be compared to a competitive monopoly market. In the former case the model applied most frequently is the perfect substitutes trade model, while in the latter case the usage of the imperfect substitutes model is recommended.

The following choice that has to be made during the specification of a foreign trade model is the level of data aggregation<sup>13</sup>. In the case of analyses performed on detailed data, the method usually applied is the division of goods into groups at the level of *SITC* sections<sup>14</sup>. On the one hand, the advantage of disaggregation is the possibility of obtaining more detailed information on the development of exports and imports in all the commodity groups. In addition, there is the opportunity to take into consideration the internal interactions occurring between these groups. On the other hand, the detailed data concerning exports and imports are usually prone to larger, relative measurement errors than the aggregate data. As a consequence, after performing a renewed aggregation of the data the results of the estimation obtained could be worse from the ones arrived at by using the aggregate data in the first place.

Finally, before beginning with a specification of a foreign trade model, one has to select a variable which will be explained by this model. As a rule the endogenous variables in the trade models are the transaction prices or the trade volume – the values of exports and imports are taken as endogenous variables very rarely<sup>15</sup>. It should be added here that the available data are very often given at current prices. In such a case the variables should be split into prices and volumes, which could provide a lot of trouble in practice.

## 2.2. The imperfect substitutes model

The basic assumption underlying the imperfect substitutes model is, as the name of the model would suggest, the lack of perfect substitution between goods imported (exported) and goods available on the domestic market. This is an assumption that finds empirical confirmation. First of all, if the above mentioned goods were perfect substitutes, then each country could only be an exporter or an importer of a homogenous good. In reality countries are both exporters and importers of goods. Moreover, the perfect substitutes hypothesis implies the law of one price, for which little confirmation has been found in empirical studies<sup>16</sup>.

<sup>13</sup> For the majority of the developed economies, data concerning trade are available in a very detailed decomposition into the product groups (e.g. the *SITC* classification). The time series for exports and imports are also available in the breakdown by world regions. As a result, the empirical studies can be performed on the aggregate or disaggregate data.

<sup>14</sup> There are, however, papers featuring a more detailed division, e.g. Stone J., 1979, Price elasticities of demand for imports and exports: Industry estimates for the U.S., the E.E.C. and Japan, *Review of Economics and Statistics*, no 61, pp. 117-123.

<sup>15</sup> Value of exports (imports) is the product of volume and transaction prices.

<sup>16</sup> The exceptions are homogenous goods, such as crude oil, metals, etc., which are traded in international commodity markets.

The general form of the imperfect substitutes model is the following<sup>17</sup>:

- the domestic demand for imports (volume):

$$M^D = f(Y, P_M[1+T], P), \quad (1)$$

where  $f_1 > 0; f_2 < 0; f_3 > 0$  are the first derivatives of the  $f$  function with respect to  $Y, P_M[1+T], P$  respectively;

- external supply of imports (volume):

$$M^S = g(P_X^*[1+S^*], P^*), \quad (2)$$

where  $g_1 > 0; g_2 < 0$  are the first derivatives of the  $g$  function with respect to  $P_X^*[1+S^*], P^*$ ;

- external demand for domestic exports (volume):

$$X^D = h(Y^*, P_M^*[1+T^*], P^*), \quad (3)$$

where  $h_1 > 0; h_2 < 0; h_3 > 0$  are the first derivatives of the  $h$  function with respect to  $Y^*, P_M^*[1+T^*], P^*$ ;

- domestic supply of exports (volume):

$$X^S = j(P_X[1+S], P), \quad (4)$$

where  $j_1 > 0; j_2 < 0$  are the first derivatives of the  $j$  function with respect to  $P_X[1+S], P$  respectively.

The above formulae use the following notation:  $Y$  is the nominal level of final demand;  $P_M, P_X$  and  $P$  are the levels of imports, exports, and total prices; while  $S$  and  $T$  represent the percentage rates of exports subsidies and the customs duties. The variables accompanied by "\*" relate to the foreign, while the ones without "\*" denote the home country<sup>18</sup>. In addition, the following relationships between the variables from the equations (1)–(4) hold:

$$P_M = \frac{P_X^*}{E} \quad (5)$$

$$P_M^* = P_X E \quad (6)$$

where  $E$  is the nominal exchange rate<sup>19</sup>.

According to the equation (1), the domestic demand for imports from abroad is an increasing function of the final demand and the general level of domestic prices, and a decreasing function of the import prices adjusted for the custom duties rates. This means that for the aggregate function of imports the possibility is ruled out that the goods imported are inferior goods. Also the equation (2) indicates that the supply of imported goods onto the domestic market is an increasing function of the foreign transaction prices in exports, which represent the income of foreign manufacturers, and a decreasing function of the general level of foreign prices, which reflect the production cost pressure abroad. The interpretation of equations (3) and (4) is symmetrical with respect to equations (1) and (2).

In practice the neutrality of money to the real sector of the economy is assumed, i.e.  $f_1 + f_2 + f_3 = 0$  and  $h_1 + h_2 + h_3 = 0$  (see equations (1) and (3)). Taking into account the above relationships, one can divide the right-hand side of the equations (1) and (3) by the general price level  $P$  or  $P^*$ . In this way one obtains a relationship between the demand for imports (exports) and the real income and the relative price level:

$$M^D = k\left(\frac{Y}{P}, \frac{P_M[1+T]}{P}\right), \quad (7)$$

where  $k_1 > 0, k_2 < 0$  are the first derivatives of the  $k$  function with respect to  $\frac{Y}{P}, \frac{P_M[1+T]}{P}$  respectively;

<sup>17</sup> This is a model featuring the so-called domestic – foreign market division. More information on this model can be found in the work of: Goldstein M., Khan M., 1985, *Income and price effects in foreign trade*, chapter 20 in Jones, Kenen P. (editors), *Handbook of International Economics*, vol. II, Elsevier Science Publishers B.V.

<sup>18</sup> The  $P_M^*$  and  $P_X^*$  indices represent foreign prices of imports from – and of exports on to the home market.

<sup>19</sup> Increase in the value of  $E$  indicates an appreciation of the domestic currency.

$$X^D = l\left(\frac{Y^*}{P^*}, \frac{P_M^*[1+T^*]}{P^*}\right), \quad (8)$$

where  $l_1 > 0$ ,  $l_2 < 0$  are the first derivatives of the  $l$  function with respect to  $\frac{Y^*}{P^*}, \frac{P_M^*[1+T^*]}{P^*}$ .

It should be added that for the sake of empirical applications the indices of export and import prices are often modelled within the framework of the 'price maker – price taker' concept. According to the above concept, the mentioned indices are dependent on the general price level in home ( $P$ ) and on the general level of foreign prices expressed in the domestic currency ( $P^*/E$ ), and namely:

$$P_x = p(P, P^*/E), \quad (9)$$

$$P_M = q(P, P^*/E), \quad (10)$$

where the respective derivatives of  $p_1$ ,  $p_2$ ,  $q_1$  and  $q_2$  are non-negative numbers. Sometimes the so-called homogeneity restriction is imposed in the process of estimating the parameters of the  $p$  and  $q$  functions, i.e.  $p_1 + p_2 = 1$ , and  $q_1 + q_2 = 1$ . The homogeneity condition means that if the indices of domestic prices and of foreign prices expressed in the domestic currency rise by 1%, then the indices of imports and export prices should also rise by 1%.

Recapitulating, the imperfect substitutes model constitutes a perfect theoretical outline, on the basis of which one can draw conclusions concerning the factors determining the volume and prices in foreign trade. For this reason the model is very often used as the subject of econometric analyses.

### 2.3. Econometric issues around the imperfect substitutes model

In practice the majority of econometric analyses concerning trade focus on the demand side of exports and imports. To a large extent this is a consequence of the fact that demand is the main factor influencing the trade volume over the short and medium term, while the adjustments on the supply side take place only in the long term. Also the model of trade between Poland and the EU, which is described in the following section, considers the function of demand for exports and imports. Owing to the above, further sections of this paper discuss only the issues pertaining to the modelling of the demand side of exports and imports.

The theoretical outline of the imperfect substitutes model indicates that the demand for exports and imports depends on the real income and relative price level (see equations (7) and (8)). However, the theory does not provide any unambiguous answer to the question concerning the dynamics of these relationships. In practice, a certain delay in the reaction of the trade volume to an income or price shock is observed. These delays are caused, *inter alia*, by such phenomena as: adjustment costs, imperfect flow of information, etc. As a result, the econometric trade model should have a very carefully selected dynamic specification. One of the possible solutions is the application of the Koyck specification<sup>20</sup>. In this case the parameters of the following model are estimated (see equations 7 and 8):

$$X_t = \beta_{X,0} + \alpha_X X_{t-1} + \beta_{X,1} \frac{Y_t^*}{P_t^*} + \beta_{X,2} \frac{P_{M,t}^*[1+T_t^*]}{P_t^*} + \eta_{X,t}, \quad (11)$$

$$M_t = \beta_{M,0} + \alpha_M M_{t-1} + \beta_{M,1} \frac{Y_t}{P_t} + \beta_{M,2} \frac{P_{M,t}^*[1+T_t]}{P_t} + \eta_{M,t}. \quad (12)$$

The above equations are the algebraic transformations of a model with an infinite distribution of lags, with the weights being a decreasing geometrical sequence, i.e.:

$$X_t = \gamma_{X,0} + \sum_{i=0}^{\infty} (\gamma_{X,1i} \frac{Y_{t-i}^*}{P_{t-i}^*} + \gamma_{X,2i} \frac{P_{M,t-i}^*[1+T_{t-i}^*]}{P_{t-i}^*}) + \varepsilon_{X,t}, \quad (13)$$

$$M_t = \gamma_{M,0} + \sum_{i=0}^{\infty} (\gamma_{M,1i} \frac{Y_{t-i}}{P_{t-i}} + \gamma_{M,2i} \frac{P_{M,t-i}^*[1+T_{t-i}]}{P_{t-i}}) + \varepsilon_{M,t}, \quad (14)$$

<sup>20</sup> The application of the Koyck model automatically implies the linear form of the function of demand for imports (exports).

where  $\gamma_{X,ji} = \beta_{X,j}(\alpha_X)^i$  and  $\gamma_{M,ji} = \beta_{M,j}(\alpha_M)^i$  for  $j=1, 2$ . It needs to be noted here that the Koyck model implies the identical distribution of lags in the event of a demand and price shock. This assumption finds no confirmation in empirical studies, which indicate that the reaction of imports (exports) to an income impulse is quicker than to a price impulse. The reason for this phenomenon, as Junz and Rhomberg<sup>21</sup> indicate, lies in the different adjustment periods resulting from the difference in lags: recognition of the shock, taking a decision, change of supplier, change of good and change of production technology. Moreover, as in the case of the income shock, the assumption of geometrically decreasing weights seems to be intuitive, in the case of relative prices shock a similar type of reasoning would seem unjustified. It is more reasonable to assume weights, which are relatively low for the initial lags, reach their maximum level in the period from two to four quarters, and then fade to zero. As a result, some authors assume that lag weights distribution is described by a polynomial function, the so-called Almon function<sup>22</sup>.

The progress made over the 1980s and 1990s in the analysis of non-stationary series resulted in the fact that currently the parameters of an imperfect substitutes model are usually estimated within the framework of a cointegration analysis<sup>23</sup>. Without a doubt the huge advantage of the cointegration analysis is the possibility to distinguish between the long-term and short-term relationships. Moreover, the short-term equation, i.e. the error correction model, offers a lot of space in determining the dynamics of the relationship between the dependent variable of the model and variables exogenous to the model.

A review of papers concerned with the estimation of the function of demand for exports and imports, which was included in the paper by Goldstein and Khan<sup>24</sup>, offers some interesting information. First of all, the average elasticities of exports and imports with respect to relative prices amounted to -1.14 and -1.00 respectively, with a complete adjustment taking place within 2 to 3 years. Secondly, the average income elasticities amounted to 1.56 and 1.45 respectively for exports and imports, with the majority of adjustment taking place in the first two quarters following the occurrence of the shock. Elasticities assuming values above one confirm the hypothesis of a growing share of exports and imports in the GDP.

On the basis of the above information one can conclude that in the short term the changes in trade volume are caused by income shocks. Whereas in the medium term the relative prices, and hence exchange rates, have a substantial impact on exports and imports.

## 2.4. The trade model for Poland

This section presents the results of the estimation of parameters of the imperfect substitutes model for trade between Poland and EU. The parameters have been estimated for the demand function for Polish exports and imports, as well as for the function of imports and export prices, presented in equations (7)–(10). The authors used the analysis of non-stationary series. The estimation has been conducted in two stages. First, the long-term relationships, i.e. the cointegration relationships, have been estimated. Then, the short term dynamics has been estimated within the framework of the error correction models (ECM), with the error correction term (ect) being obtained in the first stage of the estimation.

The estimation has been performed on the basis of quarterly data for the period from 1<sup>st</sup> Q 1995 until 4<sup>th</sup> Q 2003, which translates into 36 quarterly observations. The results of the analysis are presented below.

<sup>21</sup> Junz H., Rhomberg, 1973, Price competitiveness in export trade among industrial countries, *American Economic Review*, no 63, pp. 412-418.

<sup>22</sup> The Almon model has been applied e.g. in the paper by Goldstein M, Khan M, 1976, *Large versus small price changes and the demand for imports*, IMF Staff Papers, no 23, pp. 200-225.

<sup>23</sup> This approach has been used e.g. by Hooper P., Johnson K., Marquez J., 1998, *Trade elasticities for G-7 Countries*, International Finance Discussion Papers no 609, Board of Governors of the Federal Reserve System.

<sup>24</sup> Goldstein M., Khan M., 1985, op.cit.

### 2.4.1 The export prices model

The index of prices for goods exported to the European Union has been modelled within the 'price maker – price taker' framework (see equation 9). According to the said concept, this index depends on the domestic prices and foreign prices. The Producer Price Index (PPI) in manufacturing has been used to approximate the domestic prices index ( $P$ ). The foreign prices have been approximated as the weighted averages of the PPI in manufacturing for the EU countries ( $P_j^*$ ). The share of the value of Polish exports to the individual EU regions over the period from 1995 to 2002 in the total exports to the EU (see table 8) has been used as the weights. In order to express foreign prices in domestic currency, we adjusted them for changes in nominal effective exchange rate ( $E$ ).

It has been assumed that the  $p$  is an exponential function (equation 9) and that the homogeneity condition is fulfilled. In consequence, the parameters of the following model with restrictions have been estimated:

$$\ln(P_x)_t = \alpha_0 + \alpha_1 \ln\left(\frac{P_1^*}{E}\right)_t + (1 - \alpha_1) \ln(P)_t + \varepsilon_{1,t} \quad (15)$$

Since the equation (15) is presented in the logarithmic form, the estimated parameters are interpreted as elasticities. The parameter estimates obtained, together with the standard deviations, are as follows.

$$\ln\left(\frac{P_x}{P}\right)_t = \underset{(0,06)}{-1,08} + \underset{(0,06)}{0,76} \ln\left(\frac{P_1^*}{E}\right)_t + (1 - 0,76) \ln(P)_t \quad (16)$$

The results show that price elasticity of exports relative to external prices amounts to 76%, while relative to the domestic prices it stands at 24%. This means that the index of export prices to the EU is determined in 76% by the prices in the EU, while in 24% – by the domestic prices. The estimated parameters are statistically significant, and the high value of the determination coefficient at the level of  $R^2$  denotes a satisfactory fit of the model. The value of the Augmented Dickey-Fuller<sup>25</sup> test at the level of  $ADF = -2.1$  [ $p = 0.03$ ] indicates the stationarity of the model's error terms, which means that the equation (16) is a co-integrating relationship.

**Table 8**  
Share in the Polish exports to the EU (%)

	Denmark	UK	Sweden	Eurozone	EU 15
1995	4.3	5.8	3.6	86.3	100
1996	4.6	6.0	3.6	85.7	100
1997	4.6	5.9	3.7	85.8	100
1998	4.0	5.7	3.5	86.7	100
1999	4.4	5.7	3.5	86.4	100
2000	3.9	6.4	3.9	85.8	100
2001	3.8	7.2	4.0	85.0	100
2002	4.0	7.6	4.7	83.6	100
<b>1995–2002</b>	<b>4.2</b>	<b>6.3</b>	<b>3.8</b>	<b>85.7</b>	<b>100</b>

Source: OECD.

According to the above discussion, the error correction model has been applied to estimate the short-term dynamics of the index of prices of exports to the EU. According to the 'from general to specific' approach, the least squares method has been used to estimate the following model:

$$\Delta \ln(P_x)_t = \lambda_0 - \rho \text{ect}_{t-1} + \sum_{p=1}^P \lambda_p \Delta \ln(P_x)_{t-p} + \sum_{q=0}^Q \sum_{k=1}^K \lambda_{qk} \Delta x_{k,t-q} + v_{1t} \quad (17)$$

<sup>25</sup> Dickey D., Fuller W., 1981, Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root, *Econometrica*, vol. 49, pp.1057-1072 and Dickey D., Said S., 1994, Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order, *Biometrika*, vol. 71, pp. 599-608.

where  $ect$  denotes the error correction term<sup>26</sup>, while  $x_k$  is the  $k$ -th independent variable occurring in the co-integrating relationship. The following estimation has been arrived at:

$$\Delta \ln\left(\frac{P}{X}\right)_t = \underset{(0.004)}{-0.003} - \underset{(0.13)}{0.19} ect_{t-1} + \underset{(0.08)}{0.51} \Delta \ln\left(\frac{P^*}{E}\right)_t + \underset{(0.01)}{0.05} \Delta \ln(P)_t, \quad (18)$$

where  $R^2=56.0\%$ ,  $LM(4)=1.63$  [ $p=0.80$ ],  $JB(2)=0.69$  [ $p=0.71$ ] indicate good statistical properties of the model (18)<sup>27</sup>.

#### 2.4.2. The import prices model

Just as in the case of export prices index, the index of prices of imports of goods from the European Union is modelled within the 'price maker – price taker' framework (see equation 10). The domestic PPI in manufacturing ( $P$ ) has been used once again as the approximation of the domestic prices index, while the external prices have been approximated as the weighted averages of the PPI in manufacturing of the EU countries ( $P_2^*$ ) expressed in zloty. In comparison to the export prices model a change has been made in the weights, which here reflect the share of values of Polish imports from the individual EU countries in the years 1995–2002 in the total imports from the EU (see table 9). Again an assumption has been made about the exponential form of the  $q$  function from the equation (10) and the homogeneity condition has been assumed to hold. In consequence parameters of the following model with restrictions have been estimated:

$$\ln(P_M)_t = \beta_0 + \beta_1 \ln\left(\frac{P_2^*}{E}\right)_t + (1 - \beta_1) \ln(P)_t + \varepsilon_{2,t}. \quad (19)$$

The parameter estimations obtained, together with the standard deviations, are as follows.

$$\ln(P_M)_t = \underset{(0.06)}{-1.30} + \underset{(0.06)}{0.97} \ln\left(\frac{P_2^*}{E}\right)_t + (1 - 0.97) \ln(P)_t. \quad (20)$$

The results indicate that the index of prices of imports from the EU countries is determined in almost 100% by prices in the EU. This means that in the case of import prices Poland is by some 21 percentage points more of a 'price taker' than in the case of export prices. The estimated parameters are statistically significant, and the high value of the determination coefficient at the level of  $R_2=95.0\%$  indicates a satisfactory fit of the model. The value of the Augmented Dickey-Fuller<sup>28</sup> test at the level of  $ADF=-3.38$  [ $p=0.00$ ] indicates the stationarity of the model's error terms, which means that the equation (20) is a co-integrating relationship.

**Table 9**  
Share in the imports from the EU (%)

	Denmark	UK	Sweden	Eurozone	EU 15
1995	3.4	8.0	4.9	83.7	100
1996	3.4	9.2	4.2	83.1	100
1997	3.1	8.6	4.7	83.6	100
1998	3.0	7.5	4.4	85.2	100
1999	2.8	7.1	4.9	85.3	100
2000	2.6	7.3	4.7	85.4	100
2001	2.9	6.8	4.4	85.9	100
2002	2.8	6.3	4.3	86.5	100
<b>1995–2002</b>	<b>3.0</b>	<b>7.6</b>	<b>4.6</b>	<b>84.8</b>	<b>100</b>

Source: OECD.

<sup>26</sup> The error correction term is the deviation of the real value of the PX variable from its level obtained from the co-integrating relationship formulated by the equation (16).

<sup>27</sup> LM(4) denotes the c2 test of the Lagrange multipliers for the autocorrelation of the error term of order 4, while JB denotes the Jarque-Berra normality test for the error term. The results mean that the error term is normally distributed and is not auto-correlated in the given model.

<sup>28</sup> cf. footnote 27.

The short-term dynamics of the index of prices of imports from the EU has been estimated in the same way as in the case of the index of export prices, i.e. within the framework of the specification of the error correction model (see equation 17). The following estimations have been obtained:

$$\Delta \ln(P_M)_t = 0.001 - 0.50 \text{ect}_{t-1} + 0.70 \Delta \ln(P^*/E)_t + 0.04 \Delta \ln(P)_t, \quad (21)$$

(0.004) (0.17) (0.11) (0.18)

where  $R^2=61.3\%$ ,  $LM(4)=6.3$  [ $p=0.18$ ],  $JB(2)=6.6$  [ $p=0.04$ ] indicate good statistical properties of the model (21).

### 2.4.3. The model of the volume of exports to the European Union.

According to the imperfect substitutes theory, the volume of exports depends on the external demand and the price competitiveness of Polish goods on the markets of the EU countries (see equation 8). The endogenous variable in the equation is the exports volume index ( $X$ ). The independent variables are assumed to be external demand, which has been approximated by the weighted real GDP in the EU ( $Q^*$ )<sup>29</sup>; the price competitiveness of Polish goods exported to the EU markets, which is measured as the ratio of the export prices index augmented by tariffs to the external prices expressed in the same currency ( $\frac{P_x[1+T^*]}{P_1^*/E}$ ).

We have decided to impose a unity restriction on income elasticity in the long-run specification. Moreover, we have added a linear trend that reflects a tendency of increasing share of Polish exports at European markets. In consequence the parameters of the following equation have been estimated:

$$\ln(X)_t = \gamma_0 + \gamma_1 t + \ln(Q^*)_t + \gamma_2 \left( \frac{P_x[1+T^*]}{P_1^*/E} \right)_t + \varepsilon_{3,t}. \quad (22)$$

The results of the estimations of other studies of the demand for exports function that have been partially discussed in section 3 of this paper indicate that the economically acceptable values of the estimated parameters amount for the price elasticity is . The parameter estimations obtained:

$$\ln(X)_t = -3.17 + 0.024 t + \ln(Q^*)_t - 0.39 \ln\left(\frac{P_x[1+T^*]}{P_1^*/E}\right)_t. \quad (23)$$

(0.31) (0.001) (0.25)

indicate rather low price elasticity of Polish exports to the EU. Positive value of coefficient  $g_1$  confirms the hypothesis that has been already quoted above, on the growing share of exports in the foreign GDP. The determination coefficient at the level of indicates a good fit of the model, while the value of the Augmented Dickey-Fuller test at the level of  $ADF=-2.3$  [ $p=0.02$ ] indicates the stationarity of the model's error terms, which means that the equation (23) is a cointegrating relationship.

The short-term dynamics of the volume of Polish exports to the EU has been estimated, the same as in the case of the previous variables, within the framework of the specification of the error correction model (see equation 17). The following estimations have been obtained:

$$\Delta \ln(X)_t = 0.15 - 0.28 \text{ect}_{t-1} + 1.59 \Delta \ln(Q^*)_t - 0.43 \Delta \ln\left(\frac{P_x[1+T^*]}{P_1^*/E}\right)_t, \quad (24)$$

(0.08) (0.16) (1.89) (0.23)

where  $R^2=27.4\%$ ,  $LM(4)=4.8$  [ $p=0.31$ ],  $JB(2)=1.1$  [ $p=0.57$ ] indicate acceptable statistical properties of the model (24). It is worth to mention, that the short-term income elasticity is higher than unity, what means that cyclical demand is more exports creating than trend demand.

### 2.4.4. The imports volume model

The fourth and last modelled variable is the volume of Polish imports from the European Union. In line with the imperfect substitutes theory it has been assumed that imports volume is a function of the weighted final demand and price competitiveness of goods imported from the EU on the Polish market. The endogenous variable in the equation is the imports volume index ( $M$ ). The first independent variable was the real final demand ( $Q$ ), measured as the weighted sum of private

<sup>29</sup> The weights have been shown in table 1.

consumption ( $C$ ), investment ( $I$ ), government consumption ( $G$ ), exports of goods and services ( $EX$ )<sup>30</sup> and change in inventories ( $\Delta Inv$ ). The weights were taken from Marczewski (2002, s. 117) and were equal to the import content of each of these components. Consequently weighted final demand was given by identity:

$$Q = 0.22C + 0.36I + 0.06G + 0.24X + 0.17\Delta Inv. \quad (25)$$

The second independent variable was price competitiveness of goods imported from the EU on the domestic market which has been approximated by the ratio of the import prices index augmented by tariffs and import taxes to the domestic prices index ( $\frac{P_M[1+T]}{P}$ ).

Similarly as in the exports volume equation, we have imposed a unity restriction on income elasticity in the long-run specification. Moreover, we have added linear trend that reflects a tendency of increasing share of imports in Polish GDP.

In consequence the parameters of the following model have been estimated.

$$\ln(M)_t = \delta_0 + \delta_1 t + \ln(Q)_t + \delta_2 \ln\left(\frac{P_M[1+T]}{P}\right)_t + \varepsilon_{4,t}. \quad (26)$$

The estimations of the parameters obtained:

$$\ln(M)_t = \underset{(0.02)}{-1.57} + \underset{(0.001)}{0.009}t + \ln(Q)_t - \underset{(0.11)}{0.55} \ln\left(\frac{P_M[1+T]}{P}\right)_t, \quad (27)$$

indicate a moderate price elasticity, which is nevertheless higher than in case of exports volume equation. The estimated parameters are statistically significant and coherent with economic theory. The determination coefficient at the level of indicates a high fit of the model, however the value of the Augmented Dickey-Fuller test at the level of  $ADF = -1.9$  [ $p = 0.06$ ] leads to ambivalent conclusions concerning the stationarity of the model's error terms.

The short-term dynamics of the volume of Polish imports from the EU has been re-estimated within the framework of the specification of the error correction model (see equation 17). The following estimations have been obtained:

$$\Delta \ln(M)_t = \underset{(0.01)}{0.03} - \underset{(0.09)}{0.17} ect_{t-1} + \underset{(0.22)}{1.84} \Delta \ln(DD)_t - \underset{(0.09)}{0.20} \Delta \ln\left(\frac{P_M[1+T]}{P}\right)_{t-1}, \quad (28)$$

The computed statistics:  $R^2 = 71.8\%$ ,  $LM(4) = 7.6$  [ $p = 0.11$ ],  $JB(2) = 1.1$  [ $p = 0.57$ ] indicate acceptable statistical properties of the model (28).

## 2.5. The analysis of the reaction of Polish trade to external shocks

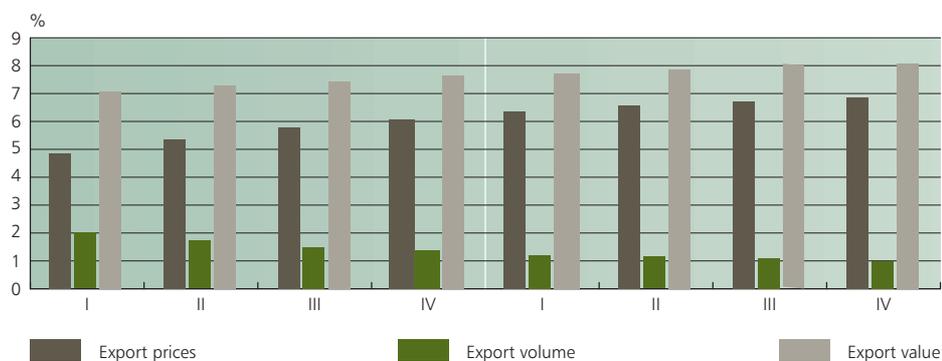
On the basis of the model of Polish foreign trade specified in section 4, an analysis has been performed of the reaction of prices and volume of exports and imports to an impulse in form of a depreciation of the real effective exchange rate of zloty relative to the currencies of the EU countries by 10%<sup>31</sup>. The real depreciation of the effective exchange rate has been introduced into the model as a rise in foreign prices as expressed in zloty ( $\Delta \ln P^*/E = 10\%$ ) at a given constant level of domestic prices ( $\Delta \ln P = 0$ ). According to the presented model, a weakening of the zloty has an impact in the first place on the growth of the imports and export price indices expressed in national currency units. It should be added that the export price index expressed in foreign currency units declines. This translates into a rise in the price competitiveness of the domestic products sold on the foreign markets and into a fall in the competitiveness of the imported products on the domestic market. As a result there is an increase in the volume of exports and a decline in the volume of imports. In the case of exports, the price and volume effects are of the same direction, i.e. we experience a growth of value. In the case of imports, the two effects are of opposite directions.

The results of an 'impulse – response' analysis, presented in charts 9 and 10, indicate that as a result of an impulse in the form of a sustained real depreciation of zloty by 10%, the

<sup>30</sup> Data from national accounts.

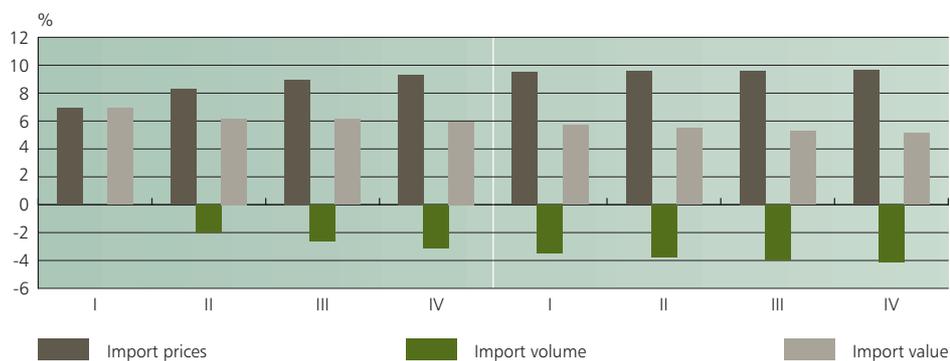
<sup>31</sup> This means a 10% real appreciation of the zloty exchange rate deflated using the PPI in manufacturing.

**Chart 9**  
Impact of a 10% depreciation of PLN on:



Source: Own calculations.

**Chart 10**  
Impact of 10% depreciation of PLN on:



Source: Own calculations.

**Table 10**  
Impact of a 10% depreciation of PLN on the balance of trade with the European Union

	Year I	Year II	Year III
Value of exports (PLN billion)	2.1	2.3	2.4
Value of imports (PLN billion)	2.2	1.9	1.7
<b>Balance (PLN billion)</b>	<b>-0.1</b>	<b>0.4</b>	<b>0.7</b>
Value of exports (% of Polish GDP)	1.1	1.2	1.2
Value of imports (% of Polish GDP)	1.1	1.0	0.9
<b>Balance (% of Polish GDP)</b>	<b>0.0</b>	<b>0.2</b>	<b>0.3</b>

Source: Own calculations.

new equilibrium is established at the levels of imports and exports that are higher respectively by 4.7%<sup>32</sup> and 8.2%<sup>33</sup>. The price adjustments are relatively fast and extinguish as early as in the first year following the occurrence of the depreciation, while the adjustments in the volume take two years.

<sup>32</sup> This is equivalent to a 9.7% rise in the import prices index and a 4.6% decline in the volume of imports.

<sup>33</sup> This is equivalent to a 7.3% growth in the export prices index and a 1.0% rise in the volume of exports.

The impact of a 10% depreciation of zloty in real terms on the balance of trade as classified by value is presented in table 10. It turns out that due to such exchange rate movement, the annual balance of trade between Poland and the EU improves by about PLN 0.7 billion within three years following the occurrence of the depreciation, which accounts for some 0.3% of the Polish GDP.

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## 3 Conclusions

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Foreign trade has an ever growing influence on the Polish economy. The changes that have taken place in the Polish foreign trade over the past few years corresponded to the tendencies observed in international trade. Trade integration with the EU, inflows of Foreign Direct Investment and increase in intra-industry trade should be mentioned among the important factors that underwent modifications. An observation should be made, however, that the openness of the Polish economy as measured by the share of per-capita exports is still relatively low. Moreover, despite substantial structural changes, the majority of Polish trade with the EU is still constituted by inter-industry trade. This follows from the structural complementarity of the Polish economy in comparison with the economies of the EU countries. This is revealed in the differences in the relative stock of basic production factors. The differences in the proportions of the factors also lead to differences in the level of national income *per capita* due to the direct link that exists between the national income and the amount of resources and production factor prices. This is a result of numerous years of backwardness, which should, however, disappear with time. The unfolding changes to the structure of Polish trade from the inter-industry trade towards the intra-industry trade should lead in the long term to a faster growth of exports. Moreover, Polish exports should become less sensitive to asymmetrical shocks.

A very important factor influencing Polish trade is the Polish accession to the EU. This will contribute to the harmonisation of the quality, safety and environmental requirements in force in Poland and in the EU countries, which should foster further creation of flows of bilateral trade. It is expected that together with the EU accession there is also going to be a rise in the FDI inflows, which will further stimulate the growth in trade.

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