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Opening the Polish Economy After 1990.

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Before 1990 Polish economy was relatively closed, but far from autarky. Foreign trade was centrally organized and influenced by political circumstances. Distorted prices, fixed exchange rates, the so-called transfer ruble etc. suppressed the external trade and impacted its structure. Centrally planned economy restricted foreign trade to a higher or lower degree throughout the period 1945-1989. Apart from inefficient foreign trade rules, a relatively low volume of exports was caused by inefficient system of production. Generally, Polish industrial products were not competitive. The most important exported good was coal. Scarce foreign currencies were allocated not according to market rules, but political decisions.

The scale of the restrictions is hard to measure. Christin [1996] estimated that in 1988 Polish export only accounted for 69% of its potential value, and import for 38%.

One of the most important processes during the transition in Poland has been the changing foreign trade pattern and, generally, opening the economy, which means not only an increase in the role of export and import, but also in the sense of the FDI inflow.

Last years, beginning from 1991, witnessed a rapid growth in foreign direct investments in Poland. The term ‘rapid’ essentially means high dynamics of the phenomenon, that reached or even exceeded 100 per cent in some years. Yet, the extent of these investments in the economy only starts being significant.

The FDI’s impact on foreign trade can be viewed from several angles. The direct aspect is the immediate increase in imports such as machinery, equipment and supplies. This phenomenon has been notable in Poland starting from 1995. In the long (or shorter) term, investments can be expected to increase the competitiveness of the economy, which translates into a substitution of imports for domestic goods and higher exports. FDI is not only a physical inflow of capital, but also a transfer of modern technologies and management methods. Foreign companies may contribute to higher competitiveness of domestic companies, either by setting examples for them to follow, or by competing (or co-operating) with domestic companies, thus forcing higher quality and competitiveness in the domestic market.

FDIs may be treated as a barometer for the economy. They show the speed with which an economy opens as they measure:

- the willingness on the part of the government (and the economic agents) to involve in global (European) economy;
- the attractiveness of the Polish economy (its potential for development, as perceived by foreign investors).

The opening process in the Polish economy is described below in terms of two categories: the share of import in total output and the share of export in GDP (calculated in fixed prices). This process is more visible in the case of import, because import grows much faster than export during last years. The trade deficit was to some extent covered (and in a sense caused) by the FDI.

The calculations were made during reformulation of IMPEC[1] – multisectoral model of the Polish economy. The model is based on input-output table. To solve the model for given vector of final demand (**Y**), instead of calculating the Leontief inverse, the equation $(\mathbf{AX}+\mathbf{Y})-\mathbf{M}=\mathbf{X}$ is solved, assuming the share of import (**M**) in total output (**M+X**). This share was forecasted to find the whole model solution. The export to GDP ratio is not needed to solve the model. After describing export with exogenous equations, the model was only used to calculate GDP.

Import

At present, we have two I-O tables for Poland, which can show the speed of these changes. One is from 1990, and the other from 1995, when the changes could be observed. Although they describe the economy in different aggregation by branch, some comparison can be made, as both of them are based on SNA categories. In Table 1 branches of the old Classification of the National Economy correspond to NACE divisions.

As Table 1 shows, the share of import in total demand grows in almost all categories of commodities. The are only two exceptions. The first is power engineering, which does not play any important role in import. Additionally, for 1995 this category includes gas and water supply which are hardly imported. Three groups of services are also opposite to general tendency, but these are almost non-tradables as well.

Numbers in Table 1 reflect not only changes in volume, but also in prices. As, in most cases, relative prices of imports went down in analyzed period, shares in 1995 would be higher if calculated in prices of 1990.

Because the data allowing for construction of time series in constant prices were available only for industrial commodities[2], the following investigations do not consider other commodities and services.

[1] The model has been developed at the Chair of Theory and Analyses of Economic Systems, University of Lodz More about IMPEC: Balcerak et al. [1995], [1997]

[2] Statistical Yearbooks of the Republic of Poland, Yearbooks of Foreign Trade Statistics, Central Statistical Office, Warsaw,

Tab.1 Share of imports in total output, current prices

Products by branches, 1990		**Products by divisions, 1995**	
Products of coal mining	0,0031	Coal, lignite and peat	0,0120
Products of the fuel industry	0,3345	Petrol and natural gas	0,9737
Products of power engineering	0,0035	Electricity, gas and water supply	0,0008
Products of metallurgy	0,0778	Metal ores	0,3059
		Basic metals	0,1132
Products of the metal industry	0,0697	Metal products (except machinery and equipment)	0,1322
Machinery and equipment	0,2924	Machinery and equipment	0,3504
Transport facilities	0,1166	Motor vehicles, trailers and semi-trailers	0,3050
		Other transport equipment	0,0605
Electrical machinery and electronics	0,2042	Office machinery and computers	0,8166
		Electrical machinery and apparatus	0,2426
		Radio, television and communication equipment and apparatus	0,3781
Products of the precision industry	0,3903	Medical,, precision and optical instruments, watches and clocks	0,4441
Products of the chemical industry	0,1475	Chemicals and chemical products	0,3416
		Rubber and plastic products	0,2504
Construction materials	0,0377	Other non-metallic mineral products	0,1366
Glassware	0,0501		
Ceramics	0,0489		
Products of the wood industry	0,0093	Wood, straw and wicker products	0,0402
Paper and paper products	0,1282	Paper and paper products	0,2469
Textiles	0,1377	Textiles	0,1800
Products of the clothing industry	0,0749	Wearing apparel and furriery	0,0575
Products of the leather industry	0,0564	Leather and manufacture of leather products	0,1536
Products of the food industry	0,0569	Food products, beverages and tobacco	0,0701
Products of the printing industry	0,0510	Prints and records	0,0980
Other products	0,0589	Furniture; other products	0,1063
All industrial commodities	0,1230	**All industrial commodities**	0,1781
Products of agriculture	0,0195	Products of agriculture and hunting	0,0721
		Products of fishery and fishing	0,0408
Products of forestry	0,0036	Products of forestry	0,0184
Transport services	0,1504	Transport services	0,0987
Communication	0,0444	Post and telecommunication	0,0485
Trade	0,0104	Trade and repairing motor vehicles	0,0027
Education	0,0126	Education	0,0029
Health care and social service	0,0116	Health care	0,0008
Other services	0,0194	Other services	0,0461
Non-industrial commodities and services	0,0307	**Non-industrial commodities and services**	0,0299
Goods and services	0,0868	**Goods and services**	0,1017

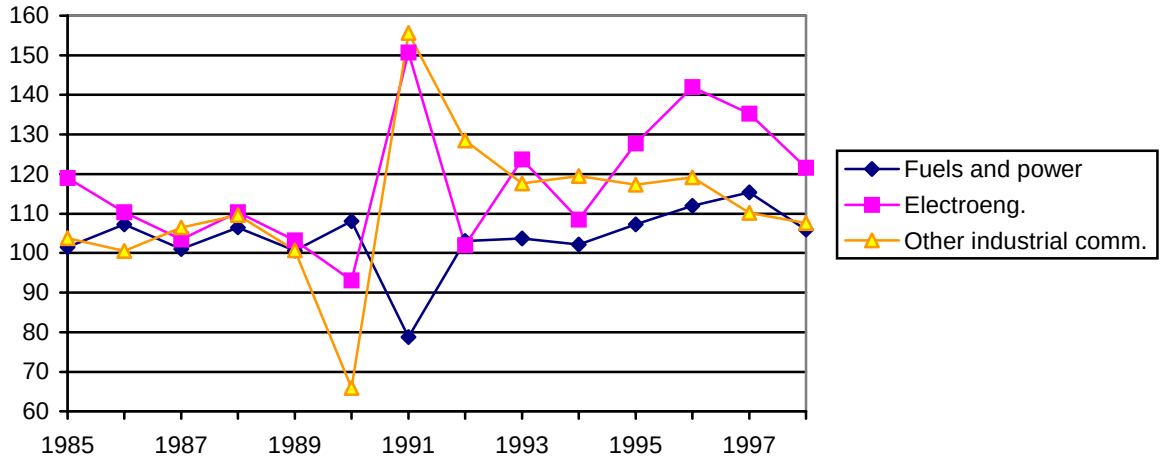
Source: Author's calculations based on I-O tables for Poland, Central Statistical Office, see footnote 2 and 3

Liberalization of the economy allowed for general tendencies typical of market economies like intra industry trade. Some commodities, however, showed specific patterns of import. The patterns were determined from two sides; one being the volume of demand, which in some cases could not be satisfied by home producers, and the second varying competitiveness of various branches. That is why the investigations below consider three main groups of industrial commodities. They are:

1) fuels and power (about 21% of imports of industrial commodities in 1990),
2) products of electroengineering industry (products of metal industry, machinery and equipment, transport facilities, electrical machinery and electronics, products of the precision industry, about 40% in 1990),
3) other industrial commodities (the rest, that is 39% in 1990).

The first group of commodities consists mainly of non-competitive products. Polish import is dominated by crude oil and petroleum products. Domestic output is dominated by coal, which, in times of centrally planned economy, was one of the basic sources of energy in Poland and played important role in Polish exports. Thus, changing the share of imports in total output has nothing to do with intra industry trade, but reflects changes in the structure of energy consumption. As the number of cars in Poland doubled between 1988 and 1998, the import of petrol increased (but not so much). Consumption of coal was significantly reduced in that period.

Fig. 1 Imports of industrial commodities, constant prices, previous year=100



Source: author's calculations, based on Statistical Yearbook of Foreign Trade, Polish Central Statistical Office.

Substantial part of the second group is investment and intermediate goods. Their import is influenced by the investment outlays, whose growth rates differed from other elements of demand, exceeding 20% after 1995. The inflow of the Foreign Direct Investment (FDI) may be another explanation for such a high growth (see Figure 1) in imports of this group, beginning from 1995 .

The third group is "normal", competitive commodities, which import is not driven upward very much by direct investment.

The first step of our investigations was to describe the process of opening the economy by finding a "transition curve". It means a time-trend function showing the pattern of growth of

the share of import in total output (M/(X+M) ratio), calculated in fixed prices. The first suggestion was the logistic trend function and its generalized form:

$$y = d + \frac{a-d}{1+be^{-ct}}, \qquad (1)$$

where the initial value, *d+(a-d)/(1+b)* is the M/(X+M) ratio typical of a planned economy and the saturation level *a* is the ratio typical of a free market economy. This kind of curve fits very well in the case of the first and the second group. In both cases a dummy variable was added to reflect the short term distortions. This variable gets the value of 1 in 1990, –1 in 1991, and 0 in other years.

The third share (for other industrial commodities) shows different growth pattern. The share is very stable until 1989. When transition starts, it rises rapidly, but then its growth slows down. The transition curve for this group of commodities does not seems to have the point of inflexion. Thus, the logistic function was replaced with the following equation:

$$y = d + \frac{t}{a+bt}. \qquad (2)$$

Here, the initial value is *d*, and the saturation level is *d+1/b*.

Estimation was performed with G program[3], using its *nl* command (a nonlinear estimation, see Help in G). Estimating nonlinear functions with iteration methods is time consuming and sometimes leads to wrong results. In this case, however, we can reduce this problems by finding reasonable starting values of parameters (like the saturation level). The results are shown in Table 2. The shapes of the curve together with the forecasted value are presented on Figure 2-4.

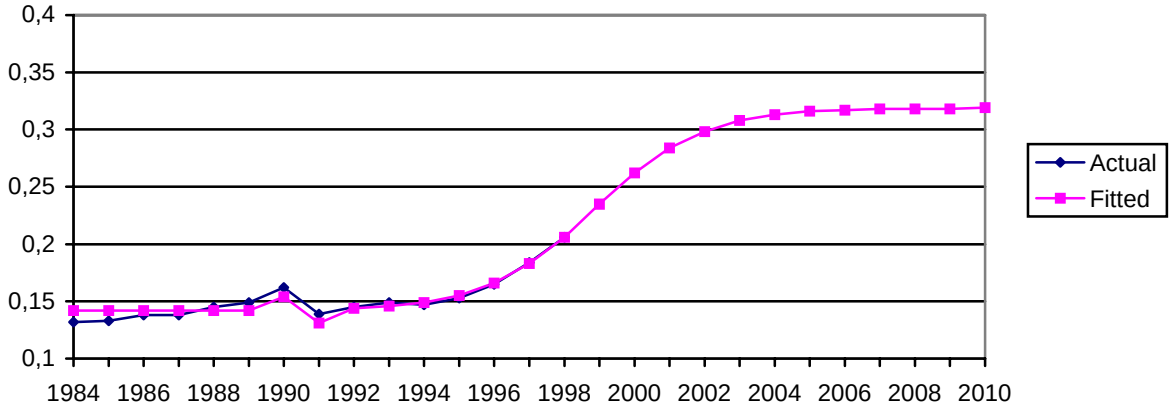
Tab.2 Estimated parameters of time trend equations (1) and (2)

Parameters	**Fuels and power**	**Products of electro-engineering industry**	**Other industrial commodities**
D	0,142	0,176	0,085
A	0,319	0,591	13,991
b	29794,488	69,670	6,100
c	0,650	0,362	-
Dummy	-0,012	0,043	-
SEE	0,005	0,009	0,004
MAPE	2,90%	2,73%	2,38%
Starting value	0,142	0,182	0,085
Saturation level	0,319	0,591	0,249
Sample	1984-1998	1984-1998	1990-1998

Source: author's calculations

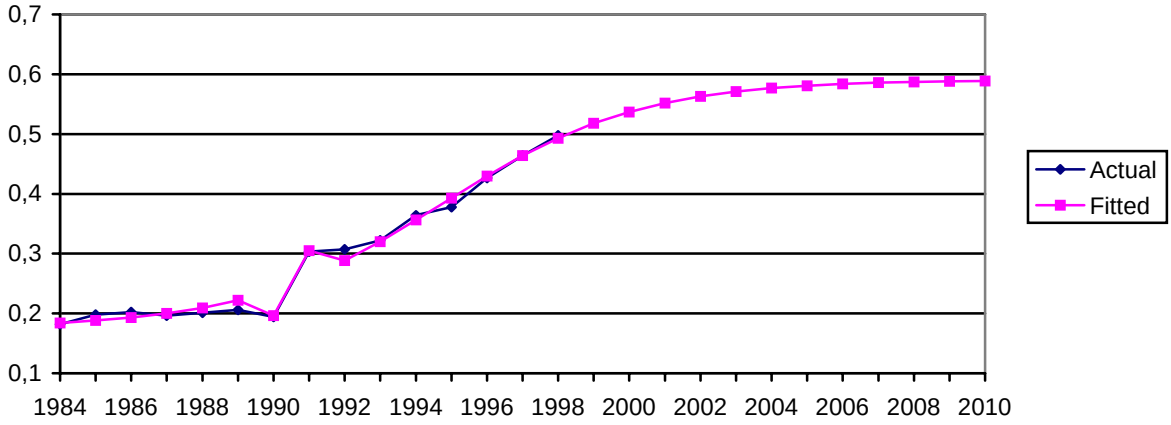
[3] G and its newer version G7, are products of INFORUM, Interindustry Economic Research Fund, Inc., see InforumWeb.umd.edu

Fig. 2 Results of estimation of e quation (1), fuels and power



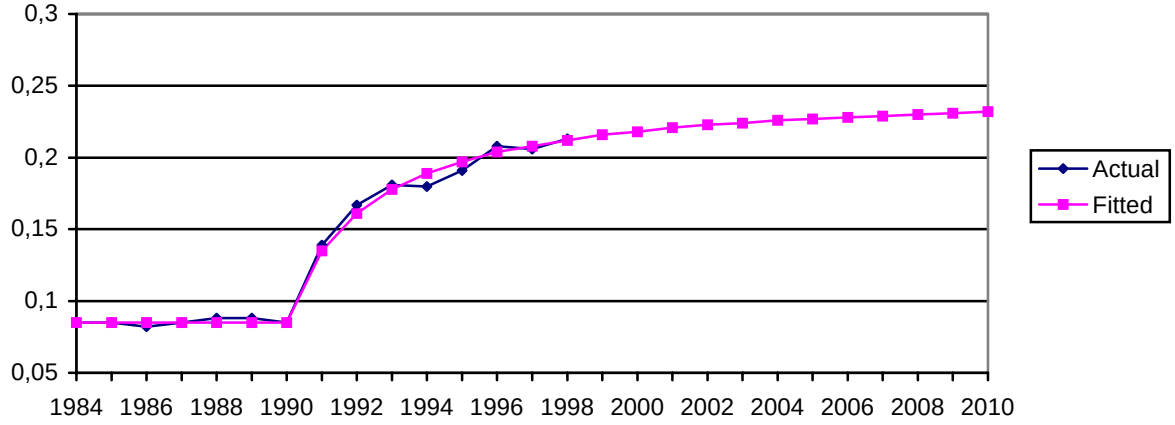
Source: author's calculations

Fig. 3 Results of estimation of e quation (1), products of electroengineering industry



Source: author's calculations

Fig. 4 Results of estimation of e quation (2), other industrial commodities



Source: author's calculations

The first explanatory variable to replace time-trend is the price ratio between imported and domestically produced goods. From Figures 2-4 we can see that our dependent variables are very stable in the period 1984-1989. In that period quite significant fluctuations in prices have not exerted any visible impact on them.

Fuels and power proved to be not sensitive to price changes in the period 1990-1998, either. This kind of dependence has a long term character, as goods in this group are noncompetitive. At the moment, the logistic curve describing the long-term effect of changing the structure of energy consumption is the best choice.

The price ratio seems to be a good explanatory variable for products of the electroengineering industry. It seems, however, that it is not enough to explain the rapid growth in the M/(X+M) ratio of that group from 1995. An additional explanatory variable should be found. As it was mentioned above, this growth may be a reaction to a fast growth in investment demand, especially the FDI.

In general form, the right side of the equation was enhanced with two variables describing two opposite aspects of FDIs' influence on imports. The first one is the value of the total FDI inflow, which should reflect the immediate effects of growing investment demand. The second is the cumulated value of the FDI in the electroengineering industry. In the long term, investments in the this industry should render this branch more competitive and lead to some substitution of imports.

Dependent variable was transformed according to Barnabani [1993], to make sure that the M/(M+X) ratio will not exceed 1:

$$\ln MX_t /(1-MX_t) = a_0 + \alpha_1 PM_t + \alpha_2 BM_t^{\alpha_3} + \alpha_4 BCM_{t-k}^{\alpha_5}, \qquad (3)$$

where:

MX - share of imports in the total output of the electroengineering products,

PM - ratio of imports' prices to domestic prices of the electroengineering products, 1990=1

BM - total foreign direct investments, inflow in year t,

BCM - cumulated value of FDIs in the electroengineering industry.

Practically, due to a short statistical sample, the last variable was not tested. Assuming that time lag k should be at least 2 or 3 years, it is too early to measure the effect of substituting imports. The reduced equation (3) (without *BCM*) was estimated using the OLS method, assuming various values of α_3. Eventually, α_3 was set to 1. Results are presented in Table 3 and Figure 5.

Tab.3 Results of reduced equation (3) estimation for electroengineering products

```
SEE   =       0.15 RSQ   = 0.8793 RHO =  -0.08 Obser  =   10 from 1989.000
SEE+1 =       0.15 RBSQ  = 0.8448 DW  =   2.17 DoFree =    7 to   1998.000
MAPE  =     187.95

  Variable name          Reg-Coef  Mexval t-value  Elas   NorRes     Mean
0 iqmel                - - - - - - - - - - - - - - - - - - - -     -0.67
1 intercept               0.16306     1.0   0.367  -0.24    8.28      1.00
2 pm                     -1.21230    43.1  -2.707   1.66    3.83      0.91
3 bm                      0.00010    95.6   4.449  -0.41    1.00   2728.31
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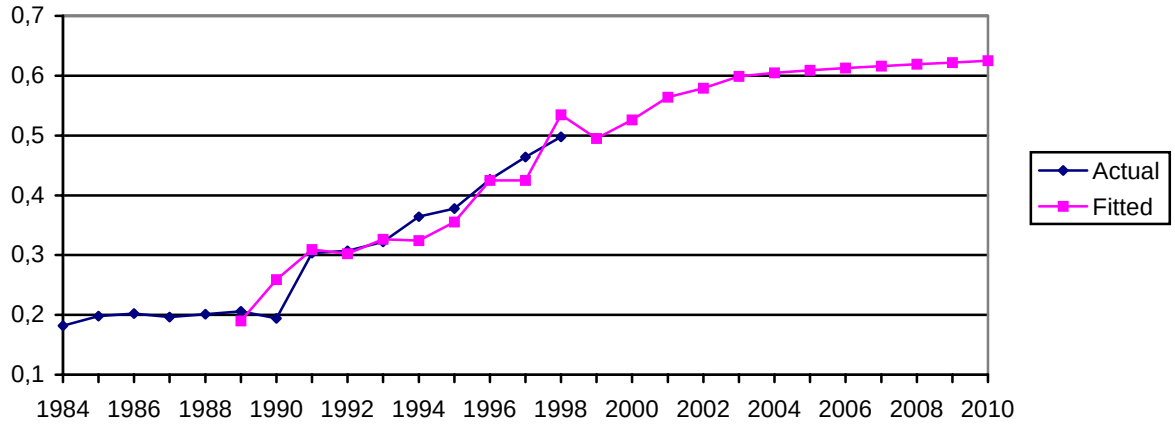
Source: author's calculations

Fig. 5 Estimation results of reduced equation (3) for electroengineering products



Source: author's calculations

Values, obtained as forecasts are higher than those on Figure 3. The curve on Figure 5 might be slightly corrected downward a little in the last years due to expected substitution of import. At the moment we can only guess how much.

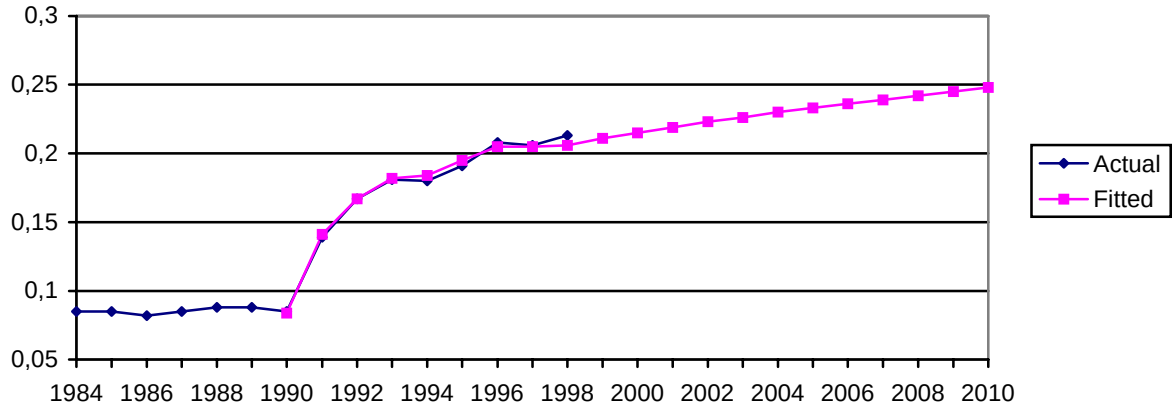
The same equation was tested for other industrial commodities (see Table 4 and Figure6). Here, α_3 was set to 0.1.

Tab.4 Results of reduced equation (3) estimation for other industrial commodities

```
SEE   =       0.02 RSQ   = 0.9955 RHO =   0.33 Obser  =    9 from 1990.000
SEE+1 =       0.02 RBSQ  = 0.9941 DW  =   1.33 DoFree =    6 to   1998.000
MAPE  =       1.16
  Variable name          Reg-Coef  Mexval t-value  Elas   NorRes     Mean
0 iqmot                - - - - - - - - - - - - - - - - - - - - -    -1.59
1 intercept              -1.43277   258.0  -8.421   0.90  224.11     1.00
2 pm                     -1.02422   186.2  -6.568   0.43   10.63     0.66
3 bm                      0.24632   226.1   7.603  -0.33    1.00     2.14
```

Source: author's calculations

Fig. 6 Estimation results of reduced equation (3) for other industrial commodities



Source: author's calculations

Setting α_3 to the value of 0.1 gave a very good fit, but made the dependent variable hardly sensitive on changes in BM in the forecasted period. Enlarging rising α_3 reduced its t-value significantly, so we come to the conclusion, that if there is any immediate effect of the FDI, it is getting weaker. Also here a lagged effect of the FDI can be expected.

Export

Shares of exports in GDP for 1990 and 1995 taken from the I-O tables are stated in Table 5. As it was mentioned, the growth of E/GDP ratio is not so obvious as in the case of imports.

Tab.5 Export to GDP ratio, current prices

Products by branches, 1990		**Products by divisions, 1995**	
Products of coal mining	1,0833	Coal, lignite and peat	0,3894
Products of the fuel industry	0,3039	Petrol and natural gas	0,1242
Products of power engineering	0,0628	Electricity, gas and water supply	0,0301
Products of metallurgy	0,7380	Metal ores	0,3866
		Basic metals	1,7609
Products of the metal industry	0,3860	Metal products (except machinery and equipment)	0,5690
Machinery and equipment	0,6972	Machinery and equipment	0,6344
Transport facilities	0,6110	Motor vehicles, trailers and semi-trailers	1,8070
		Other transport equipment	2,0452
Electrical machinery and electronics	0,4283	Office machinery and computers	0,7839
		Electrical machinery and apparatus	0,8673
		Radio, television and communication equipment and apparatus	0,9753
Products of the precision industry	0,9698	Medical,, precision and optical instruments, watches and clocks	0,4338
Products of the chemical industry	0,7213	Chemicals and chemical products	1,3184
		Rubber and plastic products	0,4517
Construction materials	0,0751	Other non-metallic mineral products	0,5202
Glassware	0,6714		
Ceramics	0,3227		
Products of the wood industry	0,5213	Wood, straw and wicker products	1,1230
Paper and paper products	0,3033	Paper and paper products	0,8843
Textiles	0,2850	Textiles	0,8777
Products of the clothing ind.	0,5032	Wearing apparel and furriery	1,3640
Products of the leather ind.	0,4387	Leather and manufacture of leather products	1,2912
Products of the food industry	0,2843	Food products, beverages and tobacco	0,6692
Products of the printing industry	0,0026	Prints and records	0,0920
Other products	0,2198	Furniture; other products	0,9200
All industrial commodities	0,4531	**All industrial commodities**	0,8671
Products of agriculture	0,1769	Products of agriculture and hunting	0,0895
		Products of fishery and fishing	0,3071
Products of forestry	0,0815	Products of forestry	0,0822
Transport services	0,7467	Transport services	0,6076
Communication	0,2134	Post and telecommunication	0,1880
Trade	0,0547	Trade and repairing motor vehicles	0,0067
Education	0,0067	Education	0,0032
Health care and social service	0,0019	Health care	0,0023
Other services	0,0517	Other services	0,1609
Non-industrial commodities and services	0,1157	**Non-industrial commodities and services**	0,1004
Goods and services	0,2750	**Goods and services**	0,2614

Source: author's calculations based on I-O tables for Poland, Central Statistical Office

The E/GDP ratio in current prices for industrial products almost doubled in the years 1990-95. However, the rise in domestic demand for non-tradables (services), slightly reduced the total ratio. In the long term, however, the E/GDP ratio for all goods and services is not going down (in 1998 it was 0.283).

The forecasts of E/GDP ratio were calculated using the IMPEC model. Values of exports in constant prices were calculated in exogenous block of equations. Then the results were put to IMPEC, to calculate the GDP by industries.

The export equations have the general form:

$$E_{i,t} = e^{\alpha_0} W_{i,t}^{\alpha_1} PW_{i,t}^{\alpha_2} e^{\alpha_3 \cdot B_{i,t-k}^{\alpha_4}}, \qquad (4)$$

where:

E_i - index of exports, fixed prices of i-th category of products and services,

W_i - index of world exports of i-th category of products and services,

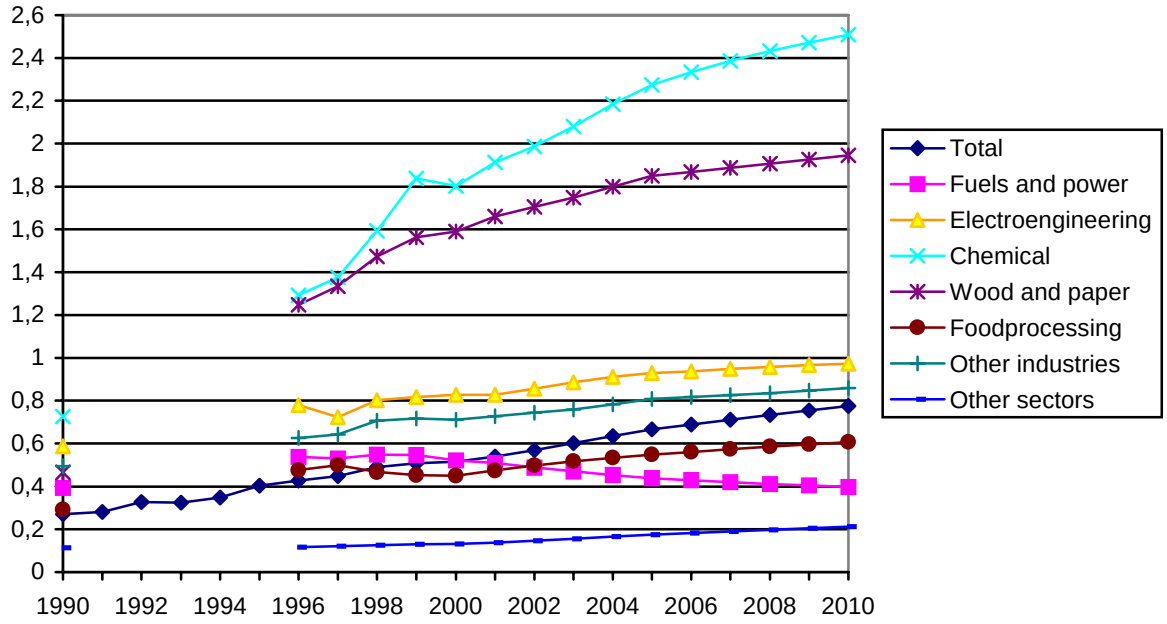
PW_i - prices of exports of i-th category of products and services referred to the world prices,

B_i – direct foreign investments in industry i,

k denotes a time lag and takes various values depending on the equation.

Only in four cases the FDIs significantly affected the volume of exports. These were products of electro-engineering, chemical, wood and paper and food industries. For other branches $\alpha_3 = 0$ was assumed[4].

Fig. 7 Export to GDP ratio, constant prices



Source: author's calculations

[4] More about introducing the FDI to the IMPEC model: see Przybylinski [1998], Przybylinski, Tomaszewicz [1999]

Looking at Figure 7 we can identify two exporting branches – chemical and wood and paper. Such a fast growth of exports is predicted assuming continuing price tendencies and the FDI inflow. Lines for other branches are also going up, but with a moderate slope. The only exception is fuel and power industry. The E/GDP ratio for this industry are expected to return to its value of 1990.

The values presented in Graph 7 cannot be compared with Table 5, as they are expressed with a different price base. The total ratio calculated in constant prices exceeds 0.4 in 1995, while in current prices it is about 0.261. Reaching almost 0.8 in constant prices in 2010 will probably mean about 0.5 in current prices. The same applies to branches.

General conclusions

The opening process in the Polish economy is easy to notice. We sketched above patterns of this process for different branches. Looking at the graphs and tables presented in the paper allows us also to draw some general conclusions:

1. The ratio for imports goes up more clearly than the ratio for exports.
2. Poland has become more involved in trade in industrial commodities. Fast growth of demand for non-tradables (services) reduces the ratios.
3. Prices of domestic products rise faster than world prices.

References

Balcerak A., Lipiński C., Plich M., Przybyliński M., Tomaszewicz Ł., [1995], The Model IMPEC of the Polish Economy and Its Use for the Analysis of Transformation Processes, Eleventh International Conference on Input-Output Techniques 27 November – 1 December 1995, New Delhi, India

Balcerak A., Lipiński C., Przybyliński M., Plich M., Tomaszewicz Ł., [1997], The Model IMPEC of the Polish Economy and the Use for the Analysis of Transformation Processes, in: Proceedings of the 3rd World INFORUM Conference (4-8 September 1995), Lodz, Poland, p. 83-102

Barnabani M., [1993], Logit Model Applied to Import Market Shares: The Italian Case, Ist World INFORUM Conference, Rennes, France

Christin D.E., [1996], The Long-Term Volume of East Europe's Foreign Trade: An Estimate, Economics of Planning 29/1996

Przybyliński M., [1998], Including FDI into Foreign Trade Equations. The Case of Poland, VI INFORUM World Conference, El Escorial, Madrid, September 1998

Przybyliński M., Tomaszewicz Ł., [1999], The Impact of Foreign Direct Investment on the Polish Economy, in: Welfe W. (ed.), Proceedings of the 25th International Conference Macromodels'98, Jurata, Poland, Vol. 2, p. 99-113