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*Iwona Świeczewska*[*], *Zofia Wysocka*[**]

# THE IMPACT OF FOREIGN DIRECT INVESTMENTS ON THE EFFICIENCY OF POLISH ECONOMY. A SECTORAL AND REGIONAL VIEW

## I. INTRODUCTION

Transition processes launched in the Polish economy in late 1980s focused on adjusting its potential – formed under the central command economy – to the structures typical of market economies. Restructuring that affects actually every aspect of economic life aims at improving the efficiency and competitiveness of economy, which is expected to reduce the economic, technological and civilisation gap to the developed countries. However, the scope of restructuring processes and its pace are sector-specific. The largest adjustments can be observed in production and services, whereas changes in agriculture, the mining and quarrying industry and the power sector are limited and reflected in the modified structure of production, its factors and their relationships[1].

The efficiency of production processes in the Polish economy may increase due to a broad technological progress[2], which is one of the crucial, if not the most important, factor of economic growth. Despite this, for many years it has been treated as exogenous. Only the development of endogenous growth theory helped identify the role of particular factors in the process of stimulating economic growth. According to that theory, technological progress, understood as the accumulation of scientific and technical knowledge and human capital used

[*] Chair of Theory and Analyses of Economic Systems, University of Łódź.
[**] Chair of Marketing, Academy of Management, Łódź.

[1] The changes are expressed by modified relations between the production factors (the capital-to-labour ratio) and by adjusted relations between production and its factors (changes in the productivity of labour, productivity of capital or total factor productivity, TFP).

[2] In narrow terms, technological progress involves only changes in production techniques or technologies; quite frequently, however, modified technology of production generates changes in the organisation of production. Separation of these factors at the macroeconomic level is practically impossible. Hence, when referring to technological progress, we actually mean technological and organisational progress.

either directly or indirectly in the production processes, results from well-though-out investment decisions taken by rationally behaving business organizations (Tokarski, 1996). Among the many factors that generate technological progress domestic and foreign investment outlays enlarging the amount of the national physical and human capital, outlays on research and development (R+D) and innovations in economy are mentioned the most frequently.

For less developed or developing economies the transfer of technologies from abroad is of special importance in the process of generating technological progress. One possible channel of such transfer is foreign direct investments that in addition to offering flows of financial capital provide also various forms of knowledge, as well as physical and human capital. Therefore, FDIs may present a significant determinant of economic growth in the recipient country[3].

This study attempts to investigate how FDIs contribute to changes in the efficiency of the Polish economy that may originate from a broad technological progress. The changes are assumed identical with changes in total factor productivity (TFP), because the TFP is one of the most common yardsticks used to quantify the effects of the technological progress. The analysis is focused on two areas: sectors and regions. Part 1 of the analysis examines the effects of domestic and foreign investments (that Polish economy received as direct investments) in TFP changes. The analysis attempts: 1) to identify empirically how domestic and foreign investments contribute to TFP changes, and 2) to verify empirically the hypothesis that foreign investments improve the efficiency of production processes more than the domestic investments. The analysis, covering the years 1992–2002, targets sections and divisions of industry. Part 2 seeks to answer the question, whether the pace of development in individual regions[4] is correlated with foreign investors' activities in those regions and, if yes, to what degree. The analysis is limited to years 1998–2002 because of the unavailability of statistical data. Each part shortly analyses foreign investments by sections and divisions of industry, as well as regions.

## II. FDIS' CONTRIBUTION TO IMPROVED EFFICIENCY OF THE PRODUCTION PROCESSES – A THEORETICAL APPROACH

The first important research into FDIs' impacts on the efficiency of economic processes examined with respect to productivity growth, was attempted in the 1970s. Its authors sought to explain the sectoral labour productivity differen-

[3] This thesis seems to be confirmed by the research by Romer (1993) and Borensztein, Gregorio and Lee (1998). Its outcomes indicate a strong correlation between the amount of FDI and an economy's growth rate. Moreover, the results suggest that in developed countries foreign capital contributes to economic growth more than domestic investments.

[4] Regions mean provinces, that is units under the administrative division of the country.

tion in economy, using FDIs' values in the sectors. The analysis concentrated on the economies of Australia (Caves 1974) and Mexico (Blomström, Persson 1983; Blomström 1986). The results of the research seem to prove the statement that the involvement of foreign capital improves the productivity of labour in the investee-sectors.

Following studies (macroeconomic and microeconomic) on the relationship between FDIs and the TFP growth do not offer such explicit conclusions as those mentioned. Even though the research by Aitken and Harrison (1993) confirmed favourable effects of foreign investments on the productivity of individual sectors of industry, the effects are limited to the foreign-owned firms. That productivity in other enterprises declines seems to support the hypothesis that modern technologies are actually transferred between a mother company and its foreign branch, whereas domestic firms take advantage of the diffusion to a limited degree. They repeated the research in 1996 (Aitken, Harrison and Lipsey 1996), analysing FDIs' participation in productivity growth in terms of wage increases. They assumed that investments could improve the workforce's skills in both foreign-owned firms and domestic firms, bringing about wage rises in all sectors of economy. Their research concentrated on the Mexican, Venezuelan and US economies. The hypothesis was valid for the USA only. In the other two economies, the positive influence of FDIs was found only for the foreign-owned firms. In domestic firms wages did not rise.

Also Kokko (1994 and 1996) confirmed that in individual branches of industry FDIs make labour productivity grow, but only in those sectors, where the technological gap between the foreign-owned and domestic firms was small. Where the technological gap was large, the impact was insignificant, and sometimes even unfavourable.

The technological gap between domestic and foreign-owned firms turned out meaningful also in the Sjöholm research (1997) who examined enterprises in Indonesia. In the foreign-owned firms the productivity of labour was higher than in domestic firms – higher when the technological gap between the firm receiving foreign capital and the investing organisation was smaller.

Another noteworthy attempt was the extensive research by Haddad and Harrison (1993) who investigated FDIs participation in TFP changes in the Moroccan enterprises. Its outcomes indicate that the foreign-owned firms have a higher TFP than those with exclusively domestic capital; however, the TFP growth rate is much higher in the latter. As the authors suggest the situation may indicate some convergence between the domestic enterprises and foreign-owned enterprises. They also proved that if we divided any sector of economy into sectors having more and less advanced technologies, then the FDIs would have much more favourable impacts on the latter.

Another research that confirmed FDIs' positive effect on the TFP growth was that by Barrell and Pain (1997). It was focused on the German (more specifically, the West German) and the UK economies.

Even though the above results generally indicate a positive relationship between the growth of efficiency and competitiveness of economic processes, on the one hand, and the involvement of foreign investors, on the other, particularly in developed economies, the case of less developed countries provides more ambiguous results. An insignificant or even unfavourable effect of foreign investments on the TFP growth was identified by Kinoshita and Ashoka (1997) who analysed the Chinese economy and by Djankov and Hoekman (2000) who investigated the Czech Republic.

## III. FDI IN THE POLISH ECONOMY

In the Polish economy foreign direct investments are a relatively new thing. They began in 1977, when the first three joint ventures were established. In fact, however, the Polish economy was opened more broadly to foreign capital by the political changes in 1989, but its inflow was rather slow and phased in.

In the years 1989–1991 foreign investments were mainly limited due to formal and legal obstacles such as complicated legislative procedures, restrictions on the transfers of profits, obligatory resale of foreign exchange at a fixed rate. The major incentives luring foreign investors were low labour cost, the magnitude of the domestic market and ready access to raw materials. Technologies were transferred mainly through the purchase of licenses, joint ventures and outside processing contracts.

This first period ended when the investment law regulating foreign investors' activities was relaxed. All restrictions regulating transfers of profits and the level of capital to be invested were abolished. From that moment onwards, we have been able to observe dynamically growing FDIs, the main reasons for which are declining investment risk, higher credibility of Poland as an investment target and highly absorptive domestic market. In the years 1992–2002 the cumulated value of invested capitals grew more thirty times to reach 250 bn PLN[5] at the end of 2002. By the year 1999, the major recipient of the invested capital was industry, but between 2000 and 2002 its share declined in favour of the service sector. Construction did not exceed a 10% share throughout the period (Chart 1).

[5] The analysis is based on data derived from the Polish Information and Foreign Investment Agency (PAIiIZ). Because data describe only „large-sized" investors with investments exceeding US$ 1 million, they are underestimated. On the other hand, „large" investments make up about 85–90% of all investments and the data on them are published on a regular basis and by various classifications, which is very useful.

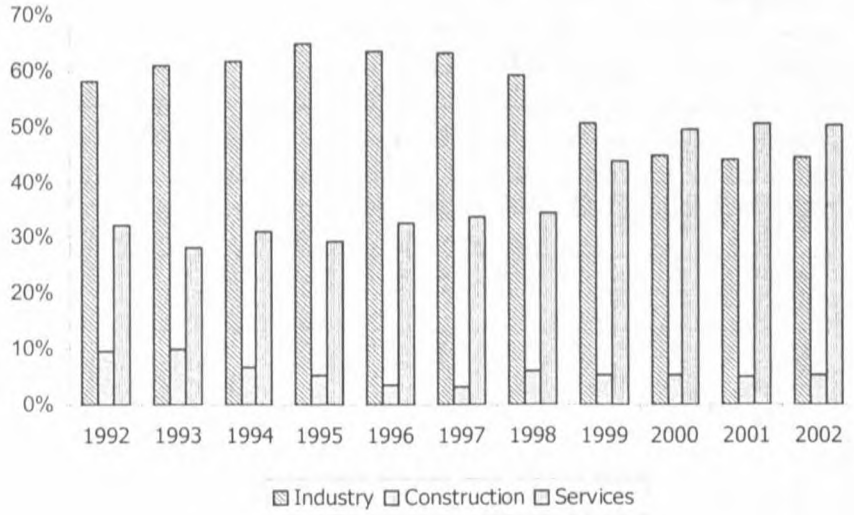



Chart 1. FDI structure in Poland, years 1992–2002

S o u r c e: developed by the authors on the basis of PAIiIZ data.

An analysis of FDI amounts by sections and divisions of Polish industry shows that particularly in the first period the largest inflow of foreign capital took place in the manufacturing of machinery and equipment, and of electrical machinery and optical instruments (Table 1). The reason could be the need to quickly develop technologies and to replace the depreciated machinery. At the same time manufacturing of food products, beverages and tobacco products grew dynamically in response to the escalating demand for consumer goods, but the intensification of production making up for market shortages did not require modern technological solutions. Foreign-owned firms followed then the strategy of manufacturing consumer goods for the domestic market. However, this approach changed soon, because of the growing amounts of better quality imports and more sophisticated consumers' needs (Karaszewski, Wiśniewski, 2000, pp. 578–579). No sooner did some of the firms switch to the strategy of manufacturing industrial exports than the domestic market saturated. Therefore, it seems justified to conclude that in the first period investments primarily targeted branches that manufactured products meeting the internal demand and the investors meant to gain, to maintain and to expand their position in this market segment. Large investments were made in the pro-export branches only in the second half of the 1990s. In that period activity of foreign-owned enterprises distinctly intensified (*Działalność gospodarcza spółek...*, 1999).

Table 1

FDI structure (%) by industry's sections and divisions

| Sectors | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Mining and quarrying | 0.0 | 2.2 | 1.7 | 1.3 | 0.8 | 0.1 | 0.1 | 0.4 | 0.1 | 0.4 | 0.8 |
| Manufacturing | 100.0 | 97.8 | 98.3 | 98.7 | 99.0 | 99.0 | 98.4 | 97.0 | 94.7 | 93.3 | 90.9 |
| Manufacture of food products, beverages and tobacco products | 17.7 | 27.6 | 29.0 | 31.4 | 34.3 | 29.4 | 27.6 | 25.9 | 25.1 | 23.5 | 22.0 |
| Manufacture of textiles, wearing apparel and furriery | 2.6 | 2.5 | 2.9 | 1.9 | 2.1 | 2.0 | 1.4 | 1.4 | 1.3 | 1.1 | 1.2 |
| Manufacture of wood and wooden products | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 2.4 | 1.3 | 1.2 | 5.5 | 4.9 |
| Manufacture of pulp and paper with publishing and printing | 16.5 | 9.7 | 9.0 | 9.7 | 9.3 | 10.4 | 8.4 | 7.7 | 7.2 | 6.7 | 6.3 |
| Manufacture of coke, refined petroleum products and derivatives | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Manufacture of chemical and chemical products | 9.9 | 16.8 | 13.9 | 10.7 | 7.4 | 9.7 | 7.9 | 7.3 | 6.3 | 5.6 | 7.1 |
| Manufacture of rubber and plastic products | 0.7 | 0.5 | 0.6 | 4.4 | 3.6 | 3.8 | 2.6 | 2.5 | 2.9 | 2.6 | 2.4 |
| Manufacture of other non-metallic mineral products | 4.9 | 6.7 | 6.0 | 10.2 | 11.1 | 8.7 | 12.1 | 11.7 | 13.6 | 13.0 | 12.4 |
| Manufacture of basic metals and metal products | 4.0 | 2.6 | 3.6 | 3.3 | 2.6 | 3.4 | 2.2 | 2.2 | 2.0 | 1.9 | 2.0 |
| Manufacture of machinery and equipment, electrical machinery, precision and optical instruments | 26.0 | 18.4 | 21.1 | 16.0 | 11.4 | 8.0 | 9.9 | 10.1 | 9.2 | 8.3 | 8.1 |
| Manufacture of transport equipment | 15.6 | 11.6 | 11.4 | 10.2 | 16.4 | 22.5 | 22.4 | 24.7 | 24.1 | 23.0 | 22.8 |
| Manufacture of furniture and other manufacturing | 2.1 | 1.3 | 0.9 | 0.8 | 0.8 | 0.9 | 1.5 | 2.1 | 1.9 | 2.0 | 1.7 |
| Recycling | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Electricity, gas and water supply | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.9 | 1.5 | 2.6 | 5.2 | 6.4 | 8.3 |

Source: Authors' calculation in based on PAIiIZ data.

In terms of FDIs' effects on the Polish economy, their most appropriate location is in sectors that make its growth more dynamic. A case in point is the technology-intensive sectors. Using the criterion of dividing FDIs into sectors with different levels of technology (Wysokińska 1997, p. 131), particular divisions of the manufacturing industry were broken down into the following sectors: labour intensive, raw-materials intensive, based on standard technologies, technology intensive based on supplies of components, and technology intensive sectors based on innovative technologies[6]. Chart 2 presents FDIs' structure by sector.

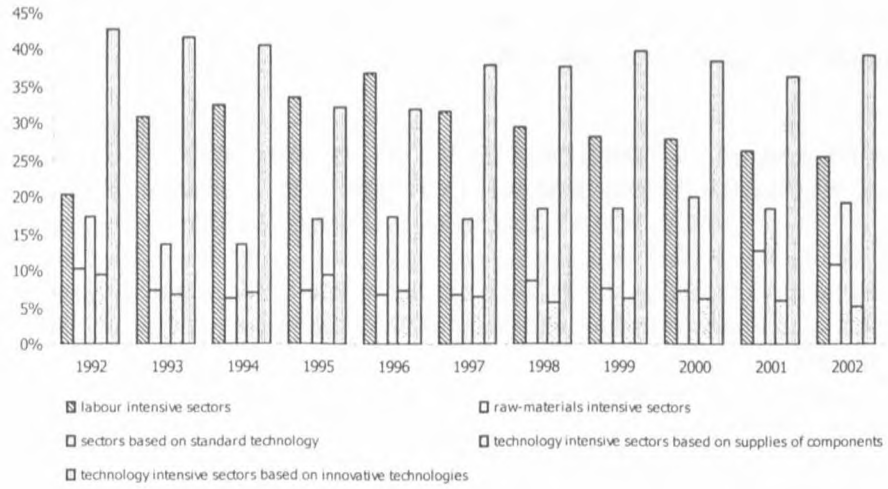



Chart 2. FDI structure (%) by sectors with various levels of technological progress

S o u r c e: Developed on the basis of the PAIiIZ data.

[6] The following sectors have been classified as labour intensive: manufacture of food products, beverages and tobacco products, manufacture of textiles, clothing and furriery, manufacture of leather and leather products; the raw-materials intensive sectors are: manufacture of wood and products of wood, manufacture of pulp and paper, manufacture of coke and refined petroleum products, manufacture of furniture and other manufacturing activities; sectors based on standard technologies are: publishing and printing, manufacture of other non-metallic mineral products, manufacture of metals and metal products; technology intensive sectors based on supplies of components: manufacture of rubber and plastic products, manufacture of electrical machinery and apparatus; technology-intensive sectors based on innovative technologies are: manufacture of machinery and equipment, office machinery and computers, manufacture of radio and television equipment and apparatus, medical, precision and optical instruments, motor vehicles and other transport equipment, manufacture of chemicals and chemical products.

In the first period of the FDI inflow, its major recipients were the technology-intensive divisions using innovative technologies (mainly those manufacturing motor vehicles and machinery and equipment), the labour-intensive and intermediate goods-intensive divisions held relatively small shares. It should be remembered, however, that the amounts of foreign capital invested at that time were limited[7]. And even though in the next years the technologically-advanced divisions continued to attract foreign investors' interest, the proportion of the labour-intensive divisions clearly grew. The share of the technology-intensive divisions dependent on the supplies of components was relatively stable (ranging from 7 to 10%). Taking into account the amounts of the invested capital, we can conclude that in the case of the Polish economy most capital was invested in the technology-intensive divisions of the manufacturing industry. This fact can be significant for the development of the Polish economy.

## IV. CHANGES IN THE STRUCTURE OF PRODUCTION AND IN ITS FACTORS IN THE POLISH INDUSTRY, YEARS 1992–2002. THE TOTAL FACTOR PRODUCTIVITY

Reforms launched in the Polish economy in late 1980s initiated the existing process of its transformation. If we look back, the period can be divided into three subperiods, namely:

– subperiod I, spanning the years 1989–1991, frequently called the period of transitional recession;

– subperiod II, covering years 1992–1997, and

– subperiod III, from 1998 to date.

The main reason for having the three subperiods is their specific levels of economic activity. Subperiod I is the time when economic activity declined, mainly due to the reform-triggered restructuring of demand and supply. Production dropped meaningly, primarily reduced by the shrinking volume of industrial and construction outputs. Mass unemployment appeared which made real wages drop.

In subperiod I the first institutional reforms were initiated. Their main goal was changing the ownership structure in economy (privatization of the real and financial sectors), supporting the development of the financial sector (banking system, insurance and the capital market) and stimulating entrepreneurship and competition. The reforms clearly boosted production, consumption, gross capital formation, wages (in real and nominal terms), as well as increased export and investment outlays. Besides, these positive tendencies contributed to higher em-

[7] According to the PAIiIZ data, gross FDIs in the first years of the analysed period amounted to US$ 1703.1 million (1992), US$ 2827.7 million (1993) and US$ 4320.8 million USD (1994), respectively.

ployment and lowered the rate of unemployment (from 16.4% in 1993 to 10.3% in 1997). After 1997, the rate of economic growth clearly decelerated, mainly because of failures in the economy restructuring process, sometimes inadequate socio-economic policy of the government, downturn in the German economy being Poland's largest trading partner and the financial crisis in Russia. All together, the factors made the rate of economic growth clearly decline, the symptoms of which were the slowing down rate of gross output and of gross capital formation growth, reducing the number of the employees and substantially increasing the rate of unemployment.

Changes affecting the structure of production and its factors resulted from new developments in particular sectors of economy. Service sectors and most manufacturing divisions expanded the most dynamically. In the analysed period, production grew insignificantly, or even declined in agriculture, fishing and fishery, mining and quarrying, as well as the power sector.

The exclusive purpose of the brief description of changes affecting the Polish economy in the transition period was identification of particular stages in its development. According to the goal of our research, the next sections will analyse changes within the production sphere.

Data in Table 2 show that in the years in question the average rate of production growth in industry (measured using both gross output and valued added) was 6.2% (5.9% for value added). The main reason for this result was the high rate of growth in the manufacturing industry whose share in the entire industry exceeds 80%. The power sector expanded much more slowly (average rates of production growth were 1.3% and 3.1%, respectively). In the analysed period, in the extractive industry gross output dropped on average 2.7% a year and value added 3.6% a year, respectively.

Clearly different growth rates can be found also for the divisions of the manufacturing industry. The highest production growth rates characterised technologically-advanced sectors, namely: manufacture of office machinery and computers, manufacture of radio, television and communication equipment and apparatus, manufacture of medical, precision and optical instruments, manufacture of motor vehicles, manufacture of chemicals and chemical products and manufacture of rubber and plastic products. The high dynamics of production growth translated into shares of these divisions in the manufacturing industry's output expanding by over 8 percentage points (from 21.3% in 1992 to 29.6% in 2002). This fact may be conducive to the development of the Polish economy. Also raw materials-intensive divisions (manufacture of wood and products of wood, manufacture of pulp and paper, manufacture of furniture and other manufacturing) and sectors using standard technologies (publishing and printing, manufacture of metal products and manufacture of other non-metallic mineral products) maintained high rates of production growth. In the labour intensive

divisions whose shares in industrial production clearly declined (from 33.5% in 1992 to 26.5% in 2002), the rate of production growth was small, and in some of them even negative.

Table 2

Annual average growth rates (%) for production and its factors, years 1992–2002, by industry sections and divisions

| Specification | OUT | VA | K | L |
|---|---|---|---|---|
| TOTAL (entire economy) | 5.2 | 4.1 | 3.2 | –0.1 |
| Industry | 6.2 | 5.9 | 2.9 | –2.7 |
| Mining and quarrying | –2.7 | –3.6 | –2.8 | –7.5 |
| Manufacturing | 7.6 | 11.2 | 3.8 | –2.3 |
| Manufacture of food products and beverages | 6.1 | 7.4 | 5.8 | –0.4 |
| Manufacture of tobacco products | 1.0 | 2.3 | 15.5 | –4.4 |
| Manufacture of textiles | 2.4 | 6.1 | –3.7 | –7.8 |
| Manufacture of wearing apparel and furriery | 3.7 | 4.4 | 3.3 | –3.4 |
| Manufacture of leather and leather products | –1.3 | –3.8 | –1.5 | –7.7 |
| Manufacture of wood and wood, straw and wicker products | 8.3 | 5.7 | 8.6 | –0.2 |
| Manufacture of pulp and paper | 10.9 | 11.4 | 7.8 | –0.2 |
| Publishing, printing and reproduction of recorded media | 12.8 | 13.8 | 14.8 | 2.0 |
| Manufacture of coke, refined petroleum products | 3.1 | –8.3 | 11.2 | –2.3 |
| Manufacture of chemicals and chemical products | 6.1 | 5.6 | 4.0 | –3.2 |
| Manufacture of rubber and plastic products | 15.0 | 16.3 | 8.6 | 3.5 |
| Manufacture of other non–metallic mineral products | 8.3 | 9.7 | 5.3 | –2.5 |
| Manufacture of basic metals | 1.4 | –2.4 | –0.3 | –8.0 |
| Manufacture of metal products | 12.3 | 11.7 | 3.8 | 1.1 |
| Manufacture of machinery and equipment | 6.6 | 6.5 | –2.4 | –5.3 |
| Manufacture of office machinery and computers | 22.2 | 30.0 | 4.3 | –1.2 |
| Manufacture of electrical machinery and apparatus | 10.3 | 9.4 | 6.3 | –0.6 |
| Manufacture of radio, television and communication equipment and apparatus | 16.2 | 17.0 | 0.7 | –7.5 |
| Manufacture of medical, precision and optical instruments, watches and clocks | 10.1 | 10.7 | 2.4 | –0.5 |
| Manufacture of motor vehicles, trailers and semi-trailers | 15.3 | 13.7 | 7.6 | –3.1 |
| Manufacture of other transport equipment | 2.5 | –2.4 | –2.0 | –4.9 |
| Manufacture of furniture; manufacturing n.e.c. | 12.1 | 8.9 | 7.7 | 0.3 |
| Recycling | 3.7 | 0.2 | 5.0 | 3.7 |
| Electricity, gas and water supply | 1.3 | 3.1 | 3.7 | –0.7 |

OUT – gross output (in comtout prices); Va – value added (in comtout prices); K – gross value of fixed assets (in comtout prices); L – number of employees.

Source: Calculated by the authors.

The dynamics of the basic production factors, capital (measured by the gross value of fixed assets) and labour (measured by the number of economically active persons) showed distinct variations. As for the capital, actually all sections and divisions of industry increased their capital resources the highest rates being noted in the manufacture of tobacco products (annual average 15.5%), in pub-

lishing and printing (14.8% on average) and in the manufacture of coke and refined petroleum products (11.2% on average). The technologically advanced divisions showed definitely lower rates of capital growth (from 0.7% a year for the manufacture of radio, television and communication equipment to 7.6% for the manufacture of motor vehicles). Negative rates of the fixed capital growth were recorded for mining and quarrying (–2.8%), the manufacture of textiles (–3.7%), the manufacture of leather and leather products (–1.5%), the manufacture of machinery and equipment (–2.4%), the manufacture of other motor vehicles (–2.0%) and the manufacture of metals (–0.3%). Employment showed different tendencies. In most sections and divisions of industry the size of the workforce distinctly declined, especially those treated by the central command economy as its crucial components, i.e. mining and quarrying (annual average – 7.5%), the manufacture of textiles (–7.8% a year), the manufacture of metals (–8% a year) and the manufacture of machinery and equipment (–7,5%). Employment only grew in five divisions of the manufacturing industry, but their share in total employment in that section does not exceed 21%.

The observed evolution in production and production factors affected both productivity of the factors (the productivity of capital, the productivity of labour and TFP[8]) and relationships between the factors (the capital-to-labour ratio). Higher productivity of the production factors improves the efficiency of the manufacturing processes that are frequently determined by a broad technological progress (Griliches 1958, 1986; Jorgenson 1984; Mansfield 1988). The changes frequently arise from modified relationships between the production factors, one symptom of which is variations in the capital-to-labour ratio[9]. A considerable growth in production (measured by the gross output and value added) accompanied by a slightly smaller rates of capital growth and of employment decline denotes significant increases in the productivity of labour, capital and the capital-to-labour ratio, practically across all analysed sections and divisions of industry [10]. The tendencies are also reflected in the TFP changes. A positive TFP growth rate results from the growing efficiency of the manufacturing processes induced by a broad technological and organisational progress. This rate, however, should not be deemed the rate of a "pure" technological progress, because

[8] Total factor productivity (TFP) is an 'extended' measure of productivity, as it involves a whole set of production factors. It is the value of production per unit combination of production factors. In this paper the indices methods were used to find the TFP rate of growth and more precisely the Tornquist chain index being a discrete approximation of the Divisia continuous time index (Griliches, Jorgenson, 1967; Hulten, 1978; Gullickson, 1995). Estimates of the TFP growth rates calculated in this way are frequently called an effective (observed) TFP.

[9] The effects of the technological progress can be seen in the growing capital-to-labour ratio, which growth results from the substitution of the production factors.

[10] The productivity of labour and productivity of capital grew the highest in technologically-advanced sectors, which may reconfirm that the Polish industry fortunately tends towards divisions based on modern technologies.

we used the real, and not potential production growth rate to calculate it. Such obtained results can be burdened by the estimation errors, such as the non-random errors, that represent effects of the supply- and demand-side shocks.

The table below shows estimates of the effective TFP growth rates by section and division of industry. These are averaged rates of growth for the entire analysed period (1992–2002) and for two subperiods (1992–1997 and 1998-2002)[11]. The TFP was estimated using the gross output, and the list of the primary production factors was extended to include material outlays.

Table 3

Annual average TFP growth rates (%) in the years 1992–2002, by industry section and division

| Specification | 1992–2002 | 1992–1997 | 1998–2002 |
|---|---|---|---|
| Industry | 2.2 | 2.9 | 1.5 |
| Mining and quarrying | 1.6 | 2.4 | 0.9 |
| Manufacturing | 2.4 | 3.2 | 1.7 |
| Manufacture of food products and beverages | 1.5 | 1.7 | 1.4 |
| Manufacture of tobacco products | –0.2 | –1.2 | 0.7 |
| Manufacture of textiles | 2.3 | 3.9 | 0.8 |
| Manufacture of wearing apparel and furriery | 2.5 | 5.1 | 0.1 |
| Manufacture of leather and leather products | 0.6 | 3.4 | –2.2 |
| Manufacture of wood and wood, straw and wicker products | 0.5 | 0.1 | 1.0 |
| Manufacture of pulp and paper | 2.0 | 2.2 | 1.7 |
| Publishing, printing and reproduction of recorded media | 1.7 | 4.5 | –1.1 |
| Manufacture of coke, refined petroleum products | 0.5 | 2.4 | –1.4 |
| Manufacture of chemicals and chemical products | 1.7 | 2.0 | 1.5 |
| Manufacture of rubber and plastic products | 3.3 | 3.8 | 2.9 |
| Manufacture of other non-metallic mineral products | 3.6 | 3.7 | 3.4 |
| Manufacture of basic metals | 1.5 | 2.5 | 0.5 |
| Manufacture of metal products | 3.4 | 4.3 | 2.5 |
| Manufacture of machinery and equipment | 4.3 | 5.7 | 3.0 |
| Manufacture of office machinery and computers | 10.7 | 15.7 | 6.0 |
| Manufacture of electrical machinery and apparatus | 2.5 | 3.2 | 1.9 |
| Manufacture of radio, television and communication equipment and apparatus | 6.9 | 12.2 | 1.9 |
| Manufacture of medical, precision and optical instruments, watches and clocks | 4.4 | 8.0 | 0.9 |
| Manufacture of motor vehicles, trailers and semi-trailers | 2.8 | 2.9 | 2.6 |
| Manufacture of other transport equipment | 2.1 | 0.6 | 3.6 |
| Manufacture of furniture; manufacturing n.e.c. | 1.7 | 3.7 | –0.3 |
| Recycling | –1.2 | –0.6 | –1.9 |
| Electricity, gas and water supply | 0.3 | 0.3 | 0.2 |

Source: Calculated by the authors.

[11] The breakdown into subperiods corresponds to the aforementioned stages in the transition of Polish economy.

Throughout the analysed period, the average TFP growth rate in industry amounted to 2.2% a year, but in Subperiod I it was much larger that in Subperiod II. A similar tendency could be found in actually all sections and divisions of industry. It resulted from the favourable business cycle at that time, expressed by a relatively high production growth generated by the mobilization of the previously underutilised production capacity (particularly in the beginning of the period in question, i.e. years 1992–1994) in order to meet the growing demand. Another reason was the system adjustments implemented during economic restructuring. The TFP rates of growth in particular sectors of the manufacturing industry were very much different. The highest rates were found in the technologically advanced sectors (the manufacture of office machinery and computers, the manufacture of radio, television and communication equipment and apparatus and the manufacture of machinery and equipment). As regards the labour-intensive and raw-materials intensive sectors, the TFP growth rates were much lower and in some sectors even negative (recycling, the manufacture of tobacco products).

## V. DOMESTIC AND FOREIGN INVESTMENTS AND THEIR EFFECT ON TFP CHANGES IN POLISH INDUSTRY

Domestic and foreign investments are - among the many factors - that could contribute to such considerable variations in the TFP growth rates in particular sections and divisions of industry. They increase the amount of human and physical capital available in an economy and contribute to its modernisation. When domestic investments are limited, which is the case of less developed economies, the transfer of foreign capital starts playing a special role. One of the most important channels utilised by such transfers is foreign direct investments that offer flows of financial capital, but also transfer modern knowledge and technology, physical and human capital.

We estimated parameters of equations describing the TFP changes in particular branches of industry with respect to the rate of domestic and foreign investments, to find empirically how domestic and foreign investment outlays affect the TFP. Investments rates were defined by the share that each type of investment held in the gross output of a given sector. As for investment outlays, two variants were taken into account, namely investment outlays on fixed assets and investment in machinery and technical equipment. To eliminate possible supply-side and demand-side shocks that might have affected he values of the TFP growth rate, we decided to substitute annual values of the TFP growth rates with values calculated using the moving average (geometric mean) for three-year subperiods. Initially, the model took the form:

$$\Delta \ln tfp_{it} = \alpha_0 + \alpha_1 fdi_{it-s} + \alpha_2 inv\_dom_{it-s} + \varepsilon_{it} \quad (1)$$

where:

$\Delta \ln tfp_{it}$ – TFP growth rate in $i$-th branch, period $t$;

$fdi_{it-s}$ – share of FDIs received by $i$-th branch in period $(t\text{-}s)$ in the gross output of the branch;

$inv\_dom_{it-s}$ – share of domestic investment outlays (or, alternatively, investment outlays on machinery and technical equipment, $inv\_dom\_m_{it}$) in $i$-th branch in period $(t\text{-}s)$ in the gross output of the branch;

$\varepsilon_{it}$ – model's random term

$s$ – time lag

Parameter $\alpha_0$ can be interpreted as the TFP growth rate in industry under a zero rate of domestic and foreign investments, whereas parameters $\alpha_1$ and $\alpha_2$ show TFP changes (as percentage points) caused by the rate of foreign and domestic investments growing one percentage point. This equation explicitly assumes that for the same rate of domestic and foreign investments in each branch of industry the total productivity growth rate would be the same. To make this assumption more flexible the constant is diversified[12] (a fixed effect model). Then equation (1) takes the form:

$$\Delta \ln tfp_{it} = \alpha_0 + \sum_{j=2}^{15} \beta_j d_j + \alpha_1 fdi_{it-s} + \alpha_2 inv\_dom_{it-s} + \varepsilon_{it} \quad (2)$$

where:

$d_j$ – dummy variable for non-baseline $j$-th branch.

In addition, to allow for the clearly decelerating TFP rate of growth in particular divisions, time trend was added to equation (2). Equation (2) takes the form:

$$\Delta \ln tfp_{it} = \alpha_0 + \sum_{j=2}^{15} \beta_j d_j + \alpha_1 fdi_{it-s} + \alpha_2 inv\_dom_{it-s} + \alpha_3 \cdot t + \varepsilon_{it} \quad (3)$$

In this case we need to readjust the interpretation of the constant term that determines the TFP growth rate in industry under a zero rate of domestic and foreign investments in the period immediately preceding the analysed time span. Parameter $\alpha_3$ shows an average change in the TFP growth rate in industry in the

[12] Diversification was also applied in the case of explanatory variables' parameters. As the results turned out unsatisfying, they were left out.

period in question caused by factors unrelated to domestic and foreign investments. In testing various time lags variants of the explanatory variables, the best results were obtained for two-year lags, for both domestic and foreign investments. Estimates of equation (3) parameters are presented in table 4.

The manufacture of machinery and equipment was taken as the baseline industry. The results suggest that:

- Foreign investments were important for the TFP growth. Their rate growing 1 percentage point makes TFP growth rate increase 0.24–0.34 percentage point on average. This effect is observable after two years ($s = 2$). This variable is statistically significant in both variants.

Table 4

Estimates of equation (3) parameters

| Specification | Parameters (I version) | t-value | Parameters (II version) | t-value |
|---|---|---|---|---|
| Constant | 0.048 | 6.977 | 0.044 | 6.782 |
| $fdi_{t-2}$ | 0.342 | 3.864 | 0.240 | 2.561 |
| $inv\_dom_{t-2}$ | 0.138 | 1.232 | – | – |
| $inv\_dom\_m_{t-2}$ | – | – | 0.506 | 2.763 |
| $t$ | –0.004 | –4.463 | –0.004 | –5.227 |
| Mining and quarrying | –0.017 | –2.038 | –0.023 | –2.913 |
| Manufacture of food products, beverages and tobacco products | –0.036 | –5.417 | –0.035 | –5.458 |
| Manufacture of textiles, wearing apparel and furriery | –0.019 | –2.754 | –0.018 | –2.852 |
| Manufacture of wood and wooden products | –0.030 | –3.120 | –0.037 | –4.120 |
| Manufacture of pulp and paper with publishing and printing | –0.035 | –4.910 | –0.043 | –5.691 |
| Manufacture of coke, refined petroleum products and derivatives | –0.037 | –3.963 | –0.042 | –4.973 |
| Manufacture of chemical and chemical products | –0.033 | –4.379 | –0.034 | –5.125 |
| Manufacture of rubber and plastic products | –0.012 | –1.628 | –0.020 | –2.585 |
| Manufacture of other non-metallic mineral products | –0.039 | –4.028 | –0.044 | –4.819 |
| Manufacture of basic metals and metal products | –0.014 | –1.937 | –0.017 | –2.550 |
| Manufacture of transport equipment | –0.044 | –4.900 | –0.039 | –4.467 |
| Manufacture of furniture and other manufacturing | –0.026 | –3.948 | –0.023 | –3.480 |
| Recycling | –0.025 | –2.952 | –0.027 | –3.341 |
| Electricity, gas and water supply | –0.064 | –2.466 | –0.062 | –5.066 |
| $R^2$ | 0.796 | | 0.813 | |
| $R^2$ (adj.) | 0.724 | | 0.747 | |
| DW | 2.37 | | 2.42 | |
| Number of observations | 90 | | 90 | |

Source: Calculated by the authors.

- Regarding total domestic investments their more significant effect on the TFP growth could not be proved. Domestic investment in machinery and equipment rate increasing 1 percentage point makes the TFP grow 0.506 percentage points. As in the case of foreign investments this effect is lagged ($s = 2$). Such results suggest that both domestic and foreign investments largely determine the TFP growth in individual sections and divisions of industry, with the effect being more distinct in the case of domestic investments.
- Throughout the period in question the TFP growth rate in industry was clearly decelerating, by ca 0.4 percentage points on average (a three-year average). In each variant, this variable was statistically significant.
- Whatever the variant, the TFP growth rate was the highest in the baseline division (manufacture of machinery and equipment). Differences between the TFP growth rate in the baseline division and in the other divisions turned out statistically significant for most divisions. An exception was manufacture of rubber and plastic products, where the difference was statistically insignificant, but only in the first variant.

## VI. FDI AND REGIONAL DEVELOPMENT. AN ATTEMPT OF ASSESSMENT

The geographical distribution of FDIs is also important for the economy of the receiving country, as foreign capital can be a key factor making up for inequalities in the development of individual regions (Karaszewski, 2004, p. 215). On the other hand, however, foreign investors planning to launch investment projects target regions they view the most attractive. Since 1993, a research has been conducted in Poland concerning the investment attractiveness of individual regions. It allows to identify groups of factors that decide about foreign capital location[13]. In general, the factors can be divided into:

- Stimulants, that is factors encouraging investment decisions;
- Destimulants, i.e. factors discouraging investment decisions,
- Nominants, that is neutral factors.

The major stimulants attracting investments to a given region are (Karaszewski 2004, pp. 221–222): the existing industry, human resources and their qualifications, highly absorptive local market, well-developed market and transport infrastructure, favourable attitude of the local authorities to foreign investors. Foreign investors are deterred by: high rate of unemployment and related pathologies, hazards resulting from high crime rates, degradation of the

[13] The research is conducted by the Gdańsk Institute for Market Economics and it attempts to assess investment attractiveness of Polish provinces, i.e. is regions established by the administrative division.

natural environment, and local communities' reluctance to foreign investors. An analysis of the above features allows to assess the attractiveness of particular provinces in investors' eyes. The results can be found in Chart 3.

For foreign investors the most attractive (class A) among the 16 provinces seem to be the provinces of Mazowsze and Silesia. Their economic potential is the largest. Their extensive urban agglomerations open voluminous and absorptive markets to investors. An additional advantage of Mazowsze is the proximity of the central offices responsible for making economic and political decisions. The next group (class B) is four provinces: Wielkopolska, Pomerania, Western Pomerania and Lower Silesia. These regions are relatively well-industrialised and they are favoured by their on-border location[14] or good accessibility, respectively. The third group is represented by 5 provinces, namely: Lubuskie, Opolskie, Małopolska, Łódź and Kujawsko-Pomorskie. The least attractive provinces can be found in the eastern part of the country (Warmia-Mazury, Podlasie, Lubelskie, Świętokrzyskie and Podkarpackie). For those areas most indicators assessing their investment attractiveness (GDP, market absorptivity, the volume of industrial output, degree of urbanisation, accessibility via communications) are relatively lower than in the other provinces.


Chart 3. Assessment of investment attractiveness of Polish provinces

S o u r c e: Developed by the authors on the basis of Gawlikowska-Hueckel K. and Dutkowski M., (ed.), 2000, *Polska regionów*, IBnGR, pp.94–95

[14] These areas border with Germany being one of the largest foreign investors in Poland.

It is quite difficult though, to analyse FDIs' impacts on regional development. A serious impediment in this process is the lack of adequately long statistical series. This problem is not specific for Polish economy or all economies in transition; the developed countries pose the same problem (Tomaszewicz, Trębska, 2004, p.37). In the case of Poland, an additional barrier seems to be the new administrative division introduced in 1999 (it reduced 49 provinces to 16). Albeit statistical organisations operating in the country (primarily the Central Statistical Office with its provincial branches) estimate some selected economic categories for the earlier years, this information is published with a serious delay[15]. As for the regional FDI statistics, the situation is even more complicated, as the available information is actually limited to the number of foreign-owned firms, the capital invested being unreported. In addition, information derived from various sources is frequently incomparable[16]. The PAIiIZ data on the geographical location of foreign capital cover the period from 1998.

The PAIiIZ information (Table 5) reveals strong concentration of foreign capital represented by the foreign-owned firms in the largest and most industrialized provinces, where the economic and social infrastructures are the best developed, and whose local markets are highly absorptive markets. Mazowsze, where 24%–30% of all foreign-owned organisations have their headquarters, is the unquestionable leader. For Silesia and Wielkopolska the corresponding share is almost twice as low and it amounts to 10–13%. Next are provinces of Lower Silesia and Pomerania (6.6%–8.3). For other provinces the share does not exceed 6%.

Western Pomerania's position is interesting, considering the fact that the province's investment attractiveness was assessed favourably. Perhaps small-sized firms that are excluded from the PAIiIZ statistics prevail in this province or, alternatively, it may be so because Germany that borders with Western Pomerania invests only small amounts in the region.

Another interesting fact is that the regional structure of foreign firms does not change very much year by year. Therefore, a justified conclusion is that it was not very much different in the previous years, either. We assessed the efficiency of particular provinces by analysing changes in the level and dynamics of the productivity of labour (measured by value added per worker), in the capital-to-labour ratio and in the TFP. The latter was found using the neoclassic, two-

[15] Today regional data are available for years 1995-2002; data on some economic categories (total production, GDP, value added) are available for years 1995-2001.

[16] Several institutions in Poland gather and process data on the amounts of invested foreign capital. The most important of them are GUS, NBP and PAIiIZ. Each of them operates a different methodology to calculate FDI values – as a result, the information they provide is considerably different. This paper uses the PAIiIZ data.

factor Cobb-Douglas production function characterised by constant returns to scale[17].

Table 5

Regional distribution of foreign-owned firms, years 1998–2002

| Province | 1998 | 1999 | 2000 | 2001 | 2002 | Regions' investment attractiveness |
|---|---|---|---|---|---|---|
| | % | | | | | |
| Mazowsze | 24.5 | 24.0 | 25.2 | 27.6 | 29.6 | A |
| Silesia | 12.6 | 13.8 | 12.8 | 12.9 | 13.1 | A |
| Wielkopolska | 11.8 | 11.8 | 11.5 | 10.2 | 9.7 | B |
| Lower Silesia | 8.3 | 8.3 | 8.2 | 8.1 | 7.6 | B |
| Pomerania | 7.6 | 7.5 | 7.3 | 6.5 | 6.6 | B |
| Łódź | 5.9 | 5.9 | 5.8 | 5.7 | 5.3 | C |
| Małopolska | 5.5 | 5.5 | 5.7 | 5.6 | 5.3 | C |
| Kujawsko-Pomorskie | 4.1 | 4.1 | 4.1 | 3.9 | 3.8 | C |
| Western Pomerania | 3.9 | 4.0 | 3.8 | 3.7 | 3.6 | B |
| Lubelskie | 2.6 | 2.2 | 2.8 | 2.9 | 2.8 | D |
| Podkarpackie | 2.6 | 2.6 | 2.5 | 2.7 | 2.7 | D |
| Warmia-Mazury | 2.3 | 2.3 | 2.4 | 2.4 | 2.3 | D |
| Świętokrzyskie | 2.4 | 2.3 | 2.2 | 2.2 | 2.2 | D |
| Lubuskie | 2.2 | 2.2 | 2.1 | 2.2 | 2.1 | C |
| Opole | 1.9 | 1.9 | 1.9 | 2.1 | 1.8 | C |
| Podlaskie | 1.6 | 1.6 | 1.6 | 1.3 | 1.5 | D |
| Number of locations | 1834 | 1919 | 1871 | 2397 | 2666 | |

Source: Calculated by the authors on the basis of PAIZ data.

Chart 5 presents regional variations in the productivity of labour, in the capital-to-labour ratio and in the TFP between Polish regions. The indicators were the highest in the provinces of Mazowsze and Silesia. They were relatively high also in Lower Silesia (particularly regarding the TFP). The high productivity of labour in Pomerania, Wielkopolska and Lubuskie combined with slightly lower capital-to-labour ratio translated into a comparatively high TFP level in the provinces. The TFP was high also in the province of Kujawsko-Pomorskie, due to the relatively high productivity of labour, compared with the low capital-to-labour ratio.

All the analysed factors were the lowest in the north-eastern provinces of Poland (Warmia-Mazury and Podlaskie), in south-eastern Poland (Lubelskie, Podkarpackie, Małopolska and Świętokrzyskie) and in the province of Łódź. Different TFP values in provinces may result from diverse sectoral structures in the product market and labour market. In provinces where the TFP was relatively high, a low-productive agricultural sector accounts for a definitely lower

[17] This function was developed into the labour productivity function and then, using the cross-section and time-series data, we estimated the elasticity of production with regard to capital (Tokarski, i in. 2005). Its value was $\alpha = 0.706$.

percentage of the generated value added and employs a lower percentage of the workforce than in other provinces (Gajewski, Tokarski 2004).

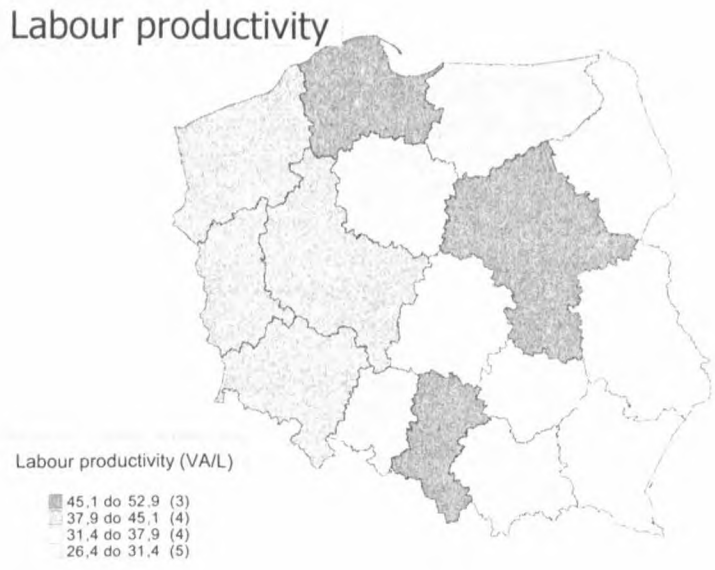
If we take into account the investment attractiveness of individual regions, then we can clearly see that the most economically developed regions are also the most attractive targets for foreign capital. This conclusion is supported by the values of correlation coefficients between the productivity of labour, the capital-to-labour ratio and the TFP, on the one hand, and the intensity of foreign investors' activity in those regions (Table 6)[18], on the other.

Table 6

Correlation coefficients between the intensity of foreign investors' activities and the level of economic development

| Specification | Pearson correlation coefficients |
|---|---|
| Productivity of labour | 0.906 |
| Capital-to-labour ratio | 0.821 |
| Total factor productivity | 0.752 |

Source: Authors' calculations.




[18] The foreign investor investment activity ratio is defined as the ratio of the number of the located foreign-owned firms (over 1 million) to the workforce size.

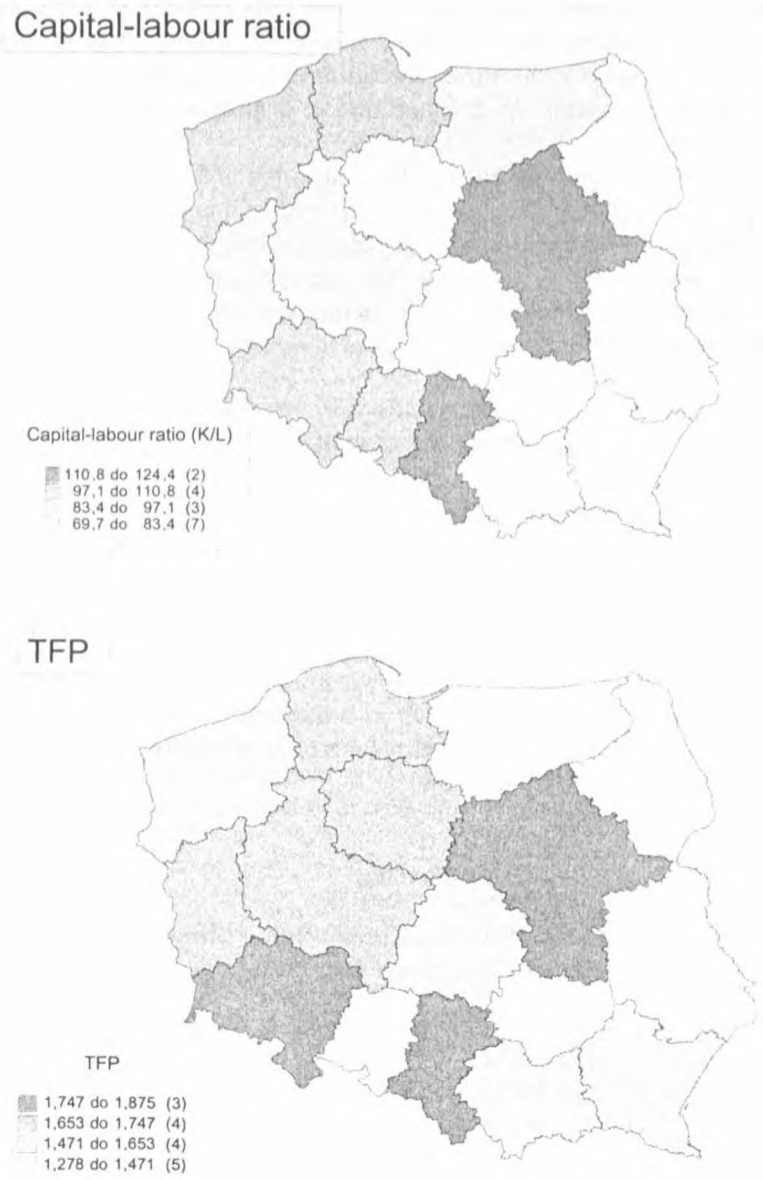



Chart 5. Regional variations in the productivity of labour, capital-to-labour ratio and the TFP

S o u r c e: estimated by the authors

The results confirm a strong positive relationship between the level of a region's economic development and the foreign investors' activity there. In other words, the most developed regions attract foreign investors whose activities then stimulate regional development. As a consequence, disproportions between regions may grow even larger.

The discussed results are only an introduction to the analysis of foreign investments' impacts on regional development. This research is seriously hindered by the unavailability of statistical data of the required length. Nevertheless, the research will be continued, as its outcomes may turn out a useful tool supporting an adequate regional policy helping offset inequalities between the levels of regional development in the long term.

## VII. FINAL REMARKS

The assessment of foreign investments' contribution economic development in Poland in the context of variations in the efficiency of production processes cannot be explicit. On one hand, the investments are an important channel for sharing knowledge, technology and new organizational solutions that are one source of broad technological progress. They are crucial for supporting domestic investment activities. One the other hand, however, foreign investors are interested in industrialised regions, where GDP and the productivity of labour are already high and where the size of human resources is adequate to their needs, which makes interregional variations grow.

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*Iwona Świeczewska, Zofia Wysocka*

## WPŁYW BEZPOŚREDNICH INWESTYCJI ZAGRANICZNYCH NA PRODUKTYWNOŚĆ POLSKIEJ GOSPODARKI. ASPEKT SEKTOROWY I REGIONALNY

Głównym celem opracowania jest analiza wpływu bezpośrednich inwestycji zagranicznych na zmiany efektywności polskiej gospodarki, które mogą być efektem szeroko rozumianego postępu technicznego. Zmiany efektywności utożsamiane są ze zmianami łącznej produktywności czynników produkcji. Analizę przeprowadzono w dwóch ujęciach: na szczeblu sektorowym i regionalnym. Pierwsza część opracowania dotyczy analizy wpływu inwestycji krajowych i zagranicznych (jakie napłynęły do polskiej gospodarki w formie inwestycji bezpośrednich) na zmiany łącznej produktywności czynników produkcji. Celem badań jest: 1) próba empirycznego określenia wpływu krajowych i zagranicznych inwestycji na zmiany łącznej produktywności czynników produkcji oraz 2) próba empirycznej weryfikacji hipotezy, że inwestycje zagraniczne w większym stopniu wpływają na poprawę efektywności procesów produkcyjnych niż inwestycje krajowe. Analizę przeprowadzono na szczeblu sekcji i działów przemysłu i obejmuje lata 1992–2002. W drugiej części podjęto próbę odpowiedzi na pytanie, czy, a jeśli tak, to w jakim stopniu tempo rozwoju poszczególnych województw jest skorelowane z działalnością inwestorów zagranicznych w tych regionach. Ze względu na dostępność danych statystycznych analizę ograniczono do lat 1998–2002. W każdej części przedstawiona została krótka analiza inwestycji zagranicznych na szczeblu poszczególnych sekcji i działów przemysłu, jak również na szczeblu regionalnym.