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Impact of pharmaceutical companies upon the economy and public finance in Poland: The Sanofi case study

ABSTRACT

The paper discusses a two-channel impact of pharmaceutical companies upon the economy and public finance. Firstly, pharmaceutical companies predominantly impact the net value added, employment, income of people employed by their suppliers and customers as well as public finance revenue in the countries where they are based. The mechanisms of such an influence are presented in the input-output matrix (input-output analysis) that shows how output from one industrial sector in the economy may become an input to another industrial sector. The input-output model was developed by Leontief and earned him the Nobel Prize. This kind of influence upon the Polish economy has been illustrated with the case study of the Sanofi company. Secondly, pharmaceutical products improve the effectiveness of medical treatment, by which they contribute to the higher standard of living and economic growth. In this part of investigation into the impact of pharmaceutical companies upon the economy the key method consists in calculating indirect costs, that is, the lost productivity (lost GDP). Non-generated GDP as well as the negative impact of diseases and the treatment thereof on public finance can be significantly reduced by using more effective pharmaceutical products. This second channel through which pharmaceutical companies exert influence on the economy has been illustrated with an example of economic consequences calculated from the social viewpoint for three gynaecological–oncology diseases. Our calculations for both channels in this exercise have led us to conclude that a pharmaceutical company positively influences its business partners and the economy while by improving the health of the population it exerts a positive impact upon the economy and public finance.

Keywords: input-output analysis, economy, net value added, employment, incomes, public finance
JEL Classification Codes: E20, I15, H20

Introduction

Each pharmaceutical corporation plays a special role in the area of health care, economy and society as it conducts R&D activities that improve the health of people.¹ Since health and education are two dimensions of human capital, the principal driver of economic growth, a pharmaceutical company impacts the economy through two channels. The first one includes cooperation with business partners, its suppliers and customers. It means the corporation has got its share in the size of GDP but also in the income of its employees and employment, which means it contributes to economic growth and development. The mechanism of such an influence is well illustrated by an input-output matrix (input-output analysis).² For the Polish economy this impact has been illustrated with the case study of the Sanofi company, who was kind enough to reveal necessary data. Yet, the analysis does not include theoretical considerations on potential, variable negative effects of the activities pursued by pharmaceutical companies. The second channel works because pharmaceutical companies are developing increasingly more effective drugs, which provide more effective health protection and better cure to patients. It reduces indirect costs defined as lost GDP (lost productivity) due to illnesses and their treatment but also decreases the losses suffered by the state budget because of lost revenue from taxes (personal income taxes and taxes on goods and services) and increases revenue from contributions paid to social security, including health insurance. At the same time, social benefits from the budget are reduced. Indirect costs are caused by absenteeism and presenteeism of employees who are sick, as well as their informal care providers, disabilities and premature deaths. This second channel of impact exerted by pharmaceutical companies upon the economy has been illustrated with calculations of economic consequences made from the social perspective for three gynaecological oncology diseases.

Studies on the impact of pharmaceutical companies upon the economy and public finance are especially relevant under the new approach to innovation in this industry [Mazzucato, 2013].

The paper focuses on the impact of pharmaceutical companies upon the Polish economy and public finance through the size of the output of their suppliers and their own production for their clients but also by improving the health of the population and, as a result, GDP. The first section is an overview of the literature on the use of input-output analysis as a method of examining the impact of an enterprise upon the economy and public finance. The next

¹ The role of the state in the impacts between the public and the private sectors in terms of innovations in the pharmaceutical industry is described in: Mazzucato Mariana, 2013, *Przedsiębiorcze państwo*, Wydawnictwo Ekonomiczne Heterodox.

² It is a method used to examine relationships within an economy (between its industries or regions). It was developed by Wassily Leontief and earned him the Nobel Prize. The method consists in collecting data about the value of outputs produced within an economy and the use thereof; outputs are grouped for industries. The method helps building a table providing data about outputs per industries and how they are used broken down into indirect use in all industries and in final demand. On top of that, it also considers other data, such as, e.g., imports, exports, taxes and value added for individual industries. In Poland input-output tables are published by the Statistics Poland every 5 years, their latest edition comes from 2014 and provides data for 2010.

section provides estimates of effects of the output of a pharmaceutical company upon the economy and public finance based on the Sanofi company case study. The third section discusses how the treatment of illnesses impacts public finance on the example of three cancer diseases.

1. Overview of the literature

Pioneering effort in input-output analysis is credited to Francis de Quesnay who published *Tableau Economique* back in 1758. Wassily Leontief developed a coherent and comprehensive model of the economy that has been used ever since [Leontief, 1941]. In the 1950s regional input-output models were developed by Isard, Chenery and Moses while Dorfman, Samuelson, and Solow expanded the Leontief model with optimising methods. Moreover, by publishing the results of studies on production factors in international trade Leontief contributed to the development of new international trade theories. In the 1960s precursors of integrated models emerged on the world stage, e.g., the Inforum group together with precursors of studies on relationships between the economy and the environment. The 1970s witnessed the growth of dynamic and international trade models. That was the time when macroeconomic models, integrated and the CGE, based on the input-output tables were built. The next decade is the time of developing the social accounting matrices (SAM) under the supervision of Richard Stone. Boratyński, Przybyliński, and Świeczewska demonstrated how input-output methods can be used in simulation analyses of potential development paths in individual areas of the economy, depending on their importance for formulating the economic policy. Dietzenbacher, Lenzen, Los, Guan, Lahr, Sancho, Suh, and Yang outline the entire array of potential applications of the method in investigations into the future of the economy and its industries over the time frame of 25 years. Przybyliński uses the input-output models to analyse exports and imports in Poland, however, due to international unification of the tables, the results of studies are universal. There are numerous publications that more broadly discuss the models and their application [e.g. Tomaszewicz, 1983, 1994, 2005; Miller & Blair, 2009].

2. Impact of a pharmaceutical company upon the economy and public finance: the case of Sanofi³

In order to identify the impact of Sanofi, a pharmaceutical company, we used an input-output model published by the Statistics Poland, which takes account of branches of the economy. Calculations started with the industrial sector “drugs and pharmaceutical products” (industrial sector 17 in the input-output matrix, item 21 in the classification of products and services

³ Results of the study were published in: *Wpływ innowacyjnych firm ponadnarodowych na rozwój społeczno-gospodarczy Polski*, 2016, Instytut Innowacyjna Gospodarka.

aggregated into 77 industrial sectors), then we considered the share of SANOFI in the sector. The input-output method is an indispensable tool in examining the impact of industrial sectors of the economy upon one another. Input-output tables show the flows of factors and products among industrial sectors reflecting the structure of the economy and the relevance of individual sectors.

In the study discussed in the paper attention is focused on the impact of pharmaceutical companies on the value added (in accordance with the model – on Gross Domestic Product (GDP) and in accordance with national accounts in the Statistics Poland – on the gross value added which, when added to taxes, makes GDP), employment, income of households, and tax income into the public finance sector.

Input-output analysis is used to present three types of effects triggered by the pharmaceutical industry and its companies. First, there are direct effects reflected in economic performance indicators of the industrial sector in question. The second type of effects includes indirect effects, i.e., how the pharmaceutical industry impacts the performance of other industrial sectors, because economic performance in selected industrial sectors depends on demand for their products. Finally, there are induced effects that show consumer expenditure of the people employed as a result of the direct and indirect effects.

The study used *Bilans przepływów międzygałęziowych w bieżących cenach bazowych w 2010 roku* [Input-output analysis in current base prices in 2010] published by the Statistics Poland in 2014 [<http://stat.gov.pl/obszary-tematyczne/rachunki-narodowe/roczne-rachunki-narodowe/bilans-przeplywow-miedzygaleziowych-w-biezacych-cenach-bazowych-w-2010-r-7,2.html>]. On top of that we used the following statistical yearbooks: “Rocznik Statystyczny Rzeczypospolitej Polskiej 2015” [Statistical Yearbook of the Republic of Poland 2015], “Rocznik Statystyczny Pracy 2015” [Statistical Yearbook Labour 2015], and “Rocznik Statystyczny Przemysłu 2015” [Statistical Yearbook for Industry 2015] [<http://stat.gov.pl/publikacje/szukaj.html?letter=R>].

2.1. Impact upon net value added

Our calculations showed that Sanofi has got a big share in the “drugs and pharmaceutical products” industrial sector, meaning it has got an impact upon its suppliers and consumers of its products. Its share in the production sold of the industrial sector in 2014 amounted to ca. 15%, while the share of the value added of the company in the value added of the sector was ca. 5.7%. These shares are indicative of the importance of the direct effect in generating GDP. We need to stress that manufacturers of drugs and pharmaceutical products depend on each other. In the entire industrial sector value added absorbed for its own needs represented ca. 33%. Value added generated in the industrial sector in question for other manufacturers from the same sector amounted to PLN 705,047,103, out of which Sanofi generated ca. 6%.

To demonstrate the indirect effect, we selected industrial sectors whose value added made a meaningful contribution into the manufacturing of drugs and pharmaceutical products, i.e.,

for which the production for Sanofi accounted for a substantial chunk of their output. Within the Polish economy companies from industrial sectors providing input also into the production of drugs and pharmaceutical products generated net value added of PLN 124,868,643 only for the needs of Sanofi. Suppliers from the same industrial sector generated value added of PLN 40,117,180 for the needs of the company. Producers from the manufacturing sector supplied value added of PLN 7,755,872. Companies dealing with trade, transport, and warehousing generated PLN 18,868,067 of value added and service providers ca. PLN 25,571,109. A separate service sector including advertising services, market research and opinion polls generated value added of PLN 25,889,663. Sanofi consumed energy and gas representing value added of PLN 2,659,642.

Net value added generated in the economy should also be viewed from another angle. While companies from other industrial sectors sell products meeting demand of the pharmaceutical industry, the “drugs and pharmaceutical products” industrial sector manufactures for companies from other sectors in the economy. Net value added generated in other sectors based on supplies from Sanofi amounted to PLN 1,978,072,149. As expected, health care was the major client (PLN 991,906,106) followed by veterinary services (PLN 100,328,777). The value added generated by Sanofi was used by service providers in public administration (PLN 96,265,989) and in social welfare services (PLN 47,491,198). Besides, net value added of PLN 705,047,103 was generated by companies from the “manufacturing drugs and pharmaceutical products” industrial sector.

2.2. Impact on employment

In 2014 Sanofi employed ca. 5% of all people employed in the industrial sector manufacturing drugs and pharmaceutical products. Sanofi’s employment is its direct effect.

The indirect effect shows how many people are employed in other industrial sectors and working for the benefit of Sanofi. To generate factors meeting the manufacturing needs of Sanofi, other industrial sectors employed 1,412 people, which is more than the size of employment in the company in question. The majority of them, 294, worked in other companies of the same industrial sector. Manufacturing sector employed 72 people out of the above pool while trade, transport and warehousing services as many as 223 people. Sanofi also created 173 jobs in the R&D sector. Advertising, market research and opinion polls employed 467 people.

2.3. Impact on the income of the employed population

The income of the people employed in Sanofi represented ca. 9% of the income of people employed in the industrial sector manufacturing drugs and pharmaceutical products in 2014, which demonstrates the size of the direct effect.

The indirect effect shows the income of people employed in other industrial sectors and working to meet the production needs of Sanofi. The workers of the drug and pharmaceutical

products sector and of the most important sectors that provide input into Sanofi's output received in total the income to the amount of PLN 56,785,784. Most of it was earned by employees from the same industrial sector (PLN 20,530,802). Workers of six aggregated service sectors earned PLN 10,296,799 and employees from the advertising, market research and opinion polls sector made PLN 10,101,936. People employed in trade, transport, and warehousing received an income of PLN 6,868,729. Employees' income in manufacturing industry was PLN 3,579,294 and in the industrial sector of energy, gas, and steam PLN 1,490,932. In the R&D sector Sanofi generated the income of PLN 3,917,291.

By knowing the income earned by the people employed in the enterprises that worked for Sanofi we can consider their expenditure on consumption, its structure as well as savings. Consumption means there is demand targeting producers of all consumer goods, an incentive to produce, which triggers induced effects. Moreover, savings increase deposits at financial institutions, which are then used to finance investment projects, which, in turn, stimulate growth.

In 2014 the income of households was divided between consumption, which accounted for 97.2% and savings, representing 2.8%. It means that out of PLN 56,785,784 of the income of people employed in other enterprises working for Sanofi PLN 55,195,782 was used for consumption, while the remaining PLN 1,590,002 was deposited (saved) with financial sector institutions. This amount multiplied by the money multiplier is a component of money supply used for investment. Household consumption expenditure by purpose shows the dominance of food and non-alcoholic beverages, which represent 17.2% of final consumption expenditure and the demand for products of food processing industry worth PLN 9,493,675. It means the food processing industry employs people working exclusively to deliver food for those who work to meet the needs of Sanofi. These people received remuneration and their employers paid taxes. The impact of Sanofi expressed in terms of money upon the economy including: net value added, employment, remuneration, and taxes further increases. The same line of reasoning should be deployed to calculate the effects for other industrial sectors, whose output meets households' demand for food.

2.4. Impact on public finance

The share of taxes paid by the company in total taxes paid by the industrial sector manufacturing drugs and pharmaceutical products reached ca. 0.2% in 2014. The share illustrates the relevance of the direct effect.

The indirect effect shows the amount of tax revenue to public finance from enterprises working for Sanofi; in this case tax revenue from other industrial sectors was PLN 4,816,825. The highest taxes, PLN 1,432,321, were paid by enterprises from the same industrial sector. The manufacturing industry paid taxes to the amount of PLN 639,588 and six service sectors contributed PLN 594,032. Taxes paid on revenue generated by advertising services, market research and opinion polls amounted to PLN 282,961. Research and development activities

generated taxes worth PLN 264,229; taxes paid on trade, transport, and warehousing services reached PLN 1,438,411, while the energy and gas supplying sector paid PLN 165,282 of taxes.

Speaking of the induced effect, the industries which meet consumer demand of workers who generate output that becomes an input for Sanofi also pay taxes to the public finance sector.

In summary, Sanofi has the generated net value added, the principal component of GDP, to the amount of PLN 124,868,643 – this is how much was contributed by the companies that supply Sanofi. Secondly, the company produced PLN 1,978,072,149 of the value added generated by companies from other industrial sectors from the input delivered by Sanofi. In Sanofi's suppliers in total 1,412 people were working exclusively to meet the company's demand. These 1,412 people earned PLN 56,785,784, out of which they allocated over 97% for consumption, meaning their demand further "fuelled" the economy. Suppliers to Sanofi paid PLN 4,816,825 of taxes to public finance coffers.

3. Impact of illnesses on the economy and public finance

Indirect costs reflect the productivity lost as a result of absenteeism caused by illnesses of workers and their informal care providers, presenteeism of sick workers and their informal care providers, inability to work (disability pension), and premature deaths.⁴

At the same time, lower productivity, i.e. reduced GDP, translates into consequences to public finance as it diminishes the income of the state budget (and also of local government budgets) from personal and corporate income tax (PIT and CIT), as well as from VAT and excise duty. Revenue from social security contributions gets reduced, while transfers from the state budget to the sick (sickness and rehabilitation benefits, disability pensions) increase. The impact of illnesses on the economy and public finance is shown in Figure 1.

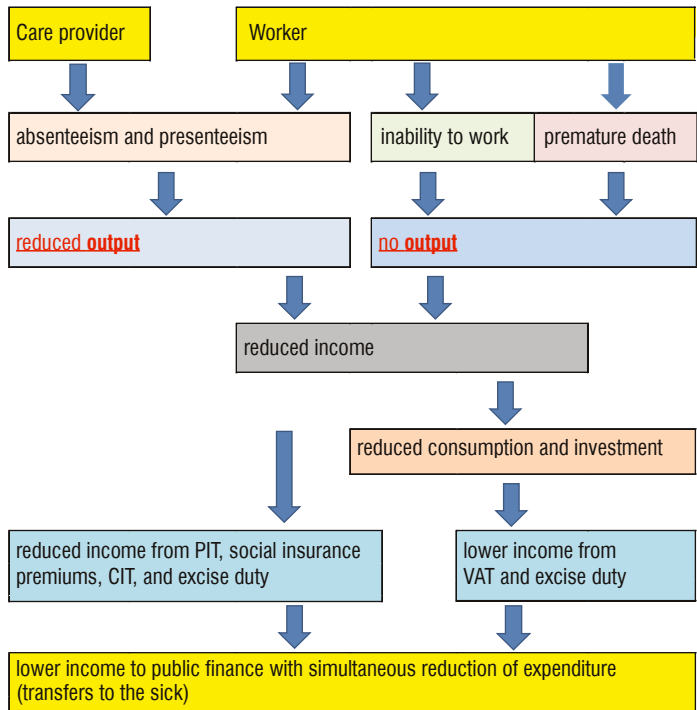
How illnesses impact the economy can be best depicted by the human resources method used in calculations for cardiac insufficiency. It shows the effects of the illness over the short- and long-term and the types of costs generated, see Figure 2.

Illnesses and their treatment use up labour and capital: human, financial and in kind. Analyses of economic losses and the cost of treatment of breast, cervical, and ovarian cancer in Poland demonstrate that indirect costs are more than six times higher than direct costs and one may not forget their consequences to public finance.⁵ All economic costs to the society involved in breast cancer (C50), cervical cancer (C53), and ovarian cancer (C56) in 2014 are presented in Table 1.

⁴ There are also social costs, which take account of social welfare including, besides lost productivity, also immeasurable costs of pain and suffering of the ill and their informal care providers.

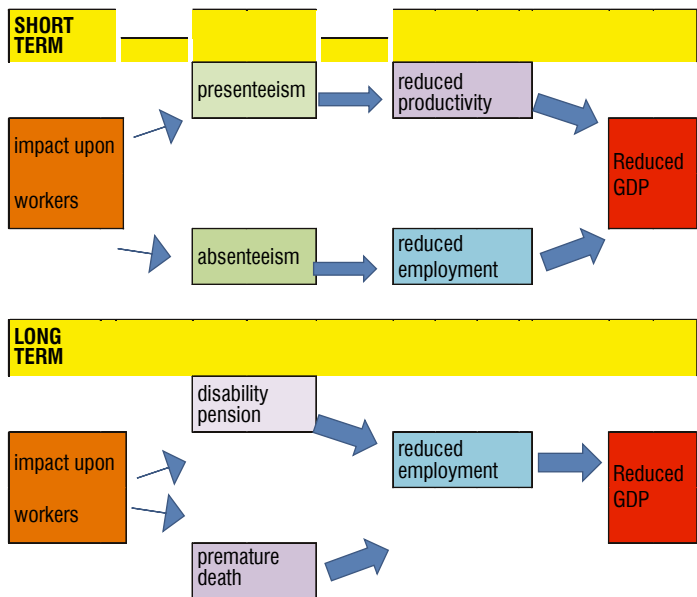
⁵ *Ocena strat ekonomicznych i kosztów leczenia nowotworów piersi, szyjki macicy i jajnika w Polsce, 2016.* E. Nojszewska (Scientific editor), Warszawa: Instytut Innowacyjna Gospodarka.

Figure 1. Impact of illnesses on the economy and public finance



Source: *Ocena strat ekonomicznych i kosztów leczenia nowotworów piersi, szyjki macicy i jajnika w Polsce*, 2016. E. Nojszewska (Scientific editor). Warszawa: Instytut Innowacyjna Gospodarka, p. 35.

Figure 2. Impact of illnesses upon the economy; the human resources method



Source: *Ocena strat ekonomicznych i kosztów leczenia nowotworów piersi, szyjki macicy i jajnika w Polsce*, 2016. E. Nojszewska (Scientific editor). Warszawa: Instytut Innowacyjna Gospodarka, p. 36.

Table 1. All types of economic costs to the society involved in breast cancer (C50), cervical cancer (C53), and ovarian cancer (C56) in 2014, in PLN

C50	C53	C56	Total
DIRECT COSTS			
543 766 000.00	53 703 000.00	90 483 000.00	687 952 000.00
INDIRECT COSTS – ABSENTEEISM OF THE SICK			
526 990 926.25	62 820 363.95	98 577 240.99	688 388 531.19
INDIRECT COSTS – PRESENTEEISM OF THE SICK			
221 291 022.92	42 584 414.88	21 764 498.81	285 639 936.61
INDIRECT COSTS – ABSENTEEISM OF CARE PROVIDERS			
2 007 859.77	259 142.11	383 994.33	2 650 996.21
INDIRECT COSTS – PRESENTEEISM OF CARE PROVIDERS			
552 108 189.02	78 981 532.46	83 188 947.88	714 278 669.37
INDIRECT COSTS – INABILITY TO WORK			
972 421 720.66	134 120 628.60	174 535 458.34	1 281 077 807.60
INDIRECT COSTS – PREMATURE DEATHS			
794 411 570.65	310 501 511.42	331 705 965.33	1 436 619 047.40
PUBLIC FINANCE – DISABILITY PENSIONS			
125 989 300.00	21 453 100.00	24 802 000.00	172 244 400.00
PUBLIC FINANCE – SICKNESS BENEFITS			
59 782 900.00	5 630 900.00	12 663 900.00	78 077 700.00
PUBLIC FINANCE – REHABILITATION BENEFITS			
44 557 600.00	4 244 600.00	7 875 100.00	56 677 300.00
PUBLIC FINANCE – REHABILITATION			
3 174 800.00	5 100.00	5 700.00	3 185 600.00
PUBLIC FINANCE – SOCIAL PENSIONS			
812 000.00	275 200.00	472 000.00	1 559 200.00
PUBLIC FINANCE – LOST INCOME FROM PIT			
138 074 600.00	28 308 700.00	31 947 600.00	198 330 900.00
PUBLIC FINANCE – LOST INCOME FROM CIT			
53 735 400.00	11 017 100.00	12 433 200.00	77 185 700.00
PUBLIC FINANCE – LOST INCOME FROM EXCISE DUTY			
111 158 800.00	22 790 300.00	25 719 800.00	159 668 900.00
PUBLIC FINANCE – LOST INCOME FROM VAT			
216 004 200.00	44 286 100.00	49 978 900.00	310 269 200.00
PUBLIC FINANCE – LOST SOCIAL INSURANCE CONTRIBUTIONS			
406 589 700.00	83 360 800.00	94 076 400.00	584 026 900.00
PUBLIC FINANCE – LOST SICKNESS INSURANCE CONTRIBUTIONS			
115 000 600.00	23 577 900.00	26 608 700.00	165 187 200.00

Source: *Ocena strat ekonomicznych i kosztów leczenia nowotworów piersi, szyjki macicy i jajnika w Polsce*, 2016. E. Nojszewska (Scientific editor), Warszawa: Instytut Innowacyjna Gospodarka, pp. 128–131.

Since the above amounts cannot be added, we must bear in mind that in 2014 alone indirect costs reached PLN 4,408,654,989, the amount paid out from the central budget amounted to PLN 311,744,200. By looking at changes in the incidence rate and in the amounts paid over time it seems that social payments made to the sick are being reduced. On top of that, public finance lost income to the amount of PLN 1,491,668,800.

Considering the data from Table 1, the structure of health policy merits some reflection. If decision makers opted for higher direct costs caused by more expensive treatment, such as personalised medicine, indirect costs and the consequences for public finance would be radically different. Adding on these two financial categories over a long period suggests that expensive but effective treatment is a viable option.

Summary

Economic growth is one of the major determinants of the quality of life. Our investigation into the impact of one pharmaceutical company upon growth has shown that, on the one hand, it does impact growth by being involved in manufacturing processes illustrated with input-output matrices. However, the second type of impact – increasing GDP through improving the health of society as a result of using more effective drugs – is especially relevant. New and increasingly more effective drugs reduce indirect costs and improve public finance performance. Thus, we may conclude that the results of both analyses for channels through which a pharmaceutical company impacts the economy confirm that it exerts a positive impact on its business partners and the economy but also – by improving the health of people – on the economy and public finance.

References

1. *Bilans przepływów międzygaleziowych w bieżących cenach bazowych w 2010 roku*, 2014. <http://stat.gov.pl/obszary-tematyczne/rachunki-narodowe/roczne-rachunki-narodowe/bilans-przeplywow-miedzygaleziowych-w-biezacych-cenach-bazowych-w-2010-r-,7,2.html>
2. Boratyński J., Przybyliński M., Świeczewska I., 2015. *Metody input-output: wybrane kierunki rozwoju*. In: *Nauczyciel akademicki wobec nowych wyzwań edukacyjnych*, P. Wdowiński (Ed.). Łódź: Wydawnictwo Uniwersytetu Łódzkiego, pp. 9–23.
3. Dietzenbacher E., Lenzen M., Los B., Guan D., Lahr M.L., Sancho F., Suh S. & Yang C., 2013. *Input-output analysis: the next 25 years*, Economic Systems Research, DOI: 10.1080/09535314.2013.846902.
4. Miller R.E., Blair P.D., 2009. *Input-Output Analysis: Foundations and Extensions*, 2nd ed. New York: Cambridge University Press.
5. Chenery H.B., Watanabe T., Oct. 1958. International Comparison of the Structure of Production. *Econometrica*, Vol. 26, No. 4 (), pp. 487–521.

6. Leontief W., 1941. *Structure of the American Economy, 1919–1929 an empirical application of equilibrium analysis*. Cambridge, Mass.: Harvard University Press.
7. *Ocena strat ekonomicznych i kosztów leczenia nowotworów piersi, szyjki macicy i jajnika w Polsce*, 2016. E. Nojszewska (Scientific editor). Warszawa: Instytut Innowacyjna Gospodarka.
8. Mazzucato M., 2013. *Przedsiębiorcze państwo*. Wydawnictwo Ekonomiczne Heterodox. Poznań
9. Przybyliński M., 2012. *Metody i tablice przepływów międzygałęziowych w analizach handlu zagranicznego polski*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego.
10. Rasmussen, P.N., 1956. *Studies in Intersectorial Relations*, Amsterdam: North-Holland.
11. *Rocznik Statystyczny Rzeczypospolitej Polskiej 2015*, <http://stat.gov.l/publikacje/szukaj.html?letter=R>
12. *Rocznik Statystyczny Pracy 2015*, <http://stat.gov.pl/publikacje/szukaj.html?letter=R>
13. *Rocznik Statystyczny Przemysłu 2015*, <http://stat.gov.pl/publikacje/szukaj.html?letter=R>
14. Tomaszewicz Ł., 1983. *Zintegrowane modele gospodarki narodowej*. Warszawa: PWE.
15. Tomaszewicz Ł., 1994. *Metody analizy input-output* Warszawa: PWE.
16. Tomaszewicz Ł., 2005. Metody analizy input-output. *Przegląd Statystyczny*, Vol. 52, pp. 15–22.
17. *Wpływ innowacyjnych firm ponadnarodowych na rozwój społeczno-gospodarczy Polski*, 2016. Warszawa: Instytut Innowacyjna Gospodarka.

