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ASSESSMENT OF THE RELATIONSHIP BETWEEN INNOVATIONS AND ECONOMIC PERFORMANCE OF MANUFACTURING ENTERPRISES IN POLAND

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ABSTRACT

Long-term economic growth is based on innovations, and these depend, among others, on investments in research and development (R&D). The aim of the paper is to measure and assess the impact of innovations on the competitiveness of manufacturing enterprises. Depending on the model version, sold production or gross value added were adopted as a measure of competitiveness. The study is based on the analysis of the Cobb–Douglas production function extended by a variable describing innovations (expenditure on innovative activity). The research process was implemented for the period 2009–2016 and is a contribution to determining the role of innovations in shaping the economic performance of enterprises. The set of input variables is based on statistical data published by the Central Statistical Office of Poland (GUS). A positive and statistically significant estimation of the autoregressive coefficient in both the sold production model and the gross value added model shows the dependence of the analysed categories on the results achieved in previous periods. The legitimacy of using dynamic panel data models has been confirmed empirically.

Key words: innovativeness, panel data models, Cobb–Douglas function, manufacturing divisions

INTRODUCTION

In the global world, in the era of knowledge-based economy, science, technology and innovations are an important element shaping competitive advantages of national economies.

Innovations are the subject of the growing interest of economic theoreticians and practitioners, as well as the subject of an increasing number of studies conducted by researchers. This is mainly due to the new perception of innovations as a factor determining the increase in management efficiency. Innovations have become another production factor apart from physical capital and labour.

The aim of the paper is to quantitatively assess the impact of innovations on the competitiveness of enterprises in divisions of manufacturing. The following two research hypotheses have been formulated to achieve this aim:

- H1: Expenditure on process and product innovations is an important determinant of the value of sold production of manufacturing enterprises in Poland in the years 2009–2016.
- H2: Expenditure on process and product innovations affect financial performance measured by gross value added of manufacturing enterprises in Poland in the years 2009–2016.

As a measure of competitiveness, sold production or gross value added, depending on the model version, was assumed. The presented study is based on the analysis of the Cobb–Douglas production function

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extended by a variable describing innovations (expenditure on innovative activity). The analysis covers the period 2009–2016 and is a contribution to determining the role of innovations in influencing economic performance of enterprises.

Expenditure on innovative activity included expenditure on: R&D; the purchase of ready-made technology in the form of rights and documentation; machines, technical equipment and tools as well as means of transport; buildings and structures; personnel training related to innovative activity; marketing for new and modernised products, as well as the inflow of foreign direct investment, export and import. All variables measuring "monetary value" were adjusted and expressed in constant prices of 2009.

The research procedure was based on statistical data published by the Central Statistical Office of Poland (GUS).

THEORETICAL BACKGROUND

Innovativeness is not an end in itself, but it is a tool used to achieve a competitive advantage by individual companies, sectors of the national economy, regions, countries or groups of countries. Similarly, competitiveness is not treated as the ultimate goal of business entities. On the one hand, in microeconomic terms, it is a means to maintain or strengthen the market position and to achieve positive economic results by enterprises, and on the other hand, in the macroeconomic dimension, it serves to raise the standard of living of citizens by increasing consumption of various goods and improving the quality of the natural environment [Świtalski 2005, Roszko-Wójtowicz and Białek 2016].

Models of economic growth are the starting point of the analysis of the relationship between innovations and competitiveness. Innovations as a factor of economic growth are indicated, among others, in works of Schumpeter [1912, 1960], where the close relationship between innovations and entrepreneurship is emphasised. In the Schumpetarian model of endogenous innovation, the rational profit search and technology modernisation are the driving force of economic growth. Such an approach can also be found in contemporary models of economic growth [Aghion and Howitt 1998]. Research results [Aghion et al. 2005, Grzelak et al. 2017] show that long-term economic growth is based on innovations, and these depend, among others, on investments in research and development (R&D). Both theory and empirical studies confirm that competitive advantages of nations arise from the implementation of innovations [Porter 1990, 2008, Cantwell 2006, Doyle and Perez-Alaniz 2017, Peneder 2017].

Harrod and Domar were the first economists who formulated the concept of economic growth, which has become a permanent element of modern macroeconomics. Their models come from the Keynesian mainstream of macroeconomics. In the theory of macroeconomics, after the Keynesian models of economic growth, neoclassical models appeared, among which the Solow-Swan model, in which a time variable which reflects the exogeneity of technological progress is introduced into the classical production function (of the Cobb–Douglas type), deserves particular attention [Cichy 2008]. Since the second half of the 1980s, endogenous growth models have appeared, expanding the neo-classical Solow model, where technological progress is endogenised. The most frequently empirically verified endogenous models are models of Lucas [1988] and Romero [1986, 1990]. The starting point in this case is the critical analysis of the Solow model and the thesis that technological progress (understood as the accumulation of scientific and technical knowledge or human capital) is a result of purposeful investment decisions of entities in the above-mentioned spheres. In turn, the rejection of the thesis about constant effects of the scale of the production function results from the fact that the accumulation of scientific and technical knowledge and human capital leads to externalities as a consequence of the fact that accumulated knowledge and human capital can be used not only by entities directly incurring the costs of this accumulation, but also by their micro and/or macroeconomic environment [Liberda 1996]. The main thesis arising from the theory of endogenous growth is the statement that due to the existence of externalities associated with technological progress, it is possible to increase the long-term rate of economic growth in an effective and sustainable manner [Tokarski 2001].

As shown in the presented theories, inventions are necessary to create and maintain competitiveness, and gaining an advantage based on innovations has become a necessary prerequisite for competitiveness. This is, firstly, due to the fact that because of modern production technologies, it is possible to achieve greater efficiency, and secondly, due to the fact that more modern products increase consumer choice possibilities, which potentially increases their utility. The presented new growth models show that technological progress is an important factor of economic growth, and it is a result of rational investing in research and education.

Competition and competitiveness

Economic entities must adapt to changes taking place in their environment, which requires the implementation of innovations and being innovative. Innovations and innovativeness of enterprises are factors that improve the efficiency of management and bring economic benefits to enterprises, industries, national economies and societies. An expression of benefits derived from implemented innovations is competitiveness. Overall, competitiveness is the ability to compete, which in reality means the ability to increase the company's market share or maintain its current position. Competitiveness may refer to a product, enterprise, industry, technology, and economy.

The relationship between competitiveness and competition is based on the assumption that competitiveness cannot be achieved in isolation from competition. The stronger the competition, the greater the chance of improving competitiveness, otherwise the company is at risk of withdrawal from a given production or market [Ziemiecki and Żukrowska 2004]. On the one hand, competition is a widely known, understandable category, and on the other hand, it is ambiguous and difficult to define.

Changes taking place in economic, social and political life alter the way of perceiving the essence of competition, its premises and mechanisms of market rivalry. The definition formulated in the year 2000 is an expression of changes occurring in the perception of the phenomenon of competition: "Competition consists of the constant struggle among firms for a comparative advantage in resources that will yield a marketplace position of competitive advantage and, thereby, superior financial performance.". The resource-based theory of competitive advantage takes into consideration that competition is disequilibrium provoking, and assumes that innovations, learning and acquiring organisational knowledge are endogenous [Hunt 2000].

DATA AND RESEARCH METHODOLOGY

Manufacturing in Poland

The study focuses on the quantitative assessment of the relationships between expenditure on innovative activity and sold production or gross value added in manufacturing enterprises (Section C) at the two-digit level of aggregation, i.e. at the level of divisions in this section. This level of aggregation of information was considered sufficiently detailed and appropriate to assess the above-mentioned relationships. Published statistical data of the Central Statistical Office of Poland (GUS) on the amount of particular types of expenditure by individual divisions of manufacturing (section C of the Polish Classification of Activities – PKD) in the years 2009–2016 were used. The collected statistical data have the structure of the panel in which the basic period is the calendar year, while the objects are divisions of manufacturing.

The selection of manufacturing enterprises for analysis was based on the relatively high importance of manufacturing in the Polish economy. The role and importance of manufacturing in the Polish economy (2016) are evidenced, among others, by its participation in the creation of gross domestic product (23.5%), in investment expenditure (38.4%), and in the gross value of fixed assets (32.5%). In addition, more than one fifth of the Polish workforce is employed in the Polish manufacturing industry (20.8%) [GUS 2017]. A special feature of manufacturing, in addition to its dominant position in exports, is also its significant role in the economy's innovativeness. Manufacturing is of key importance for the development of company expenditures on research and development. In most of the EU countries, expenditure on R&D incurred in manufacturing accounts for more than 50% of total expenditure, and often even more than 70%, as in the case of Sweden and the Netherlands, or more than 80% as in the case of Germany.

The analysis of the information presented in Figure 1 indicates that the sold production, gross value added, investment expenditure and gross value of fixed assets in the analysed period were characterised by a clear up-

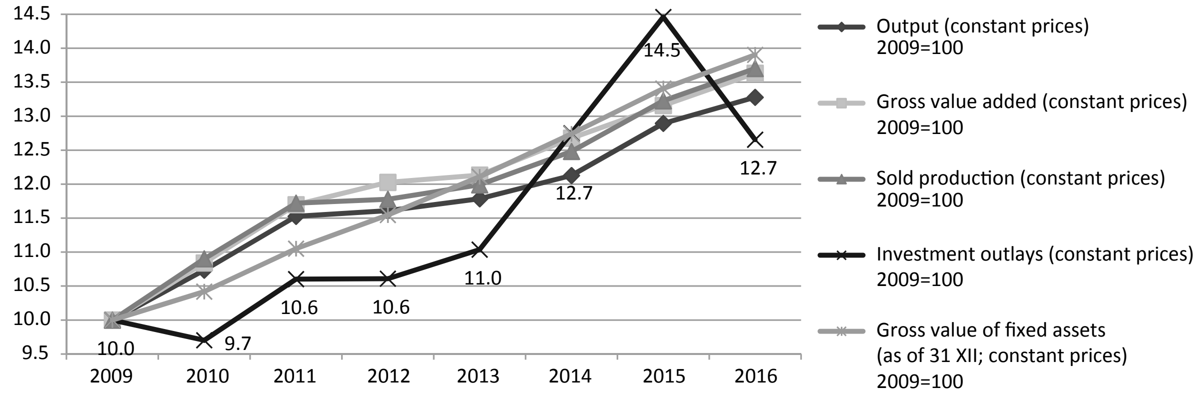

Fig. 1. The dynamics of selected indices describing the development of manufacturing in Poland in the years 2009–2016
Source: Own elaboration based on GUS [2017].

ward trend. The positive growth rate of these indices confirms that in Poland manufacturing is developing, maintaining an important position in the economy.

DYNAMIC PANEL DATA MODELS

In studies on the economic performance of enterprises, attention is paid to a certain degree of their sustainability – the results obtained in the past determine the current state. The dynamic nature of the studied phenomena combined with the panel nature of the data necessitates the use of dynamic panel data models.

In general, a dynamic panel data model can be expressed as follows:

$$y_{it} = \gamma y_{i,t-1} + \mathbf{x}_{it}^T \boldsymbol{\beta} + u_{it} = \gamma y_{i,t-1} + \mathbf{x}_{it}^T \boldsymbol{\beta} + \alpha_i + \varepsilon_{it},$$
$$i = 1, \ldots, N, \; t = 1, \ldots, T \qquad (1)$$

where:
$\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$ for each i, t;
α_i – group effects; if α_i are random, then $\alpha_i \sim N(0, \sigma_\alpha^2)$;
$\boldsymbol{x}_{it} = [x_{kit}]_{K\times 1}$ – vector of explanatory variables with K coordinates;
$\boldsymbol{\beta}$ – vector of parameters ($K \times 1$), identical for each i and t [Maddala 2006, Dańska-Borsiak 2011];
γ – autoregressive coefficient.

The most important proposals for the estimation of dynamic panel data models presented in the contemporary literature are based on the generalised method of moments (GMM) and the instrumental variables method resulting from it [Baltagi 2003]. This method makes it possible to simultaneously take into account heteroscedasticity and autocorrelation of a random component as well as to distinguish and apply appropriate instrumental variables. The generalised method of moments is particularly useful for estimating models that contain endogenous or predetermined explanatory variables, and when the process that generates time series is not fully specifiable [Dańska-Borsiak 2011]. It is assumed that one can have instrumental variables Z which are independent of the random components of the model.

The estimator of the generalised method of moments has the following form:

$$\begin{bmatrix} \hat{\gamma} \\ \hat{\boldsymbol{\beta}} \end{bmatrix} = (\mathbf{X}^T \mathbf{Z} \mathbf{W}_\mathbf{N} \mathbf{Z}^T \mathbf{X})^{-1} (\mathbf{X}^T \mathbf{Z} \mathbf{W}_\mathbf{N} \mathbf{Z}^T \mathbf{y}) \qquad (2)$$

where:
$\mathbf{Z} = (Z_1, Z_2, \ldots, Z_N)$ – properly constructed matrix of instruments;
$\mathbf{W_N}$ – weight matrix.

This class of models requires the use of specific estimation methods, other than the methods used for static models. The most important proposals of such methods, presented in the contemporary literature, are based on the generalised method of moments. Among a number of methods proposed for the estimation of dynamic panel data models, in practice the greatest role is played by two such methods: the GMM for the model in the form of first differences (FDGMM) and the system estimator GMM (GMM-SYS) which is its expansion. Each of the estimators can be considered as a one- or two-step estimator. Instrument matrix **Z** and weight matrix $\mathbf{W}_N$ determine the form of the estimator. In the correctness analysis of the estimated GMM model, particular attention is paid to two tests: the Arellano–Bond autocorrelation test and the Sargan test of over-identifying restrictions.

In the first-difference model (model FDGMM), the occurrence of the autocorrelation of random component ε_{it} is an expected phenomenon[1]. The presence of higher-order autocorrelation would mean that the instruments used in the GMM estimation process are not appropriate. Therefore, the test which verifies the correctness of the moment conditions can be a test examining the occurrence of the second-order autocorrelation in model (1). Arellano and Bond (1991) proposed a second-order autocorrelation test in which the null hypothesis assumes a lack of such autocorrelation. The empirical statistic of the Arellano–Bond test has the following form:

$$AR(2) = \frac{\Delta\hat{\boldsymbol{\varepsilon}}_{-2}^{T}\Delta\hat{\boldsymbol{\varepsilon}}_{*}}{\Delta\hat{\boldsymbol{\varepsilon}}^{1/2}} \qquad (3)$$

where:

$\Delta\hat{\boldsymbol{\varepsilon}}_{-2}$ – the second differences of vector $\Delta\boldsymbol{\varepsilon}$, and the elements of vector $\Delta\hat{\boldsymbol{\varepsilon}}_{*}$ are equal to the elements of $\Delta\boldsymbol{\varepsilon}$, omitting the first two values (to make the multiplication feasible);

$AR(2)$ – statistic has a normal distribution $N(0, 1)$.

Another important test is the Sargan test used to test the correctness of over-identifying restrictions not used in the estimation process. According to the null hypothesis, the instruments used are appropriate in the sense of a lack of their correlation with the random components of the first-difference model. The empirical statistic has the following form:

$$s = \Delta\hat{\boldsymbol{\varepsilon}}^{T}\mathbf{Z}\left[\sum_{i=1}^{N}\mathbf{Z}_i^{T}\Delta\hat{\boldsymbol{\varepsilon}}\Delta\hat{\boldsymbol{\varepsilon}}^{T}\mathbf{Z}_i\right]^{-1}\mathbf{Z}^{T}\Delta\hat{\boldsymbol{\varepsilon}} \qquad (4)$$

Statistic s has a distribution of χ^2 with q degrees of freedom, where q is the number of columns of matrix **Z** less the number of estimated parameters [Dańska-Borsiak 2011].

RESULTS

An attempt to quantify the impact of expenditure on innovations on the economic performance of enterprises in divisions of manufacturing was made for two selected variables characterising the economic performance of manufacturing enterprises: sold production and gross value added.

The starting point of the analysis of the impact of innovation expenditure on sold production was a two-factor function of production extended by another factor – expenditure on innovations. Finally, the sold production model of manufacturing divisions took the following form:

$$\begin{aligned}\ln(SP)_{it} &= \beta_0 + \gamma\ln(SP)_{i,t-1} + \beta_1\ln(Empl)_{it} + \\ &+ \beta_2\ln(Ninv)_{it} + \beta_3\ln(Innov)_{it} + \varepsilon_{it}\end{aligned} \qquad (5)$$

where:

$\ln(SP)_{it}$ – natural logarithm of the value of sold production in PLN million at constant prices from 2009 (the price index of sold production in manufacturing was used for data adjustment) for the *i*-th manufacturing division in the time period *t*; the other designations are the same as in the value added model;

$\ln(Empl)_{it}$ – natural logarithm of the average employment in thousands of people for the *i*-th manufacturing division in the year *t*;

$\ln(Ninv)_{it}$ – natural logarithm of investment expenditure at constant prices in PLN million from 2009 (the CSO index of investment prices was used for data adjustment);

$\ln(Innov)_{it}$ – the natural logarithm of expenditure on innovative activity in the field of product and process innovations in manufacturing at constant prices in PLN million from 2009 (the CSO GDP price index was used for data adjustment).

The data used cover the period 2009–2016 for 24 divisions of manufacturing in Poland.

Similarly as in the case of sold production, the starting point for gross value added analyses was the Cobb–Douglas production function, including the ad-

[1] If ε_{it} are independent, their first differences are correlated to the order of 1 [cf. Dańska-Borsiak 2010].

ditional factor in the form of current expenditure on innovations. Bearing this in mind, the following value-added model was used in the study:

$$\ln(GVA)_{it} = \beta_0 + \gamma \ln(GVA)_{i,t-1} + \beta_1 \ln(Empl)_{it} + \beta_2 \ln(Ninv)_{it} + \beta_3 \ln(Innov)_{it} + \varepsilon_{it} \quad (6)$$

where:

$\ln(GVA)_{it}$ – natural logarithm of gross value added at constant prices in PLN million from 2009 (the CSO GDP price index was used for data adjustment) for the i-th manufacturing division in the year t;

The other designations are the same as in the sold production model.

Due to the higher statistical value, measured by the results of the Arellano–Bond and Sargan tests for the GMM-SYS method, the estimations obtained with the use of this method were presented.

The results are summarised in Table 1. The absolute values of the Student t-statistics are quoted in brackets, the last three lines contain respectively: $AR(2)$ – the empirical values of Arellano–Bond statistic which verify the occurrence of autocorrelation of the first- or second-order random component in the first-difference model; H0: the autocorrelation of the first (second)-order does not occur, the Sargan s-statistics – the empirical values of Sargan statistic verifying the correctness of over-identifying restrictions; H0: instruments are appropriate, N – number of observations.

A positive and statistically significant estimate of the autoregressive coefficient in both the sold production model and the gross value added model shows the dependence of the analysed categories on the economic performance in previous periods. This confirms the validity of the use of dynamic panel models. The results of statistical tests indicate the correctness of the instruments used in both models. The values of Sargan test statistics do not give rise to rejecting the H0 hypothesis at the significance level of 0.05, which allows for the recognition of the over-identifying restrictions as correct. The Arellano–Bond autocorrelation test indicates no grounds for rejecting the null hypothesis, which means that there is no second-order autocorrelation.

The estimation of the autoregressive coefficient in both the sold production model and the gross value added model is statistically significant and positive. Its higher value in the case of the sold production model

Table 1. Results of estimation of parameters of dynamic panel data models of sold production and gross value added in manufacturing

Explanatory variables and selected characteristics	Parameter estimate	z	p	Parameter estimate	z	p
	sold production model: $\ln(SP)_{it}$			gross value added model: $\ln(GVA)_{it}$		
$\ln(SP)_{i,t-1}$	0.7510	33.8910	0.0000	–	–	–
$\ln(GVA)_{i,t-1}$	–	–	–	0.5827	80.2720	0.0000
$\ln(Ninv)_{it}$	0.0850	13.2380	0.0000	0.1858	20.7844	0.0001
$\ln(Empl)_{it}$	0.1551	9.3291	0.0000	0.0970	24.5348	0.0001
$\ln(Innov)_{it}$	0.0443	9.9016	0.0001	0.0474	9.8977	0.0001
Constant	1.0465	8.4855	0.0001	1.7831	20.8361	0.0001
Sargan test [p]	20.0887	–	[0.7873]	22.4666	–	[0.6629]
$AR(2)$ test [p]	[–0.1983]	–	[0.8428]	[–0.7007]	–	[0.4834]
N	168	–	–	168	–	–

p – probability value ($p \in [0, 1]$).

Source: Own calculations.

than in the case of gross value added indicates a higher degree of sustainability of sold production.

The results of the conducted research confirm the impact of basic production factors on sold production in manufacturing. The size of employment and investment expenditure are positively and significantly correlated in statistical terms with the value of sold production. The impact of expenditure on process and product innovations in the analysed manufacturing divisions on their production expressed in terms of value was also statistically significant. An 1% increase in current expenditure on product and process innovations results in a 0.044% increase in sold production.

When assessing the impact of basic production factors on the value added in manufacturing, a significant relationship, consistent with expectations, between the variables under study was confirmed. Both employment and investments have a positive impact on the value added in manufacturing. The expenditure on product and process innovations, which constituted the main subject of the conducted analyses, is important for the creation of the gross value added of manufacturing enterprises. An 1% increase in the current expenditure on innovations contributes on average to a 0.047% increase of gross value added.

CONCLUSIONS

Taking into account dynamically changing environmental conditions, innovativeness should be one of the most important engines of the economy, while on the micro- and meso-economic scale, it should determine the competitiveness of enterprises and industry sectors. The analyses carried out with the use of dynamic panel data models for the years 2009–2016 confirm a positive impact of expenditure on innovative activity in the field of product and process innovations on selected results of economic performance in divisions of manufacturing understood alternatively as sold production and gross value added. The applied function form of the models enables the interpretation of parameter estimates in terms of elasticity of the considered economic results with respect to expenditure on innovative activity. The impact of the analysed expenditure on innovations expressed by the model parameter estimate is slightly higher in the case of gross value added. Attention should be paid to the low values of estimates of parameters at the variable describing innovations, which suggests that in the context of other factors (especially technical equipment) innovativeness is a secondary factor of change in Polish enterprises.

The presented assessment of the relationship between innovations and competitiveness (sold production and gross value added) in manufacturing enterprises does not exhaust the complexity of the issue, and constitutes only one of the threads that make up the whole assessment system. The issues considered are particularly important in the context of the Polish economy, which is facing difficult development-related challenges. In Poland, the existing sources of competitiveness such as relatively low labour costs and costs of other production factors are being exhausted. Therefore, new factors of modernisation and competitive advantages of manufacturing enterprises based on knowledge, innovations and human capital should be sought. An important source of competitiveness should be quality and uniqueness of products, the ability to identify and satisfy individual customer needs, comprehensive promotional activities, and creating a company image based on trust in the quality of its products.

The research conducted and conclusions formulated are a contribution that should prompt further research in this area.

REFERENCES

Aghion, P., Bloom, N., Blundell, R., Griffith, R., Howitt, P. (2005). Competition and Innovation: an Inverted-U Relationship. Oxford Journals, Quarterly Journal of Economics, 120 (2), 701–728. https://doi.org/10.1093/qje/120.2.701

Aghion, P., Howitt, P. (1998). Endogenous Growth. MIT Press, Cambridge MA 1998.

Arellano, M., Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies, 58, 277–297. https://doi.org/10.2307/2297968

Baltagi, B.H. (2003). Econometric Analysis of Panel Data. John Wiley & Sons, Chichester.

Cantwell, J. (2006). Innovation and Competitiveness. [In:] J. Fagerberg, D.C. Mowery, R.R. Nelson (Eds.), Handbook of Innovation. Oxford University Press, Oxford, 543–567.

Cichy, K. (2008). Kapitał ludzki i postęp techniczny jako determinanty wzrostu gospodarczego. Instytut Wiedzy i Innowacji, Warszawa.

Dańska-Borsiak, B. (2011). Panelowe modele dynamiczne. Wydawnictwo Uniwersytetu Łódzkiego, Łódź.

Doyle, E., Perez-Alanis, M. (2017). From the Concept to the Measurement of Sustainable Competitiveness: Social and Environmental Aspects. Entrepreneurial Business and Economics Review, 5 (4), 35–59. http://doi.org/10.15678/EBER.2017.050402

Grzelak, M.M., Roszko-Wójtowicz, E., Cika, N. (2017). Innovation Activities of Industrial Enterprises in Poland in the Light of Public Statistics. Acta Scientiarum Polonorum. Oeconomia, 16 (4), 61–70. https://doi.org/10.22630/ASPE.2017.16.4.45

GUS [2017]. Rocznik Statystyczny Przemysłu 2017. Warszawa.

Hunt, S.D. (2000). A General Theory of Competition, Resources, Competence, Productivity. Economic Growth. Sage Publications, Thousand Oaks–London–New Delhi.

Liberda, B. (1996). Oszczędności w teoriach konsumpcji i wzrostu. Ekonomista, 3, 325–342.

Lucas, R.E. (1988). On the Mechanism of Economics Development. Journal of Monetary Economics, 22 (1), 3–42. https://doi.org/10.1016/0304-3932(88)90168-7

Maddala, G.S. (2006). Ekonometria. PWN, Warszawa.

Peneder, M. (2017). Competitiveness and Industrial Policy: From Rationalities of Failure Towards the Ability to Evolve. Cambridge Journal of Economics, 41 (3), 829––858. https://doi.org/10.1093/cje/bew025

Porter, M.E. (1990). The Competitive Advantage of Nations. The Free Press, New York.

Porter, M.E. (2008). On Competition. Harvard Business School Press, Boston.

Romer, P.M. (1986). Increasing Returns and Long-Run Growth. Journal of Political Economy, 94 (5), 1002––1037. https://doi.org/10.1086/261420

Romer, P.M. (1990). Endogenous Technological Change. Journal of Political Economy, vol. 98 (5), 71–102. https://doi.org/10.3386/w3210

Roszko-Wójtowicz, E., Białek, J. (2016). A multivariate approach in measuring innovation performance. Proceedings of Rijeka Faculty of Economics, 34 (2), 443–479. https://doi.org/10.18045/zbefri.2016.2.443

Schumpeter, J.A. (1912). Theorie der Wirtschaftlichen Entwicklung. Duncker und Humblot, Leipzig.

Schumpeter, J.A. (1960). Teoria rozwoju gospodarczego. Wydawnictwo Naukowe PWN, Warszawa.

Świtalski, W. (2005). Innowacje i konkurencyjność. Wydawnictwo Uniwersytetu Warszawskiego, Warszawa.

Tokarski, T. (2001). Modele wzrostu endogenicznego. [In:] W. Welfe (Ed.), Ekonometryczny model wzrostu gospodarczego, Wydawnictwo Uniwersytetu Łódzkiego, Łódź.

Ziemiecki, J., Żukrowska, K. (2004). Konkurencja a transformacja w Polsce. Wybrane aspekty polityki gospodarczej. Oficyna Wydawnicza SGH, Warszawa.

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STRESZCZENIE

Wzrost gospodarczy, jak wynika z badań, opiera się w długim okresie na innowacjach, a te z kolei zależą m.in. od inwestycji w działalność badawczo-rozwojową (B+R). Celem artykułu jest pomiar i ocena wpływu innowacji na konkurencyjność przedsiębiorstw z działów przetwórstwa przemysłowego. Jako mierniki konkurencyjności przyjęto – w zależności od wersji modelu – produkcję sprzedaną lub wartość dodaną brutto. Badanie opiera się na analizie funkcji produkcji Cobba–Douglasa poszerzonej o zmienną opisującą innowacje (nakłady na działalność innowacyjną). Postępowanie badawcze zostało zrealizowane dla okresu 2009–2016 i stanowi przyczynek do określenia roli innowacji w kształtowaniu wyników ekonomicznych przedsiębiorstw. Podstawą zbioru zmiennych wejściowych są dane statystyczne publikowane przez Główny Urząd Statystyczny. Dodatnia i istotna statystycznie ocena współczynnika autoregresyjnego zarówno w modelu produkcji sprzedanej, jak i w modelu wartości dodanej brutto wskazuje na zależność analizowanych kategorii od wyników osiągniętych w okresach wcześniejszych. Zasadność zastosowania dynamicznych modeli panelowych została potwierdzona empirycznie.

Słowa kluczowe: innowacyjność, modele panelowe, funkcja Cobba–Douglasa, działy przetwórstwa przemysłowego