Analysis of the Relationship between Unemployment and GDP in Poland and Spain in the Years 2002–2015

Joanna Podgórska, Małgorzata Leśniowska-Gontarz

University of Information Technology and Management, Poland

Abstract

The aim of this study is to analyze the correlation between the unemployment rate and the rate of growth in two European countries: Poland and Spain; the hypotheses put forward are verified with the use of data from a public database of the OECD for the years 2002–2015. The first hypothesis assumes the existence of a relationship between the unemployment rate and changes in GDP. The second indicates that for every 2–3 percentage point decrease (increase) of real GDP in relation to potential GDP, the unemployment rate increases (decreases) by 1 percentage point in the two countries surveyed. The calculations verify positively the first hypothesis and, at the same time, falsify the second hypothesis for both countries.

Keywords: GDP rate of growth, unemployment rate, Okun's law

Introduction

Unemployment is a phenomenon that has a negative influence on individuals, families and the entire economy. Job loss and problems with finding a new place of employment can become a cause of pessimism or apathy, or can bring about health and financial problems in a community. The economy grows then much more slowly, which is reflected in the level of GDP, and the income tax revenues paid to the budget of a country are reduced. The analysis of the relationship between GDP and unemployment raises key economic problems, which include economic development and unemployment, because the direction of changes in these variables determines, among other things, the level of prosperity, living standards and poverty rates in a country. At the same time, the increase in prosperity and living standards, as well as minimizing the poverty rate are main objectives belonging to the framework of the economic policy of a country.

1 Unemployment and economic growth rate

For many years, the traditional (neoclassical) approach stated that economic growth depends on technological progress whereas the unemployment rate depends on the amount of the natural rate of unemployment, while there is no correlation between economic growth and unemployment rate (Zagler 2004, 3). The above view evolved over time and, more and more often, various factors which are the source of economic growth and unemployment were pointed out. At the same time the relationship between unemployment and economic growth took different forms (Gruchelski 2013, 23). Therefore, the relationship between economic growth and unemployment is still the subject of many theoretical and empirical analyses, especially since the very existence of their interdependence does not raise major concerns today.

The sensitivity of unemployment to economic fluctuations was a central element of Keynesian views. Moreover, the possibility of a short-term increase in unemployment as a result of cyclical fluctuations in the economy was also allowed by representatives of neoclassical economics (Kwiatkowski 2002, 99–120). Hall and Taylor (2007, 211) point out that a negative correlation of the growth of domestic product and unemployment rate is one of the most reliable generalizations which economists have formulated. The main argument of Keynes's theory is that the size of employment in an economy is determined by the size of effective demand, including consumption and investment demand. Consumer demand in turn depends on household income. Thus, Keynes negatively referred to the neoclassical thesis about a successful impact of cuts in nominal wages on employment growth. He stated that the reduction in nominal wages neither guarantees full employment nor an increase in production volumes (Gruchelski 2013, 79–80). Another argument of this economist is the assumption of rigid nominal wages. While defining his theory of employment and unemployment, Keynes does not analyze the data for long-term growth. His theory can be defined as the theory of a short period of time. This does not mean that the implementation of a policy in the spirit of the theory of Keynes will have no impact on long-term economic growth and unemployment in the long term. It should rather be assumed that this impact will be visible. Keynesian theory also says that the level of effective demand depends on the size of production. The increase in effective demand leads to the increase in production and employment, and a decline in unemployment. Insufficient demand causes in turn a reduction in production and a reduction in employment. This occurs when the sum of intended investments in the economy is less than the sum of savings corresponding to the income at full employment (Milewski and Kwiatkowski 2005, 544). Effective demand, which corresponds to full employment, is a special case, according to Keynes, which occurs only if the propensity for consumption and propensity for investment are in relation with each other (so-called optimum dependency).

Keynes suggests monetary policy, through which the increase in money supply causes a reduction in interest rates, as a measure designed to stimulate effective demand, because this policy stimulates effective demand as well as production and employment resulting from, among other thing, investment growth. According to this economist, if at the same time there are economic recession and unemployment, and there are unused capital resources, then the growth of aggregate demand for goods and services usually leads to an increase in employment and production, and to a decline in unemployment (Gruchelski 2013, 82). The eighties of the twentieth century showed, however, that increasing public spending to stimulate economic growth does not necessarily translate into a decline in unemployment. Moreover, literature studies point to different interpretations of the dependence between Keynesian unemployment and economic growth. Now, the increase in unemployment can both accelerate and slow down economic growth because demand shocks, which have a positive influence, stimulate the economic growth and reduce the unemployment, whereas supply shocks have an impact on the growth of both unemployment and the economy. Therefore, to effectively fight unemployment, it is important to first of all identify its nature. Depending on whether the economy is struggling with Keynesian or classical unemployment (or perhaps the two types of unemployment occurring simultaneously), proper tools must be used, which will effectively fight it. Okun's law is an example which gives an overview of the relationship between Keynesian unemployment and economic growth.

2 Okun's law

One of the first modern economists who analyzed the relationships between changes in domestic product and unemployment was Arthur Okun whose theoretical model of the dependence: unemployment — economic growth was based on the study of the economy in the United States (Ziomek 2006, 17). Okun's law says that for each percentage point by which the actual unemployment rate is above the natural rate of unemployment, real GDP is 3 percentage point lower than potential GDP. The difference between the actual and potential level of output (Okun's coefficient), is mostly comprised between 2 and 3 (Gruchelski 2013, 14). Okun's law can be expressed thus:

$$U - U^* = \beta(Y - Y^*),$$

where:

Y — actual GDP (in %),
Y^* — potential GDP (%),
$Y - Y^*$ — a gap showing the difference between actual and potential rate of growth,
U — actual unemployment rate (in %),
U^* — the natural rate of unemployment (in %),
$U - U^*$ — a gap showing the difference between the actual level of unemployment and natural unemployment rate,
β — Okun's coefficient.

The value of the coefficient at a particular time is an approximation resulting, among other things, from the difficulty of measuring a number of determining changes in the product and the number of the unemployed. The coefficient also varies in time and is typical for the economy of a country (Ziomek 2006, 19). According to the above formula, in order to prevent an increase in unemployment, the growth of actual and potential GDPs must be equal. On the other hand, to reduce the level of real unemployment, real GDP must grow faster than potential GDP (Gruchelski 2013, 84). In other words, to increase the employment rate, GDP growth needs to be above potential product growth (Khemraj, Madrick, and Semmler 2006, 4).

By referring to a gap between actual and potential value of both analyzed figures, the author measures the degree of utilization of production potential in the economy and indicates the amount of unused labor resources in the form of a group of the unemployed exceeding (numerically) the size of natural unemployment (Ziomek 2006, 22). Okun showed that the decline in unemployment with an increase of the product is the result of many processes that trigger and accompany these changes. He came, among others, to a conclusion that the percentage decline in the unemployment rate is accompanied by the percentage increase in the number of hours actually worked per employee or an increase in weekly working hours. Another interpretation of Okun's coefficient suggests that unemployment will decrease with the increase of income, when income growth will exceed the growth of productivity and population growth (Acocella 2002, 199).

In summary, under Okun's law the labor market is in equilibrium when the real unemployment rate is equal to the natural unemployment rate and the real gross domestic product is equal to potential GDP. Numerous empirical studies, whose aim was to investigate whether Okun's law is confirmed in practice, indicate that in a short period of time Okun's law does not work. On the other hand, it has been confirmed that it works in the long term (Klimczak and Wronkowska 2010, 263–272).

3 Okun's law — a review of research

Okun's analyses, published in 1962, were based on a simple model in which the change in the unemployment rate depended on the growth rate of real GDP. The study was based on quarterly data from the United States from the years 1947–1960. The estimation of the coefficient at a rate of GDP growth that he obtained was −0,3,[1] which means that the average change in GDP of three percentage point is attributable to the change in the unemployment rate by one percentage point (Misztal 2014, 130). The results obtained by Okun have become a point of reference for many researchers analyzing the relationship between employment and economic growth in many countries. The results of research into the Okun relationship published over the past years can be divided into two streams. One of them suggests that economic growth and employment are not necessarily positively correlated. The other indicates the existence of a positive relationship between economic growth and employment. Below is an overview of selected studies with a particular emphasis on applied approaches and methods for the estimation of Okun's coefficient.

---

1. [In the journal European practice of number notation is followed — for example, 36 333,33 (European style) = 36 333.33 (Canadian style) = 36,333.33 (US and British style). — Ed.]

While examining the US economy Prachowny showed that Okun's coefficient is not constant over time. He made attempts to separate the relationship between unemployment and production volume from such factors as productivity or the number of hours worked. The Okun's coefficient that he received was −0,67, so these results highlighted the need to penetrate the essence and mechanisms related to Okun's law (Prachowny 1993, 334–335). Attfield and Silverstone (1997, 326) questioned the results obtained by Prachowny. They made an estimation of the relationship between unemployment and GDP using the US macroeconomic data and explained the discrepancy obtained by Prachowny as a result of the omission in the model of the integration of variables (variables are formed in the subsequent periods in a similar way). The research made by Swan and Vistrand (2006, 16) indicates in turn that the average employment elasticity with respect to changes in GDP in Sweden (in 1980–2004) stood at 0,7 percentage point and did not change significantly over time. On the other hand, Lee, who estimated Okun's coefficients for OECD member countries, noted that economic growth affects the growth of employment, and the impact of growth factors on changes in employment varies considerably between countries (Swane and Vistrand 2006, 8). The significance of the relationship shown in these studies was lower than in the original article of Okun.

A significant influence of the economic growth on employment in OECD countries was observed in turn by Schmid (2008, 9) and Onaran. However, this relationship was noticed only in the case of some countries covered by the analysis, and, what is more, employment elasticity with respect to the economic growth was relatively low in the short term. In the Czech Republic, Bulgaria and Romania a total lack of impact of the economic growth on employment was observed (Onaran 2007, 26). Herman, who made research into this relationship in Romania for the period 1990–2010, arrived at the conclusion that there is a no impact of economic growth on employment (Herman 2012, 9). On the other hand, Saget, who examined 11 countries in 1989–1998, divided them into those where employment growth seemed to be closely linked with economic growth (Poland, Hungary and Slovenia), while the Baltic states, Slovakia and Russia were classified by him as those countries where employment elasticity was much lower. However, in the case of Bulgaria, Romania and Ukraine, he did not find a statistically significant relationship between employment and economic growth (Saget 2003). Ball, Leigh, and Loungani made a comprehensive study of different approaches to Okun's law and methods of analyzing it. They used the data for twenty countries, including the original figures used by Okun. They pointed out that despite the possibility of using multiple approaches and strong heterogeneity of the results, the parameters of Okun's model remain relatively stable, and observed that Okun's estimates differ from later ones mainly due to the assumptions about potential GDP and the natural rate of unemployment, adopted in the original study. They also challenged the criticism of some researchers in regard to the problem of linearity or instability of Okun's coefficient in the business cycle, and recognized the differences shown to be negligible. The obtained parameters differed between countries, which had a mainly structural and institutional basis (Ball, Leigh, and Loungani 2013, 1–2).

When analyzing Polish studies about the relationship between economic growth and employment, it is noteworthy to mention the research made by Ziomek. She analyzed the following values: the indicator of GDP growth, three variants of the index of unemployment rate dynamics, the dynamics index of the sold production of industry and the real and nominal value of the sold production of industry. These categories were linked in pairs, and then the relationship between variables forming them was studied. The author used two versions of the model. In the first one she considered unemployment as a dependent variable and GDP as an explanatory variable. In the second model she adopted the opposite pattern of variables. The results she received in the course of the study confirmed the existence of a long-term relationship between the variables analyzed, but the strength of this relationship was considered an insignificant value. Okun's coefficient ranged from −0,02 to −0,1 (Ziomek 2006, 251). Dykas, Misiak, and Tokarski (2013) analyzed in turn, factors affecting the differentiation of unemployment rates registered at the level of provinces in Poland. The authors used a model in which an increase in unemployment rates (in subsequent years and in individual provinces) depends on their past values and growth rates of real GDP in provinces with regard to a variable that controls the asymmetry of the relationship between unemployment

and GDP. They observed that the growth rate of real GDP by 1 percentage point causes (depending on the adopted method of estimation) the decline in the unemployment rate by about 0,32–0,33 percentage points in OLS estimations (ordinary least squares method) and by about 0,38–0,39 percentage points based on the GMM (generalized method of moments) (Dykas, Misiak, and Tokarski 2013, 19). Majchrowska, Mroczek, and Tokarski analyzed in turn spatial differentiation of registered unemployment in Poland at the level of counties. The estimated elasticity of changes in unemployment with respect to changes in sold production of the industry ranged between 0,12 and 0,15. However, due to the lack of data on GDP at county level and thus the use of the data on the value of sold production of industry, this result cannot be compared with traditional analyses of Okun's relationships (Majchrowska, Mroczek, and Tokarski 2013, 83). Gajderowicz, Grotkowska, Wincenciak, and Wirtek took in turn the question of the sensitivity of unemployment in relation to changes in production volume aggregated in Poland in the years 1995–2011. The authors used both methods described in world literature — the study based on the differences from the preceding year, as well as the deviations from the long-term value (representing an approximation of natural values of unemployment rate and of GDP). The resulting estimates differed depending on the specifications of the model they adopted, but generally the estimates stood at approximately −0,4, which is the result that does not deviate significantly from the results obtained in previous studies for Poland (Gajderowicz et al. 2014, 39). It is also worth mentioning the research made by Gruchelski, who analyzed the relationship of unemployment — economic growth in Poland in 1990–2007 against the background of the situation in the US and Japan in this period. The aim of the study was to investigate the relationship between the dynamics of growth of the national income and employment in Poland, and the definition of the role of the increase in labor productivity and capital efficiency in the national income within the analyzed period. As a result of this analysis, it was found that in 1990–2007 the economic development in Poland was largely jobless (GDP growth was accompanied by a decline in employment). In the analyzed period there was a high limit of jobless growth at the level of 4,2–5,0 percentage points. Gruchelski (2013, 237–239) compared this parameter with other European countries, such as Spain, Greece, Italy and France, for which the index in the 1990s ranged from 1,0–1,2 percentage points, for the Czech Republic it was 2,5 percentage point, Lithuania 4,5 percentage point, Hungary 6,2 percentage point and 12,7 percentage point for Estonia. In this paper, Okun's theory is the starting point to explore the relationship between the level of unemployment and changes in the rate of economic growth in Poland and Spain.

4 Verification of hypotheses and empirical analysis

The data for our study were taken from a public database of the OECD, both for Poland and for Spain. The econometric model used here is based on the data on the unemployment rate (u_{it}) and GDP (Y_{it}) for Poland and Spain on an annual basis, starting from 2002 and ending in 2015 (a total of 14 observations over a time series). Two hypotheses were adopted for the empirical study:
1. There is a correlation between the unemployment rate and the changes in GDP in Poland and Spain.
2. For each 2–3 percentage points decrease (increase) of real GDP in relation to potential GDP, the unemployment rate increases (decreases) by 1 percentage point, both in Poland and in Spain.
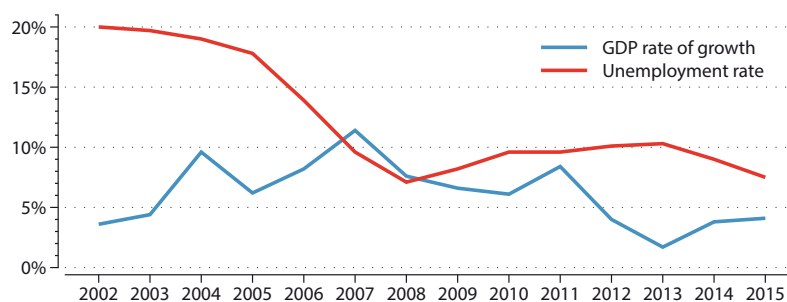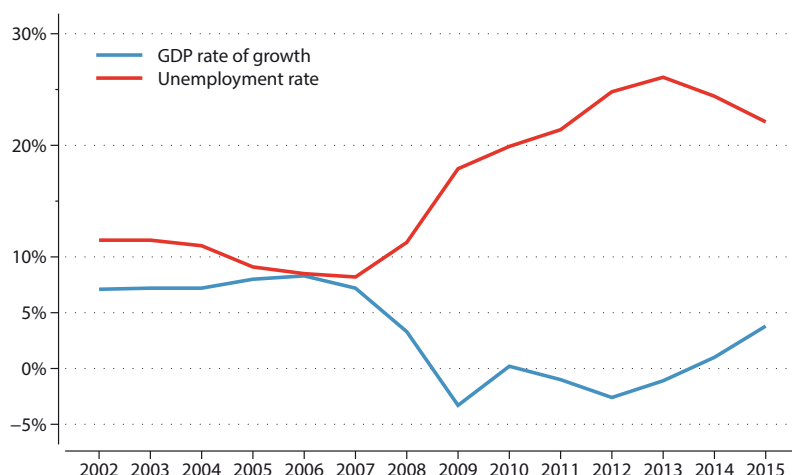

Fig. 1. GDP rate of growth and unemployment rate for Poland in the years 2002–2015

Source: Own work based on OECD Database

Fig. 2. GDP rate of growth and unemployment rate for Spain in the years 2002–2015

Source: Own work based on OECD Database

A modification in Okun's law proposed by Gajderowicz, Grotkowska, Wincenciak, and Wirtek (2014, 43) was used for the empirical analysis. An additional variable was included in the model, so its final form was the following:

$$u_{it} - u_{it}^* = \alpha + \beta(Y_{it} - Y_{it}^*) + \gamma(u_{i,t-1} - u_{i,t-1}^*) + \theta(u_{i,t-2} - u_{i,t-2}^*) + \pi d_{2008-2011}\Delta Y_{it} + \varepsilon_{it}$$

where:

u_{it}	— unemployment rate in the year t in country i (Poland or Spain) (in %),
u_{it}^*	— the unemployment rate in equilibrium obtained by using the Hodrick-Prescott filter while taking into account the smoothing parameter $\lambda = 100$ (Hodrick and Prescott 1997),
Y_{it}	— GDP rate of growth in the year t in country i (in %),
Y_{it}^*	— potential GDP rate growth obtained by using the Hodrick-Prescott filter while taking into account the smoothing parameter $\lambda = 100$,
$u_{i,t-1}$	— unemployment rate in the year $t-1$ in country i (in %),
$u_{i,t-1}^*$	— the unemployment rate in equilibrium rate in the year $t-1$ in country i (in %),
$u_{i,t-2}$	— unemployment rate in the year $t-2$ in country i (in %),
$u_{i,t-2}^*$	— the unemployment rate in equilibrium rate in the year $t-2$ in country i (in %),
ΔY_{it}	— growth rate of the GDP in the year t in country i (in %),
$d_{2008-2011}$	— a variable, which takes the value of 1 for the period of 2008–2011, and 0 in the opposite case,
$\alpha,\ \beta,\ \gamma,\ \theta, \pi$	— parameters.

The introduction of the variable in the model is a derivative of the crisis taking place in 2008–2011, and the interaction of this variable with the GDP rate of growth allows to take into consideration a possible impact of this recession on the coefficient of Okun's law for both Poland and Spain.

After estimating the parameters of the proposed model the following conclusions can be drawn for Poland: the value of β parameter that is associated with Okun's law is negative and statistically significant ($p = 0,042$). Thus, one must consider statistically significant the correlation between the GDP growth and fluctuations in the unemployment rate in Poland in the years 2002–2015. The value of β parameter amounts to $-0,36$, which is the result that is very close to the estimations obtained by Gajderowicz et al. (2014, 45), who obtained the value of $-0,4$ based on the sample from 1995–2011 for Poland. This value of β parameter indicates that the 1 percentage point of GDP rate of growth in Poland is connected with an approximate 0,36 percentage point decrease in the unemployment rate. The obtained result was statistically significant and negative, which is consistent with the expected assumptions and economic interpretation. In summary, the correlation described by Okun's law is confirmed by the empirical estimation of the parameter of the

Tab. 1. Results of the estimation of the parameters of equation 2 using the OLS Method for Poland

Variable	Parameter	*p*-value
Constant	−0,1080	0,5552
$Y_{it} - Y_{it}^*$	−0,3600	0,0428
$u_{i,t-1} - u_{i,t-1}^*$	1,4141	< 0,0001
$u_{i,t-2} - u_{i,t-2}^*$	−0,8077	0,0009
$d_{2008-2011}\Delta Y_{it}$	−0,5407	0,2358

R-squared	0,9547	Adjusted R-squared	0,9288
F(4, 7).	36,9049	*p*-value (F)	< 0,0001
Log-likelihood . . .	−7,3584	Akaike criterion. . .	24,7169
Schwarz criterion .	27,1414	Hannan-Quinn . . .	23,8193
rho	−0,2469	Durbin-Watson . . .	−0,9983

LM test for autocorrelation of the order of 2
The null hypothesis: the lack of autocorrelation of the random component
The test statistic: LMF = 0,747909
with the value of $p = $ P (F (2, 5) > 0,747909) = 0,519805

Tab. 2. Results of the estimation of the parameters of equation 2 using the OLS Method for Spain

Variable	Parameter	*p*-value
Constant	−0,2697	0,0631
$Y_{it} - Y_{it}^*$	−1,0058	< 0,0001
$u_{i,t-1} - u_{i,t-1}^*$	0,7369	< 0,0001
$u_{i,t-2} - u_{i,t-2}^*$	−0,1668	0,0377
$d_{2008-2011}\Delta Y_{it}$	0,1628	0,2648

R-squared	0,9911	Adjusted R-squared	0,9860
F(4, 7).	195,0006	*p*-value (F)	2,9707
Log-likelihood . . .	−1,3064	Akaike criterion. . .	12,6128
Schwarz criterion .	15,0374	Hannan-Quinn . . .	11,7152
rho	−0,6096	Durbin-Watson . . .	−2,1670

LM test for autocorrelation of the order of 2
The null hypothesis: the lack of autocorrelation of the random component
The test statistic: LMF = 4,77948
with the value of $p = $ P (F (2, 5) > 4,77948) = 0,0691193

equation, according to the accepted model. The R-squared coefficient indicates a very good fit of the model at 95,47%, which means that 95,47% of the variation has been explained by this model.

In addition to estimating the parameters of the model for Poland, the estimation of coefficients for Spain was also made. Its results are shown in table 2. In the case of Spain the estimation of β parameter, which is linked to Okun's law, is negative and statistically significant ($p = 0,0001$). It must therefore be inferred that there exists a statistically significant correlation between the GDP growth and fluctuations in the unemployment rate in Spain in the years 2002–2015, just like in the case of Poland. The result should be interpreted as follows: the 1 percentage point of GDP rate of growth in Spain is connected with an average 1 percentage point decrease in the unemployment rate. The R-squared coefficient obtained for the estimated model was 99,11%, which means that 99,11% of the variation is explained by the model, and the obtained result is even more accurate than in the case of Poland. The fit of the model to the example of Spain is shown graphically in figure 2.

After calculating the coefficients, the hypothesis of the existence of a relationship between the unemployment and GDP in both Poland and Spain was positively verified. The lack of reasons to

reject this hypothesis points to the logic of the mechanism of links between production and unemployment described by Okun's law. The second hypothesis assumed that for every 2%–3% decrease (increase) of real GDP in relation to potential GDP, the unemployment rate increases (decreases) by 1 percentage point in both countries surveyed. The obtained results are the basis for rejecting the second hypothesis, assumed for both Poland and Spain.

Originally sounding Okun's law (for every 2%–3% decrease (increase) of real GDP in relation to potential GDP, the unemployment rate increases (decreases) by 1 percentage point) calculated for US data, shows the rapid pace of change in case of Poland and Spain — i.e., the unemployment in Poland and Spain is changing faster than the GDP, which is described by Okun's coefficients indicated above.

Conclusions

The analysis carried out here has positively verified the hypothesis about the existence of the relationship between unemployment and GDP both in Poland and Spain. The results also provide a basis for rejecting the second assumed hypothesis which states that for every 2%–3% decrease (increase) of real GDP in relation to potential GDP, the unemployment rate increases (decreases) by 1 percentage point in both countries surveyed. The results obtained in the course of our research and the considerations included in this work are an attempt to develop a discussion on the essence of the relationship between GDP and unemployment. A small number of studies (especially by Polish authors) on Okun's law only confirm the need for further development of this type of research, which may lead to important insights in the analysis of cyclical changes in the economic situation, fluctuations of domestic product and unemployment level. The research into the relationship between GDP and unemployment cannot be done without taking into account a wide range of factors that have an impact on this relationship. Only such an approach will give one a chance to understand and accurately explain the strength of the relationship between domestic product and unemployment.

References

ACOCELLA, N. 2002. *Zasady polityki gospodarczej. Wartości i metody analizy.* Translated by A. Wojtyna. Warszawa: Wydawnictwo Naukowe PWN.

ATTFIELD, C., and B. SILVERTONE. 1997. "Okun's Coefficient: a Comment." *The Review of Economics and Statistics* no. 69 (2):326–329.

BALL, L.M., D. LEIGH, and P. LOUNGANI. 2013. "Okun's Law: Fit at Fifty?" *NBER Working Paper* (18668):1–40.

DYKAS, P., T. MISIAK, and T. TOKARSKI. 2013. "Czynniki kształtujące regionalne zróżnicowanie stóp bezrobocia rejestrowanego w Polsce w latach 2002–2010." *Humanities and Social Sciences* no. 18 (1):9–21.

GAJDEROWICZ, T., G. GROTKOWSKA, L. WINCENCIAK, and E. WIRTEK. 2014. "Wrażliwość stóp bezrobocia względem wahań PKB w przekroju województw." *Ekonomia* (39):29–58.

GRUCHELSKI, M. 2013. *Bezrobocie w procesie wzrostu gospodarczego. Teoria i praktyka.* Warszawa: Szkoła Główna Handlowa. Oficyna Wydawnicza.

HALL, R.E., and J.B. TAYLOR. 2007. *Makroekonomia.* Translated by J. Czekaj. 3rd ed. Warszawa: Wydawnictwo Naukowe PWN.

HERMAN, E. 2012. "The Influence of the Economic Growth Process on Romanian Employment." *Annals of "Dunarea de Jos" University of Galati* no. 18 (1):5–12.

HODRICK, R.J., and E.C. PRESCOTT. 1997. "Postwar US Business Cycles. An Empirical Investigation." *Journal of Money Credit and Banking* no. 29 (1):1–16.

KHEMRAJ, T., J. MADRICK, and W. SEMMLER. 2006. Okun's Law and Jobless Growth. *Policy Note* (3): 1–12, http://www.economicpolicyresearch.org/images/docs/research/employment/0603_PN_Okun's_Law.pdf.

KLIMCZAK, P., and G. WRONKOWSKA. 2010. "Prawo Okuna w warunkach kryzysu gospodarczego." In *Wzrost gospodarczy i polityka makroekonomiczna*, edited by W. Kwiatkowska and E. Kwiatkowski. Łódź: Wydawnictwo Uniwersytetu Łódzkiego.

Kwiatkowski, E. 2002. *Bezrobocie. Podstawy teoretyczne, Współczesna Ekonomia*. Warszawa: Wydaw. Naukowe PWN.

Majchrowska, A., K. Mroczek, and T. Tokarski. 2013. "Zróżnicowanie stóp bezrobocia rejestrowanego w układzie powiatowym w latach 2002–2011." *Gospodarka Narodowa* no. 83/24 (9):69–90.

Milewski, R., and E. Kwiatkowski. eds. 2005. *Podstawy ekonomii*. 3rd ed. Warszawa: Wydawnictwo Naukowe PWN.

Misztal, P. 2014. "Hipoteza bezzatrudnieniowego wzrostu gospodarczego w krajach o różnym poziomie rozwoju gospodarczego." *Polityki Europejskie, Finanse i Marketing* (12):129–141.

Onaran, Ö. 2007. "Jobless Growth in the Central and Eastern European Countries. A Country Specific Panel Data Analysis for the Manufacturing Industry." *Department of Economics Working Paper Series* (103):1–54.

Prachowny, M.F.J. 1993. "Okuns Law — Theoretical Foundations and Revised Estimates." *Review of Economics and Statistics* no. 75 (2):331–336. doi: 10.2307/2109440.

Saget, C. 2003. "Can the Level of Employment be Explained by GDP Growth in Transition Countries? (Theory versus the Quality of Data)." *Labour* no. 14 (4):623–643.

Schmid, G. 2008. *Full Employment in Europe. Managing Labour Market Transitions and Risks*. Cheltenham–Northampton, Mass: Edward Elgar.

Swane, A., and H. Vistrand. 2006. *Jobless Growth in Sweden? A Descriptive Study*. Master's Thesis, Stockholm School of Economics, Stockholm.

Zagler, M. 2004. *Growth and Employment in Europe*. Basingstoke: Palgrave Macmillan.

Ziomek, A. 2006. *Produkt krajowy a bezrobocie*. Poznań: Wydawnictwo Wyższej Szkoły Bankowej w Poznaniu.