

PIOTR KRAJEWSKI* , KATARZYNA PIŁAT**

**Does A Progressive PIT Stabilize The Economy?
A Comparison Of Progressive And Flat Taxes**

Abstract

The aim of the article is to examine the impact of progressive personal income tax rates and the effectiveness of this tax as an automatic economic stabilizer. The assessment of automatic stabilizers is based on the estimates of tax cyclical components. The study shows that the output elasticity of PIT is higher than one, which means that the analysed tax acts relatively efficiently as an automatic stabilizer. However, it was also observed that the tax progressivity is not the main reason of the effectiveness of a progressive PIT as an automatic stabilizer. The study shows that changes in progressive rates of PIT, contrary to widespread opinions, have little effect on the effectiveness of passive fiscal policy. Personal income tax acts as automatic stabilizer mostly due not to the progressive tax rates, but because of the sensitivity of employment to GDP fluctuations.

Keywords: PIT, taxes, automatic stabilizers, fiscal policy

* Ph.D., Professor at Institute of Economics of the Polish Academy of Sciences, e-mail: krajewski@inepan.waw.pl

** Ph.D., University of Lodz, Faculty of Economics and Sociology, Institute of Economics, e-mail: katarzyna.pilat@gmail.com

1. Introduction

Almost all taxes, except for lump-sum taxes, act as automatic stabilizers. They can be described as a built-in response of public revenues to economic fluctuations. Studies concerning automatic stabilizers and the interactions between economic activity and budget deficits date back to the 1930s, i.e. the times of the Great Depression (see Hansen 1941). Automatic stabilizers smooth output and employment fluctuations, so they were once again of great importance during Great Recession which started in 2007. Moreover, automatic stabilizers have the advantage over the discretionary fiscal policy that their effects are more predictable (see Buiter 1990).

The size of automatic stabilizers depends on fiscal multipliers and the sensitivity of cyclical components of public revenues and public expenditures to GDP fluctuations. Most public revenues are sensitive to economic cycles, whereas only a small share of public expenditures depend on output fluctuations, thus automatic stabilizers act mostly on revenue side of budget.

According to Ricardian equivalence, lump-sum taxes have no impact on GDP (see Barro 1974). However, taxes are usually not lump-sum and directly or indirectly depend on output. The short term impact of taxes on GDP has been the subject of numerous studies, conducted on the basis of RBC models (Baxter and King 1993, McGrattan 1994), new-Keynesian models (Cardia 1995, Zubairy 2014), the narrative approach (Romer and Romer 2010), or SVAR models (Blanchard and Perotti 2002, Baum and Koester 2011). Almost all empirical analyses show that tax multipliers are negative and statistically significant.

As mentioned above, the size of automatic stabilizers also depends on the size of the cyclical component of a deficit. The higher the cyclical budget deficit, the stronger is the smoothing effect of automatic stabilizers of a business cycle (see, for example, Rogor and Veld 1997, Momigliano 1999).

A progressive personal income tax is often seen as a key element of automatic stabilizers. The article examines the effectiveness of PIT as an automatic stabilizer in Polish economy. The assessment of this effectiveness of PIT was based on estimates of cyclical components of tax revenues in Poland.

The effectiveness of the progressive PIT as an automatic stabilizer in years 2000–2014 is compared with the hypothetical effects of a flat personal income tax. Such a comparison enables to verify whether tax progression has a significant impact on the effectiveness of PIT as an automatic stabilizer.

The structure of the paper is the following. The first part presents the methodology of the study. In the following section the results of the estimation are presented. Then the effectiveness of progressive and flat taxes is compared. The paper ends with conclusions.

2. Methodology

It is assumed that the effectiveness of personal income tax as an automatic stabilizer is proportional to its sensitivity to output fluctuations (see Krajewski 2012). Short term output elasticity of PIT revenues (Ψ) is given by equation:

$$(1) \quad \Psi = \frac{\partial T}{\partial Y} \frac{Y}{T} = \frac{\partial(t_a w L)}{\partial Y} \frac{Y}{t_a w L}$$

where:

Y – output,

T – revenues from personal income tax,

L – employment,

w – wages,

t_a – average tax rate.

The short term output elasticity of PIT revenues is estimated under the assumption that new employees have the same wage distribution as employees previously employed (see Giorno, Richardson, Roseveare and van den Noord 1995), that is:

$$\Psi = \left(\frac{\partial(t_a w)}{\partial w} \frac{w}{t_a w} \right) \left(\frac{\partial w}{\partial Y} \frac{Y}{w} \right) + \left(\frac{\partial L}{\partial Y} \frac{Y}{L} \right) \quad (2)$$

The above equation can be written as:

$$\Psi = \psi_{tw,w} \psi_{w,Y} + \psi_{L,Y} \quad (3)$$

where:

$\psi_{tw,w}$ – wage elasticity of average tax,

$\psi_{w,Y}$ – output elasticity of wages,

$\psi_{L,Y}$ – output elasticity of employment.

Generally, the average tax rate is a function of wages, that is $t_a = t_a(w)$. However, for the flat tax the average tax rate doesn't depend on wages.

Thus $\psi_{tw,w} = 1$ and consequently:

$$\Psi = \psi_{w,Y} + \psi_{L,Y} \quad (4)$$

In the case of a progressive tax system the average tax rate is higher for higher wages. Thus the percentage increase in the average tax paid by the taxpayer is higher than percentage increase in wages ($\psi_{tw,w} > 1$).

The greater the difference between the marginal and average tax rates, the stronger wages impact on the average tax.

Short-term elasticity of average personal income tax with respect to wages was estimated using the following formula (see Józefiak, Krajewski and Mackiewicz 2006):

$$\psi_{tw,w} = \sum_{j=1}^n w_j \frac{t_{m,j}}{t_{a,j}} \quad (5)$$

where:

$t_{m,j}$ – marginal tax rate for j-th tax bracket,

$t_{a,j}$ – average tax rate for the j-th tax bracket,

w_j – share of total tax revenues obtained from j-th tax bracket,

n – number of tax brackets.

Short term output elasticities of wages and employment were estimated on the basis of the percentage deviations of output, wages and employment from the potential levels. To obtain cyclically adjusted levels of variables, the Hodrick and Prescott (1980) filter was used.

Thus, to estimate the short term output elasticity of wages, the parameters of the following equation were estimated:

$$\ln w_t^{SA} - \ln w_t^{HP} = \alpha_0 + \alpha_1 (\ln Y_t^{SA} - \ln Y_t^{HP}) + \varepsilon_t \quad (6)$$

where:

w_t^{SA} – real wages seasonally adjusted,

W_t^{HP} – real wages corrected by cyclical fluctuations,

Y_t^{SA} – GDP seasonally adjusted,

Y_t^{HP} – GDP corrected by cyclical fluctuations,

ε_t – random variable.

Analogically, in the case of short term output elasticity of employment the parameters of the following equation were estimated:

$$\ln L_t^{SA} - \ln L_t^{HP} = \beta_0 + \beta_1 (\ln Y_t^{SA} - \ln Y_t^{HP}) + \xi_t \quad (7)$$

where:

L_t^{SA} – employment seasonally adjusted,

L_t^{HP} – employment corrected by cyclical fluctuations,

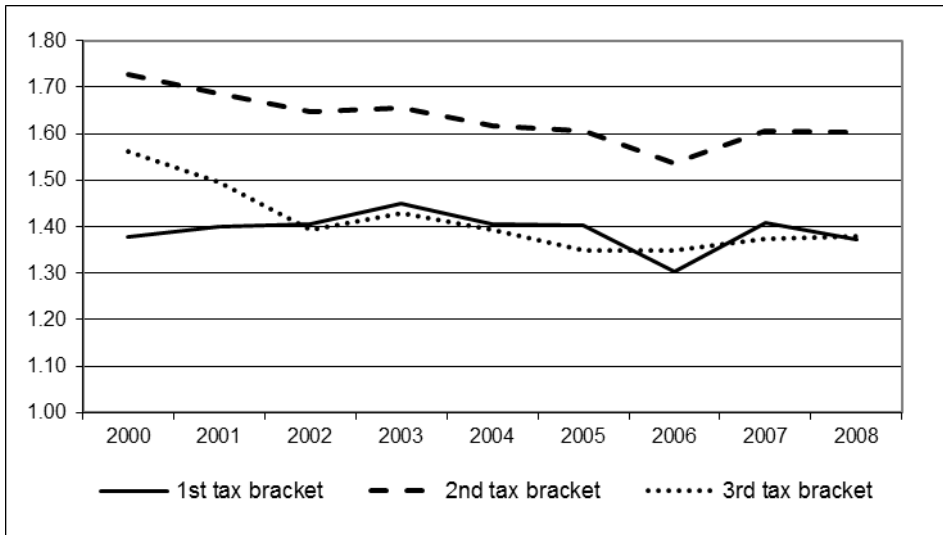
ξ_t – random variable.

Estimations of parameters α_1 and β_1 are the estimations of output elasticity of wages and employment respectively.

3. Results

Estimates of the effectiveness of personal income tax as an automatic stabilizer are based on Polish data covering the period 2000–2014. Two sub-periods were analysed: 1995–2008 and 2009–2014, to compare the effectiveness of PIT with three marginal rates with the effectiveness of the subsequent tax rate with two marginal rates. The estimates of wage elasticity of average tax are based on Ministry of Finance annual PIT reports. Other estimates are based on quarterly Central Statistical Office data.

The progressive tax system has an impact on the short-term elasticity of average taxes with respect to wages. To obtain the short-term elasticity of average taxes with respect to wages, marginal to average tax rate ratios were calculated (see equation (5)). The marginal rates until 2008 were 19%, 30%, and 40%. The ratio of marginal to average tax rate during years 2000–2008 for each tax bracket is presented in Figure 1.

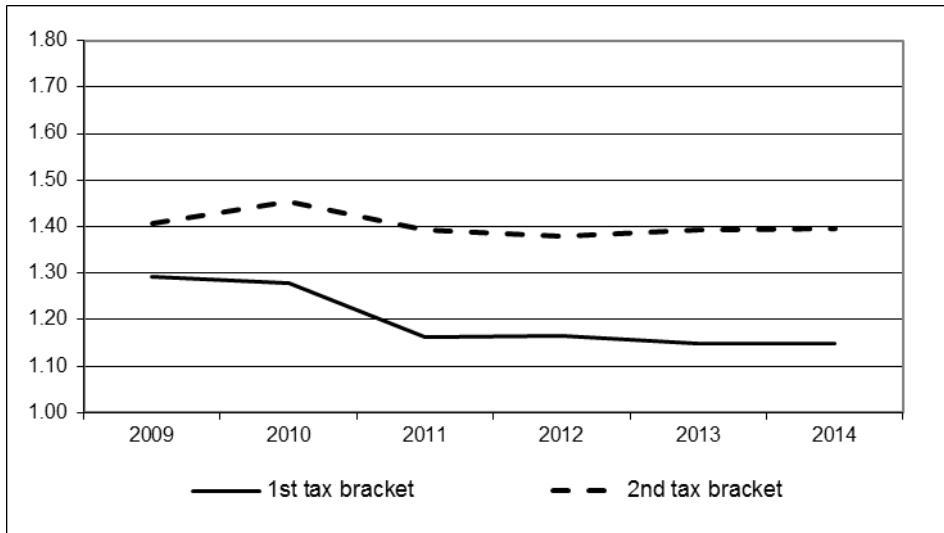
Figure 1. The ratio of marginal to average tax rate in years 2000–2008

Source: own calculations based on Ministry of Finance data (<http://www.finanse.mf.gov.pl/pit/statystyki>).

As shown in Figure 1, during the years 2000–2008 the biggest difference between the marginal and average tax rate was observed in the second tax bracket. In analysed period, an increase in taxable income within the second tax bracket by 1 per cent led to the increase in the marginal to average tax ratio by about 1.6 per cent.

The ratio between the marginal and average tax rate in the third tax bracket was lower than in the second bracket, due to the fact that the third bracket included taxpayers with very high incomes. In case of very rich taxpayers, income taxed at the rate of 19% or 30% accounted for a negligible part of their total income, and as a result the average tax rate approached the marginal tax rate.

Since 2009 there have been only two tax brackets: 18% and 32%. The ratios of marginal to average tax rate during years 2009–2014 are presented in Figure 2.

Figure 2. The ratio of marginal to average tax rates in years 2009–2014

Source: own calculations based on Ministry of Finance data (<http://www.finanse.mf.gov.pl/pit/statystyki>).

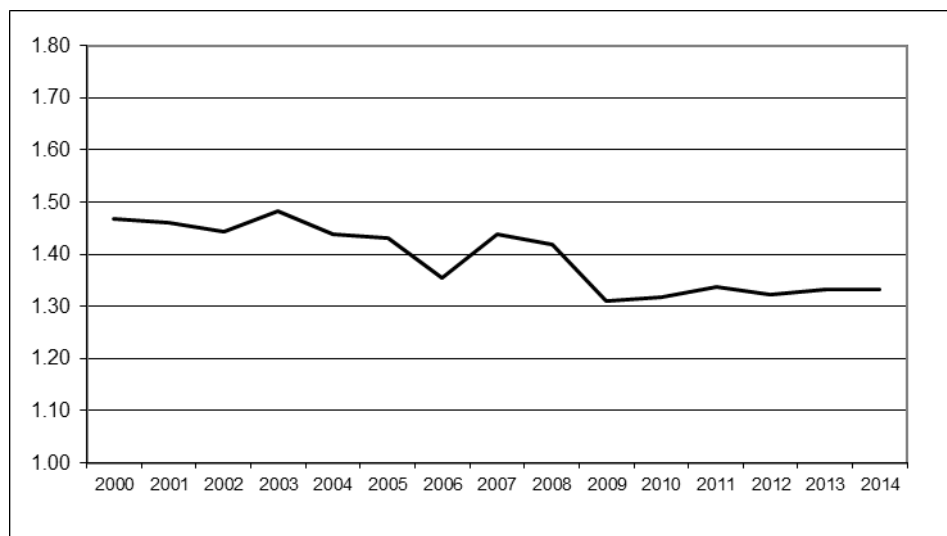
Similarly as in case of the first analysed period, the marginal to average tax rate ratio was higher in second tax bracket than in first bracket. Moreover, the difference between the marginal and average tax rate was diminishing. As a result, the marginal tax rate in the first tax bracket was higher than the average tax rate by only 15% in 2004. The decrease in this ratio resulted from the decreasing importance of tax-free allowances. Tax-free allowances were not indexed in this period, so their relative importance decreased with increases in the average wage.

The wage elasticity of average tax depends not only on ratios of marginal to average tax rates in each tax bracket, but also on the share of the total tax budget revenues obtained for each tax bracket (see equation (5)).

The estimates of the wage elasticity of the average tax in period 2000–2014 are shown in Figure 3.

The wage elasticity of the average tax has decreased since the third tax bracket was removed. The average value of this elasticity during years 2009–2014 equalled 1.33, which is 0.11 lower than the average for the years 2000–2008.

According to equation (3), the effectiveness of PIT as an automatic stabilizer depends not only on tax progression but also on the sensitivity of wages and employment to economic fluctuation. Short term output elasticities of wages and employment were estimated on the basis of equations (6) and (7).

Figure 3. Wage elasticity of the average tax in the years 2000–2014

Source: own calculations based on Ministry of Finance data (<http://www.finance.mf.gov.pl/pit/statystyki>).

The quarterly series of output, employment and real wages were seasonally adjusted by the use of Tramo/Seats method. The cyclical components were extracted using the Hodrick-Prescott filter with a standard for quarterly data parameter, that is $\lambda = 1600$. Cyclical components of the analysed series are shown in Figure 4.

The following estimates were obtained using equations (6) and (7):¹

$$\ln\left(\frac{W_t^{SA}}{W_t^{HP}}\right) = -0,0001 + 0,31 \ln\left(\frac{Y_t^{SA}}{Y_t^{HP}}\right) \\ (-0,10) \quad (3,48)$$

$$\ln\left(\frac{L_t^{SA}}{L_t^{HP}}\right) = -0,0004 + 0,83 \ln\left(\frac{Y_t^{SA}}{Y_t^{HP}}\right) \\ (-0,27) \quad (6,73)$$

Thus, the estimates of output elasticity of wages and labour are 0.83 and 0.31 respectively. The short term output elasticity of employment is lower than one. This means that GDP fluctuations, according to Okun's law, lead to relatively

¹ T-student statistics are shown in brackets.

low employment fluctuations. Thus, cyclical changes of output are to a certain extent absorbed by work efficiency fluctuations.

Figure 4. Cyclical components of GDP, wages and employment in the years 2000–2014 (as percentage of cyclically adjusted levels)



Source: own calculations based on Central Statistical Office data (<http://www.stat.gov.pl/wskazniki-makroekonomiczne/>).

Estimates of the effectiveness of PIT as an automatic stabilizer, calculated on the basis of equation (3), are shown in Table 1.

Table 1. Output elasticity of PIT revenues in the years 2000–2014

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Elasticity	1.285	1.283	1.278	1.289	1.276	1.273	1.250	1.276	1.270	1.236	1.239	1.245	1.240	1.243	1.243

Source: own calculations based on Ministry of Finance and Central Statistical Office data (<http://www.finanse.mf.gov.pl/pit/statystyki>, <http://www.stat.gov.pl/wskazniki-makroekonomiczne/>).

The average value of output elasticity of PIT revenues equals, on average, 1.262. This means that the fluctuations of PIT revenues are relatively higher than the fluctuations of output, and personal income tax acts well as an automatic stabilizer.

After the third tax bracket was abandoned, the effectiveness of PIT as an automatic stabilizer decreased slightly. The average analyzed elasticity diminished from 1.275 for the period 2000–2008 to 1.241 for the period 2009–2014.

4. Progressive tax versus flat tax

Personal income tax in Poland is progressive, contrary to the most of Central and Eastern European countries (see Table 2). The tax progression in the Polish tax system is often seen as a key element of its effectiveness as an automatic stabilizer. Thus the effectiveness of PIT as an automatic stabilizer is compared in this section with the hypothetical effects of a flat personal income tax in Poland.

Table 2. PIT marginal tax rates in Central and Eastern European Countries

Country	Tax rates (%)
Bulgaria	10
Croatia	12, 25, 40
Czech Republic	15, 22*
Estonia	20
Hungary	15
Latvia	23
Lithuania	15
Poland	18, 32
Romania	16
Slovakia	19, 25
Slovenia	16, 27, 41, 50

* Including a solidarity surcharge

Source: Taxation trends in the European Union, Publications Office of the European Union 2016, http://ec.europa.eu/taxation_customs/business/economic-analysis-taxation/taxation-trends-eu-union_en.

In order to estimate the impact of progressive PIT on the effectiveness of this tax as automatic stabilizer, the estimates obtained for the GDP elasticity of tax revenues were compared with hypothetical values for a flat tax.

To assess to what extent PIT acts as an automatic stabilizer due to progression in tax rates, the following index was calculated:

$$I = \frac{\Psi - \Psi_{flat}}{\Psi_{flat}}$$

(8)

where:

Ψ_{flat} – hypothetical value of output elasticity of a flat personal income tax.

Index I shows the percentage increase in the effectiveness of PIT as an automatic stabilizer due to tax progressivity. Taking into account equation (3), after simple transformations we obtain:

$$(9) \quad I = \frac{\psi_{w,Y} (\psi_{tw,w} - \psi_{tw,w(flat)})}{\psi_{tw,w(flat)} \psi_{w,Y} + \psi_{L,Y}}$$

where:

$\psi_{tw,w(flat)}$ – wage elasticity of average tax in the case of a flat PIT.

For flat tax $\psi_{tw,w(flat)} = 1$, so we can simplify the above formula:

$$(10) \quad I = \frac{\psi_{w,Y} (\psi_{tw,w} - 1)}{\psi_{w,Y} + \psi_{L,Y}}$$

The analogical index was calculated to show the effects of the change in marginal tax rates since 2009:

$$(11) \quad I' = \frac{\psi_{w,Y} (\psi_{tw,w} - \psi_{tw,w(3tb)})}{\psi_{tw,w(3tb)} \psi_{w,Y} + \psi_{L,Y}}$$

where:

$\psi_{tw,w(3tb)}$ – hypothetical value of elasticity of average tax with respect to wages in the case of maintaining three tax brackets.

The estimates of indexes I and I' are presented in Table 3.

Table 3. Indexes I and I' in the years 2000–2014

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Index I (%)	12.7	12.5	12.1	13.1	11.9	11.7	9.6	11.9	11.4	8.4	8.7	9.2	8.8	9.0	9.0
Index I'	-	-	-	-	-	-	-	-	-	-2.7	-2.5	-2.0	-2.4	-2.1	-2.1

Source: own calculations based on Ministry of Finance and Central Statistical Office data (<http://www.finanse.mf.gov.pl/pit/statystyki>, <http://www.stat.gov.pl/wskazniki-makroekonomiczne/>).

The effectiveness of PIT as an automatic stabilizer is on average only 10.7% higher than it would be in case of flat tax. Thus it may be concluded that the progressivity of PIT has little effect on the effectiveness of passive fiscal policy. In the main, personal income tax acts as an automatic stabilizer not

because of the progressivity of tax, but due to the sensitivity of employment and average wages to GDP fluctuations.

The reform of personal income taxes in Poland, which removed the third marginal tax rate, slightly decreased the effectiveness of passive fiscal policy. However, as shown in Table 2, this tax reform had very little impact on automatic stabilizers. In the case of maintaining three tax brackets the effectiveness of PIT as an automatic stabilizer would be higher by only about 2 per cent.

The results of our study indicate that the progressivity of PIT is not the key factor in the effectiveness of this tax as an automatic stabilizer. Thus, the introduction of a flat personal income tax in Poland, similarly as in Hungary, Romania, Bulgaria, Lithuania, Latvia and Estonia, would not significantly decrease the effectiveness of automatic stabilizers in Poland.²

5. Conclusions

Automatic stabilizers can be described as a built-in response of public revenues to economic fluctuations. This article examined the impact of progressivity in personal income tax on the effectiveness of this tax as an automatic stabilizer.

The assessment of automatic stabilizers was based on the estimates of cyclical components of tax revenues. The study shows that the output elasticity of personal income tax is higher than one, which means that PIT acts relatively well as an automatic stabilizer. However, in the main this is not because of the tax progression. Our study found that the effectiveness of personal income tax as an automatic stabilizer is only about 10 per cent higher than it would be in the case of a flat tax. In fact, PIT acts as automatic stabilizer mostly due to the sensitivity of employment to GDP fluctuations.

Our study also shows that the effectiveness of personal income tax as an automatic stabilizer has decreased since 2008. At the same time however, the reform of PIT in Poland and cancellation of the third marginal tax rate had very little effect on the effectiveness of this tax.

To sum up, our study shows that changes in the progressivity of PIT, contrary to widespread opinions, have little effect on the effectiveness of passive fiscal policy. Personal income tax acts as an automatic stabilizer mostly due not to the progressivity of tax rates, but because of the sensitivity of employment to GDP fluctuations.

² However, it should be stressed that the progressiveness of PIT, although not an important factor in its effectiveness as an automatic stabilizer, has a significant impact on income redistribution.

References

- Barro R. (1974), *Are Government Bonds Net Wealth?*, 'Journal of Political Economy', vol. 82(6).
- Baum A., G.B. Koester (2011), *The impact of fiscal policy on economic activity over the business cycle – evidence from a threshold VAR analysis*, Deutsche Bundesbank, Discussion Paper, no 03.
- Baxter M., R.G. King (1993), *Fiscal Policy in General Equilibrium*, 'The American Economic Review', vol. 83(3).
- Blanchard O., R. Perotti (2002), *An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output*, 'The Quarterly Journal of Economics' vol. 117(4).
- Buiter W.H. (1990), *Principles of Budgetary and Financial Policy*, The MIT Press, Cambridge.
- Cardia E. (1995), *The effects of fiscal policies in a general equilibrium model with nominal wage contracts*, 'Economic Letters', no. 49.
- Giorno C., P. Richardson, D. Roseveare, P. van den Noord (1995), *Potential Output, Output Gap and Structural Budget Balances*, OECD Economic Studies No 24.
- Hansen A. (1941), *Fiscal Policy and Business Cycles*, George Allen and Unwin Ltd, London.
- Hodrick R.J., E. Prescott (1980), *Post-war U.S. Business Cycle: An Empirical Investigation*, Working Paper, Carnegie-Mellon University.
- Józefiak C., P. Krajewski, M. Mackiewicz (2006), *Deficyt budżetowy. Przyczyny i metody ograniczenia*, PWE, Warszawa.
- Krajewski P. (2012), *The Role of Automatic Stabilizers in Mitigating the Effects of the Crisis*, 'International Journal of Business and Management Studies', vol. 1(2).
- McGrattan E.R. (1994), *The Macroeconomic Effects of Distortionary Taxation*, 'Journal of Monetary Economics', vol. 33.
- Momigliano S. (1999), *Introduction*, [in:] *Indicators of structural budget balances*, Banca D'Italia.
- Roger W., J. in't Veld (1997), *QUEST II: A Multi Country Business Cycle and Growth Model*, European Commission Economic Papers, no 123.
- Romer Ch.D., D.H. Romer (2010), *The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks*, 'American Economic Review', vol. 100(3).
- Zubairy S. (2014), *On Fiscal Multipliers: Estimates from a Medium Scale DSGE Model*, 'International Economic Review', vol. 55(1).

Streszczenie

CZY PROGRESJA PODATKOWA STABILIZUJE GOSPODARKE? PORÓWNANIE PODATKU PROGRESYWNEGO I LINIOWEGO

Cel artykułu stanowi zbadanie wpływu progresywności podatku PIT na jego skuteczność jako automatycznego stabilizatora koniunktury. Ocenę efektywności tego podatku w niwelowaniu wahań koniunktury przeprowadzono w oparciu o szacunki komponentów cyklicznych. Z badania wynika, że elastyczność wpływów podatkowych z podatku PIT względem PKB jest wyższa od jedności, co oznacza, że podatek dochodowy od osób fizycznych jest skutecznym stabilizatorem koniunktury. Jednocześnie uzyskano jednak, że występowanie progresji podatkowej nie jest głównym powodem wysokiej efektywności tego podatku w stabilizowaniu fluktuacji gospodarczych. Wyniki przeprowadzonych oszacowań wskazują, że zmiany w progresywności podatku PIT, odmiennie niż wynikałoby z powszechnych opinii na ten temat, jedynie w niewielkim stopniu wpływają na efektywność biernej polityki fiskalnej. Podatek dochodowy od osób fizycznych działa bowiem jako automatyczny stabilizator głównie nie poprzez progresję podatkową, lecz na skutek zmian poziomu zatrudnienia wynikających z fluktuacji gospodarczych.

Słowa kluczowe: PIT, podatki, automatyczne stabilizatory koniunktury, polityka fiskalna