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Regional Heterogeneity of Government Expenditure Multipliers in Poland

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Abstract

The study analyzes the regional heterogeneity of the impact of government expenditure on Polish voivodships. The aim of the paper is to estimate regional fiscal multipliers in Poland. The empirical research is based on the structural vector autoregression model with the identification scheme proposed by Blanchard and Perotti. The estimations were carried out on the basis of quarterly data covering the period 2000Q1–2022Q4. The empirical results show that the regional effects of government expenditure are characterized by a high level of heterogeneity. The static fiscal multipliers range from 0.17 to 0.55, and the strongest impact of government expenditure on the level of employment occurs in the eastern voivodships of Poland. Thus, the results have important policy implications — the eastern Polish voivodships are among those with below-average economic development, so an expansive fiscal policy may contribute to reducing differences in economic development and enhance regional convergence in Poland. However, the empirical results also indicate that expansionary fiscal policy has the most permanent impact on the labor market in the Mazowieckie Voivodship, which is the richest Polish voivodship. It means that although expansionary fiscal policy in Poland, in the short term, is an effective tool of reducing inequalities in its regional economic development, in the long term, it may lead to an increase in disproportions between the economic development of the richest region and other Polish voivodships.

Keywords: regional heterogeneity, government expenditure, fiscal multipliers

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Introduction

Recently, due to the worldwide recessions caused by the Global Financial Crisis and COVID-19 pandemic, it has become particularly important to precisely estimate the effectiveness of fiscal policy as a macroeconomic tool to stimulate the economy.

On the one hand, the work of Auerbach and Gorodnichenko (2012) gave rise to numerous empirical studies (e.g., Afonso, Baxa, and Slavík 2018; Barnichon, Debortoli, and Matthes 2021; Caggiano et al. 2015) showing that increasing government expenditure is an effective method of boosting the economy during a recession. On the other hand, there is a burgeoning literature on the heterogeneity of the effects of government spending showing that the effectiveness of fiscal policy can significantly vary. First of all, numerous studies indicate that when the zero lower bound occurs, fiscal policy is much more effective than when interest rates are positive (Erceg and Lindé 2014; Klein and Winkler 2021; Olivier and Takongmo 2017). The heterogeneity of fiscal multipliers has also been analyzed on the basis of the household leverage cycle — government spending multipliers are usually larger when household leverage is high (Eggertsson and Krugman 2012; Jones, Midrigan, and Philippon 2022;

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Klein, Polattimur, and Winkler 2022). The third strand of research on the heterogeneity of fiscal multipliers focuses on liquidity constraints, indicating that they lead to higher fiscal multipliers (Andrés et al. 2022; Auclert, Bardóczy, and Rognlie 2023; Cantore and Freund 2021).

The abovementioned analyses regarding the heterogeneity of the effects of government spending refer to the aggregated impact of fiscal policy at the national level. For this reason, they do not consider the regional diversity of fiscal multipliers. There are however grounds for assuming that the heterogeneity of the effects of government expenditure also exists at the regional level. First of all, government expenditure on the purchase of goods and services may be distributed unevenly — for example, military expenses mainly stimulate regions in which military factories are located (Hooker and Knetter 1997). Secondly, the strength of the impact of government spending on economic activity in a given region may depend on the kind of public spending (Pappa 2009) as well as the economic structure of the region (Owyang and Zubairy 2013).

The regional heterogeneity of government expenditure multipliers has been confirmed by empirical research carried out, among others, by Martínez-López (2005), Fishback and Kachanovskaya (2010), Owyang and Zubairy (2013), Nakamura and Steinsson (2014), and Matarrese and Frangiamore (2023). Such empirical analyses, however, have been conducted almost exclusively for highly developed economies – mostly the US and Eurozone. Moreover, these analyses mainly focus on the impact of fiscal policy on GDP rather than employment. Therefore, the aim of our paper is to estimate the impact of government expenditure on regional labor markets in Poland, that is, regional fiscal multipliers.

The novelty of our research is that it is the first analysis of the impact of government expenditure at the national level on regional labor markets in Central and Eastern European countries conducted on the basis of an empirical sample covering the COVID-19 pandemic substantial fiscal tools. The added value of the study lies in its verification of the regional heterogeneity of fiscal policy effects in Central and Eastern European countries and estimation of the impact of domestic fiscal policy on stimulating regional labor markets. Moreover, what is especially important is the fact that our research verifies whether expansionary fiscal policy leads to the regional convergence of economic development in Poland. Such an analysis is of particular importance given recent cases of very large temporary increases in government expenditure (see figure 1).

The study is based on the structural vector autoregression model with the identification scheme proposed by Blanchard and Perotti (2002). This methodology, due to its use of quarterly data and estimation of cyclical tax revenue components, enables the identification of government expenditure shocks. However, unlike Blanchard and Perotti, we use employment instead of GDP as a variable describing regional economic activity.

The structure of the paper is as follows: firstly, the methods for estimating fiscal multipliers are discussed; then, the structural vector autoregression model applied in our empirical research is presented, to be followed by the analysis of the data and empirical results and a conclusion.

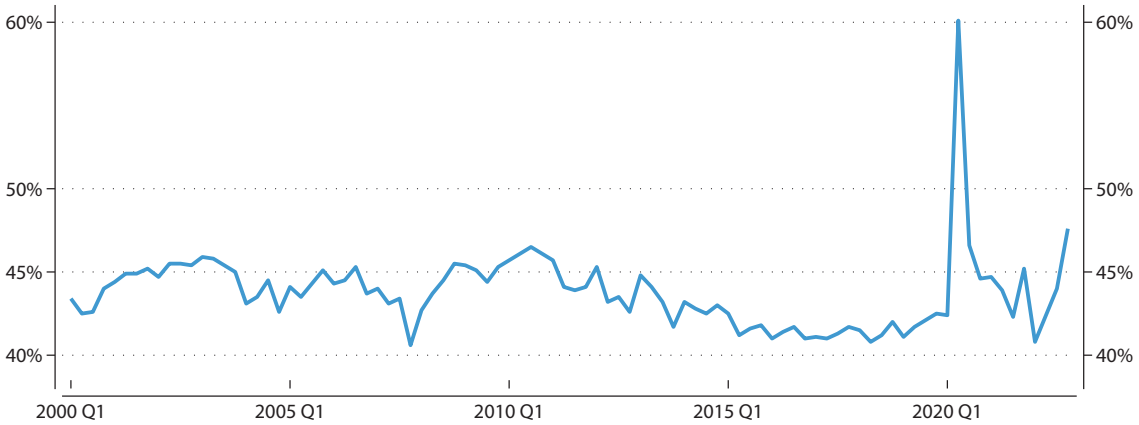

Figure 1. Government expenditure in Poland (as a percentage of GDP)

Source: Own calculation on the data published by Eurostat.

1 Review of methods for estimating government expenditure multipliers

The impact of government expenditure on the economy is usually analyzed on the basis of structural vector autoregression models (SVAR models), dynamic stochastic general equilibrium models (DSGE models), and the narrative approach.

The use of SVAR models for fiscal policy analysis was initiated by Fatas and Mihov (2001). In the subsequent years, numerous studies based on SVAR models were conducted, including, among others, Perotti (2008), Mountford and Uhlig (2009), Ilzetzki, Mendoza, and Végh (2013), Afonso and Leal (2019), and Angelini et al. (2023). The use of such models is usually based on the assumption that the government expenditure in a given quarter is not dependent on fluctuations in economic activity (Blanchard and Perotti 2002). Furthermore, additional assumptions are made regarding the sensitivity of tax revenues to these fluctuations. The strength of this relationship, associated with automatic stabilizers, is estimated on the basis of the elasticities of individual tax categories with respect to GDP (Brunila, Buti, and 'T Veld 2003). Empirical research on fiscal policy using SVAR models has become particularly popular ever since the world financial crisis, mainly due to Auerbach and Gorodnichenko (2012), who showed that government expenditure in the US economy is a very effective macroeconomic tool of stimulating GDP during recessions. Similar analyses, based on SVAR threshold models, were also conducted for various European countries (e.g., Afonso and Leal 2019; Baum and Koester 2011), including the economies of Central and Eastern Europe (e.g., Boiciuc 2015; Grdović Gnip 2014). The vast majority of analyses using threshold SVAR empirical results show that increasing government expenditure brings stronger effects during recessions than during recovery periods. An interesting extension of the fiscal policy analyses based on SVAR models also accounts for the anticipation of changes in fiscal policy (Leeper, Walker, and Yang 2008). This approach takes into account that there are usually significant delays between the decision taken by the fiscal authorities and the actual incurring of expenses resulting from this decision.

The second group of methods for studying the effects of fiscal policy are DSGE (dynamic stochastic general equilibrium) models. DSGE models were initially used in supply real business-cycle models, based on the studies of Kydland and Prescott (1982) and Hansen (1985). Since the 1990s, the analysis of fiscal policy by means of DSGE models has been primarily based on the new-Keynesian models (Coenen and Straub 2005; Eggertsson 2008)[1]. In recent years, DSGE models have been utilized for, among others, theoretical explanations of the greater efficiency of expansive fiscal policy in the period of zero interest rates (Christiano, Eichenbaum, and Rebelo 2011; Klein and Winkler 2021; Olivier and Takongmo 2017).

The third frequently used group of studies on the effects of fiscal policy is based on the narrative approach. Within this approach fiscal shocks are estimated on the basis of public information on shifts in fiscal policy, orthogonal to other macroeconomic shocks. Such analyses are often focused on military expenditure (Favero and Giavazzi 2012; Ramey 2011; Ramey and Shapiro 1998). Under the narrative method, based on the analyses of legal acts and statements of politicians responsible for fiscal policy, it is possible to identify whether the shift in government expenditure is exogenous or is a reaction to economic fluctuations.

The abovementioned studies on the effects of fiscal policy, based on SVAR models, DSGE models, and the narrative approach, usually focus on the aggregate effects of government expenditure at the national level. Research into the regional differentiation of the effects of fiscal policy is rare and conducted mainly for the US and Eurozone economy. It should also be noted that studies on the regional heterogeneity of government expenditure are usually based on SVAR models rather than on DSGE models and the narrative approach. Our study is also in line with this stream of research.

The earliest analyses of the regional effects of changes in government expenditure focused on the impact of military expenditure on the labor market (Davis, Loungani, and Mahidhara 1997; Hooker and Knetter 1997). Later, Nakamura and Steinsson (2014) showed a considerable heterogeneity of the regional effects of military expenditure in the context of closed and open economy

1. [Paper written by Eggertsson, updated and revised, was eventually published in *NBER Macroeconomics Annual 2010*, vol. 25, as "What Fiscal Policy Is Effective at Zero Interest Rates?", doi: 10.1086/657529—Ed.].

analyses, treating individual US states as open economies and the entire American economy as a closed economy. According to the research conducted by Fishback and Kachanovskaya (2010), there also occurs a substantial regional heterogeneity of the effects of civil government expenditure. In turn, Owyang and Zubairy (2013) examined the impact of both military and civil government expenditure on the shaping of income and employment in individual US states. On the one hand, in the case of military expenditure, they obtained the highest multipliers in states with a large value added in industry. On the other hand, civil government expenditure has a stronger impact on income and employment in states specializing in agriculture and construction. In turn, Suárez Serrato and Wingender (2016), who examined the diversity of fiscal multipliers at the local level, showed that multipliers of government expenditure are higher in those counties where the level of income is lower. Finally, it is worth noting that studies on regional government expenditure multipliers have recently also been conducted for some highly-developed Western European economies, showing that the heterogeneity of fiscal multipliers occurs not only in the US but also in Eurozone countries (Cerqua and Pellegrini 2020; Deleidi, Romaniello, and Tosi 2021; Matarrese and Frangiamore 2023).

2 An empirical SVAR model

Our model consists of three variables—two fiscal variables and one variable representing short-term economic fluctuations. The fiscal variables are defined as government expenditures and taxes. Due to the fact that the study analyzes the regional heterogeneity of the effects of domestic fiscal policy, the fiscal variables relate to aggregate (nationwide) values.

The level of GDP is usually assumed as a variable representing an economic fluctuation. However, for the Polish economy, there is no regional quarterly data on GDP. Moreover, for inhabitants of the voivodship, the level of employment is often more relevant than GDP, and it is less often analyzed in the literature concerning fiscal multipliers. For these reasons, we used employment instead of GDP, which was originally included in Blanchard and Perotti's (2002) model.

Moreover, we take into account that employment results not only from itself and fiscal policy but also from wage levels. We add wages as a control variable, because without it, the effects of fiscal policy on employment could be overestimated.

The SVAR model for each of the Polish voivodships was estimated as follows:

$$\mathbf{A}_0\mathbf{y}_t = \boldsymbol{\alpha}_0 + \sum_{i=1}^{p} \mathbf{A}_i\mathbf{y}_{t-i} + \mathbf{B}\mathbf{v}_t + \mathbf{C}\mathbf{w}_t, \tag{1}$$

where:
$\mathbf{y}_t' = [G_t, T_t, L_t]$ —government expenditures,
T_t —taxes,
L_t —regional employment,
$\mathbf{v}_t$ —a vector of structural shocks,
$\mathbf{w}_t$ —wages,
p —row of delays amounting to a maximum of 4 periods.
It was assumed that structural shocks have a normal distribution, with an average zero and the following variance-covariance matrix $\boldsymbol{\Omega}$:

$$\boldsymbol{\Omega} = \mathbf{B}E(\mathbf{v}_t\mathbf{v}_t')\mathbf{B}'. \tag{2}$$

The parameters of equation (1) are not directly estimable. Thus, we estimated the parameters of the reduced form of the model:

$$\mathbf{y}_t = \boldsymbol{\gamma}_0 + \sum_{i=1}^{4} \mathbf{D}_i\mathbf{y}_{t-i} + \mathbf{E}\mathbf{w}_t + \boldsymbol{\varepsilon}_t, \tag{3}$$

where $\boldsymbol{\varepsilon}_t$ indicates the vector of the random components of the reduced form of the model with the variance-covariance matrix $\boldsymbol{\Psi}$ specified by the formula

$$\mathbf{\Psi} = \mathbf{A}_0^{-1}\mathbf{\Omega}_t\mathbf{A}_0^{\prime -1}. \tag{4}$$

Considering equations (2) and (4), the variance-covariance matrix can be transformed to

$$\mathbf{\Psi} = \mathbf{A}_0^{-1}\mathbf{B}E(\mathbf{v}_t\mathbf{v}_t^{\prime})\mathbf{B}^{\prime}\mathbf{A}_0^{\prime -1}. \tag{5}$$

Thus, the reduced form of the model takes the following form:

$$\mathbf{y}_t = \mathbf{A}_0^{-1}\boldsymbol{\alpha}_0 + \sum_{i=1}^{4}\mathbf{A}_0^{-1}\mathbf{A}_i\mathbf{y}_{t-1} + \mathbf{A}_0^{-1}\mathbf{B}\mathbf{v}_t + \mathbf{A}_0^{-1}\mathbf{C}\mathbf{w}_t. \tag{6}$$

Based on the above transformations, the relationship between structural shocks and random components of the reduced form of the model is as follows:

$$\mathbf{A}_0\boldsymbol{\varepsilon}_t = \mathbf{B}\mathbf{v}_t. \tag{7}$$

In order to identify the shocks, it is necessary to adopt assumptions concerning simultaneous impacts. We used the identification method proposed by Blanchard and Perotti (2002). It means that the identification of structural shocks is possible due to the fact that government expenditure is not dependent on the economic activity in a given quarter, while tax revenues depend on GDP fluctuations.

On the basis of the above assumptions, matrices $\mathbf{A}_0$ and $\mathbf{B}$ take the following form:

$$\mathbf{A}_0 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -a_{23} \\ -a_{31} & -a_{32} & 1 \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} b_{11} & 0 & 0 \\ 0 & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix}. \tag{8}$$

The diagonal elements of matrix $\mathbf{A}_0$ are standardized to one. The non-diagonal and non-zero elements of the matrix are defined as $-a_{23}$, $-a_{31}$, and $-a_{32}$ in order for the parameters a_{23}, a_{31}, and a_{32} to be interpreted as the direct impact of employment on tax revenues, government expenditure on employment, and government expenditure on taxes, respectively. Within matrix $\mathbf{A}_0$, the parameter a_{23} is determined by the combined elasticity of tax revenues with respect to GDP and output elasticity with respect to employment.

As a result, assuming the notations

$$\mathbf{v}_t = \begin{bmatrix} v_G \\ v_T \\ v_L \end{bmatrix}, \quad \boldsymbol{\varepsilon}_t = \begin{bmatrix} \varepsilon_G \\ \varepsilon_T \\ \varepsilon_L \end{bmatrix}, \quad a_{23} = e_{T,L}, \tag{9}$$

where $e_{T,L}$ means the elasticity of tax revenues in relation to the employment, we get

$$\varepsilon_G = b_{11}v_G, \quad \varepsilon_T - e_{T,L}\varepsilon_L = b_{22}v_T, \quad \varepsilon_L = a_{31}\varepsilon_G + a_{32}\varepsilon_T + b_{33}v_L. \tag{10}$$

The above restrictions enable the estimation of parameters a_{31}, a_{32}, b_{11}, b_{22}, b_{33} and, as a result, the identification of the structural parameters.

3 The data and empirical results

The empirical research was carried out on the basis of Polish quarterly data on the regional and national level. The sample covers the period 2000Q1–2022Q4.

The domestic data cover fiscal variables. The data on the domestic level of government expenditure and tax revenues come from Eurostat. Government expenditure was defined as the sum of public consumption, public investment and transfers, whereas taxes were defined as tax revenues of the public sector. The regional data consist of the employment time series for each voivodship. The data on regional employment come from the Labor Force Survey.

All the data are seasonally-adjusted using the TRAMO/SEATS method. Fiscal variables are defined in constant prices while employment is expressed per thousand people. All the variables used in the model are transformed to natural logarithms.

The results of unit root tests indicate that not all the variables used in the study are stationary. However, since the analysis focuses on short-term relationships, the variables are expressed in levels, because, as Sims, Stock, and Watson (1990) point out, the use of non-stationary variables does not cause estimator inconsistency. Moreover, transforming the variables into first differences would result in loss of information. It should be noted that non-stationary variables in the analyses of fiscal multipliers were used, among others, by de Castro and Hernández de Cos (2008) and Heppke-Falk, Tenhofen, and Wolff (2006).

The Akaike information criteria were used for choosing the lag structure of the models.

The empirical research was carried out on the basis of the regional SVAR models for each of the sixteen Polish voivodships. Based on the estimated parameters of the $\mathbf{A}_0$ and $\mathbf{B}$ matrices, static fiscal multipliers showing the impact of a 1% increase in government expenditure on the concurrent percentage increase in employment were estimated.

Static fiscal multipliers (e_{GL}) were calculated on the basis of the following formula:

$$e_{GL} = \frac{a_{31}}{1 - a_{32}e_{TL}}. \tag{11}$$

Table 1 below presents the empirical results concerning regional government expenditure multipliers in Poland.

The empirical results show that government expenditure multipliers are heterogeneous - they range from 0.17 to 0.55. On the one hand, the strongest impact of government expenditure on the current level of employment occurs in the Warmińsko-Mazurskie, Lubelskie, Świętokrzyskie, Podkarpackie, and Podlaskie voivodships. In these voivodships the multiplier exceeds 0.4. On the other hand, the lowest static fiscal multipliers were received in the Zachodniopomorskie, Lubuskie, Śląskie, Wielkopolskie, and Pomorskie voivodships. In these voivodships the multiplier is lower than 0.25.

Thus, our empirical results indicate that in the voivodships located in eastern Poland the short-term impact of fiscal policy on the labor market is generally stronger than in western Poland, as presented in figure 2.

It is worth noting that static fiscal multiples are lower than one in all the voivodships, which is influenced by the fact that they measure the current impact of government expenditure, whereas

Table 1. Regional government expenditure multipliers in Poland

Voivodship	Static multiplier	Cumulative multiplier
Dolnośląskie	0.29	1.18
Kujawsko-pomorskie	0.33	1.41
Lubelskie	0.52	1.86
Lubuskie	0.23	1.09
Łódzkie	0.31	1.24
Małopolskie	0.33	1.91
Mazowieckie	0.35	3.02
Opolskie	0.31	1.29
Podkarpackie	0.42	1.75
Podlaskie	0.41	1.68
Pomorskie	0.24	1.05
Śląskie	0.24	0.96
Świętokrzyskie	0.43	1.92
Warmińsko-mazurskie	0.55	2.12
Wielkopolskie	0.22	0.87
Zachodniopomorskie	0.17	0.64

Source: Own calculation on the basis of Eurostat and Labor Force Surveys.

Figure 2. Static fiscal multipliers in Poland

Source: Own calculation on the basis of Eurostat and Labor Force Surveys.

employment often reacts with a delay to changes in the economic situation and its fluctuations are weaker than fluctuations in GDP. To examine the medium-term impact of fiscal policy, cumulative government expenditure multipliers were also calculated, showing the impact of the cumulative impact of the fiscal stimulus over a four-year period. However, it should be noted that, due to non-stationarity of some variables, cumulative multipliers should be interpreted with more caution than static multipliers. Generally, the cumulative government fiscal multipliers are higher than one. It means that increasing government spending is an effective method of stimulating employment in most regions of Poland. The empirical results indicate that the cumulative fiscal multipliers exceed one in 14 voivodships, and only in the case of Zachodniopomorskie and Śląskie voivodships are they slightly lower than one.

The strongest cumulative impact of government expenditure on employment occurs in the Mazowieckie Voivodship, where the capital of Poland is located. Due to the high durability of the effects of changes in government expenditure, in the case of the Mazowieckie Voivodship, the cumulative fiscal multiplier is much higher than in other voivodships — it exceeds 3 (see table 1).

Thus, the short-run effects of government spending are strongest in the eastern Polish voivodships, while its medium-run impact is the most significant in the Mazowieckie Voivodship. The high fiscal multipliers in the eastern voivodships may result from the relatively large role of transfers in these voivodships. Transfers increase global demand, but their impact on the economy is usually temporary. In contrast, in the Mazowieckie Voivodship the role of transfers is weaker, but there is another important channel of the impact of fiscal policy on the regional market — the majority of central institutions are located in this voivodship (in Warsaw). As a result, changes in government expenditure on employment in central administration have the most permanent impact on employment in the Mazowieckie Voivodship. Changes in employment are generally permanent, which translates into a lasting impact of government spending on the labor market in this voivodship.

Conclusion

The study analyses the impact of government expenditure on regional labor markets in Poland. The empirical results show that the regional effects of changes in government expenditure are characterized by a high level of heterogeneity. The static fiscal multipliers range from 0.17 to 0.55. The strongest impact of government expenditure on the level of employment occurs in the eastern voivodships of Poland, and the potential reason for this phenomenon is the relatively significant role of transfers in these voivodships.

Our results have important policy implications — the regions of eastern Poland are among those with below-average economic development, so an expansive fiscal policy may contribute to reducing differences in economic development and enhance regional convergence in Poland. However,

it should be noted that the positive impact of fiscal policy on regional convergence in the longer term may be limited. This is due to the fact that increasing government expenditure has the most permanent impact on the labor market in the Mazowieckie Voivodship — i.e., the richest Polish voivodship — where the capital is located. Thus, our results show that although, in the short term, expansionary fiscal policy in Poland is an effective tool of reducing inequalities in its regional economic development, in the long term, it may lead to an increase in disproportions between the economic development of the Mazowieckie Voivodship and other voivodships.

The study puts forward the policy recommendation that in order to reduce regional development disparities, it is crucial to implement an expansionary fiscal policy that would produce more permanent effects not only in the Mazowieckie Voivodship but also in other regions of Poland. Thus, identifying the structure of budget expenditure that promotes regional convergence over the long run is an interesting field for further research.

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