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Flowers vs garbage trucks: which type of local government investment has the greatest impact on economic growth?

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Flowers vs garbage trucks: which type of local government investment has the greatest impact on economic growth?[1]

Abstract: Recently, there has been a rise in research focused on determining the magnitude of the fiscal multiplier. One aspect of this research involves estimating the fiscal multiplier of specific components of government revenues and expenditures and different sub-sectors within the general government sector. The article showcases the results of an analysis that calculates the fiscal multipliers of local government total investments and investments broken down into 10 different categories of investment expenditures, for 73 NUTS-3 sub-regions in Poland over the period from 2007 to 2021. The findings suggest that in the 1-2 years following the initial shock, the accumulated fiscal multipliers of investment expenditures are either insignificant or are significant but less than 1. Contrarily, during the 3-5 year period, the accumulated fiscal multipliers of total investment expenditures and expenditures on road construction show a significant increase, surpassing 1.5. Meanwhile, the fiscal multiplier of investments funded by EU structural funds can reach as high as 3.0.

Keywords: fiscal multiplier, local government investment, fiscal multiplier of disaggregated investment expenditure, local projections

JEL codes: E62; H70; R50

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1. Introduction

The COVID-19 pandemic and the measures taken to control it resulted in a severe economic shock, causing the European Union's Gross Domestic Product (GDP) to drop sharply by 5.6% in 2020. This led to a recession in 26 out of the 27 EU Member States. This substantial external shock prompted the implementation of fiscal measures on an unparalleled scale. One of the objectives of these fiscal expansions was to boost the economies in line with Keynesian principles. Additionally, at the European Union level, a Next Generation EU fund worth EUR 750 billion was established to support the recovery of European economies from the COVID-19 pandemic. In Poland, to counteract the crisis in 2020 and 2021, investment grants were provided to local governments through the Government Local Investment Fund and the Government Fund – Polish Deal: Strategic Investment Program.

It is not surprising that the extensive use of fiscal measures to combat the effects of the crisis has generated greater interest in their impact. One way to measure the effectiveness of fiscal policy tools in driving output growth is through the fiscal multiplier estimation, which quantifies the responsiveness of output to changes in government revenues or expenditures. The value of fiscal multiplier received significant attention from economists during the Great Recession of 2008. Similarly, the outbreak of the crisis in 2020 has led to a renewed surge of publications exploring the magnitude of the fiscal multiplier.

One ongoing area of research is to estimate fiscal multipliers not only at the national level but also for individual sub-regions, providing more nuanced and detailed results and allowing for the identification of economic, structural, and institutional factors that impact the magnitude of the multiplier (e.g. Deleidi et al. 2021a, Acconcia et al. 2014, Brückner & Taladhar 2013). Another avenue of research is to assess the magnitude of the fiscal multiplier not only for total government revenue or expenditure, but also for specific components of revenue and expenditure, with a particular focus on government consumption and investment expenditures (see e.g. Saccone et al. 2022, Deleidi 2021, Deleidi et al. 2021b, Petrović et al. 2021, Ganelli & Tervala 2020).

This article aligns with the aforementioned strands of research. It presents the results of estimating the fiscal multipliers of local government investment expenditure in Poland. The study utilises a novel and unparalleled dataset that includes the Gross Domestic Product (GDP) of 73 NUTS-3 national sub-regions and data on the investment made by municipalities and counties within these sub-regions from 2007 to 2021. This study benefits from the Polish institutional background that allows for collecting unique and detailed data on various types of investment. In addition to estimating fiscal multipliers for overall investment expenditures, the study also provides multiplier values for investment expenditures funded by EU structural funds and investment expenditures in specific sectors, such as agriculture, transport, public housing, education, utilities, culture, and sports.

Thus, this article contributes significantly to the literature by highlighting that using the aggregate value of government investment without breaking it down into specific categories can result in ambiguous findings. It is important to note that the aggregate of investments includes a wide range of investments such as military investments, roads, trains, garbage

trucks, drainage ditches, sewers, cemeteries, swimming pools, street lamps, and urban greenery. Spending EUR 10 million on purchasing garbage trucks will impact the economy differently than if the same amount was used for planting flowers. Investment in urban greenery will mainly have a demand-side impact on the economy, while investment in waste management can also improve the supply side of the economy by reducing costs for local inhabitants and businesses over time. No study has estimated the fiscal multipliers of investments made by local governments at a disaggregated level, despite using disaggregated investment data in prior research (Saccone et al. 2022).

The estimation of fiscal multipliers shows that for most categories, the accumulated short-term (1-2 years) fiscal multipliers are in the range of 0-1 and statistically insignificant, likely due to implementation lags. The only categories where investment expenditures show a significant fiscal multiplier greater than 0 are agriculture, transport, public housing, education, and public utilities. In the long term, up to 3-5 years, the fiscal multipliers for total investment, EU-funded investment, and investment in road construction are statistically significant and have values ranging from 1.5 to 3.0. These findings suggest that some investments may have a short-term and demand-side impact on the economy, while others can have both short and long-term effects on both demand and supply.

Additionally, investments financed by EU Structural Funds were analysed, as their impact on economic growth is still debated and controversial today (see, for example, the meta-analysis by Dall'Erba and Fang 2015). The estimation results show that investments co-financed by EU funds have a relatively high fiscal multiplier of 1.3 to 3.0 over a period of 3 to 5 years after the initial cash flow.

The rest of the article is structured as follows: Section 2 provides a review of the existing literature on public capital, investment, and fiscal multipliers. Section 3 details the data used, and Section 4 outlines the identification strategy. Section 5 examines the estimation results and Section 6 offers conclusions.

2. Literature Review

The relationship between the amount of public capital generated by past investments and its impact on output has been a topic of discussion among economists for a long time. However, the issue gained greater attention in the 1970s and 1980s, when Western countries experienced productivity growth slowdowns. Aschauer (1989) made a seminal contribution by demonstrating that the decline in investment in 'core' infrastructure, including streets, highways, airports, mass transit, sewers, water systems, and others, was the cause of the slowdown in productivity growth during this period. Since then, numerous studies have been published exploring the relationship between changes in the size of public capital and changes in output. De Haan and Romp (2007) conducted a literature review and found that the impact of public capital on output is heterogeneous and specific to each country. However, researchers generally estimate the elasticity of public capital with respect to output to be between 0.1 and 0.3. Contrarily, Bom and Ligthart (2013) conducted a more recent meta-analysis based on 68 previous studies and found that the average output elasticity of public capital is estimated to be 0.106. However, when only considering core infrastructure, the elasticity is almost twice as high, estimated at 0.193. These estimates indicate that studying

the impact of investment value (generating public capital) on economic growth (output growth) is a legitimate area of research.

However, the impact of investment on economic growth is not necessarily always positive. Baxter and King (1993) introduced public capital as an additional production factor resulting from government-funded investment in the neoclassical production function. Public investment can also crowd out private investment due to various factors, including a rise in the cost of investment materials. Ultimately, the impact on economic growth depends mainly on the efficiency of public investment and the extent of the crowding-out effect it causes for private investment. Ramey et al. (2021) showed that investment expenditures have short-run Keynesian effects associated with increases in employment and material purchases and long-run neoclassical effects associated with increases in Total Factor Productivity (TFP). Ramey et al. (2021) concluded that the magnitude of changes in output under the influence of changes in the amount of investment (i.e., the magnitude of the fiscal multiplier) is likely influenced by public capital productivity, investment financing (debt-financed, tax-financed or spending cuts financing) and whether the economy starts from a point below the socially optimal amount of public capital. Gupta et al. (2014) took a look at how public investment affects productivity, and discovered that a 1-unit increase in investment does not result in a 1-unit increase in public capital. An efficiency gap can be caused by various factors such as corruption, waste, inflated tenders, and poor project selection. According to the International Monetary Fund (IMF), in 2014, the estimated gap for advanced economies was around 13%. It can significantly reduce the productivity of investments, and consequently reduce their effects on output growth (Ganelli and Tervala 2020).

The estimation of fiscal multipliers is a commonly used method to study the short-term impact of fiscal policy instruments on changes in GDP. The fiscal multiplier describes the elasticity of output to a fiscal shock, which is an increase or decrease in government revenues or expenditures. Numerous studies have estimated the magnitude of the fiscal multiplier for total government revenues and expenditures or specific budget categories.

Despite a large number of studies on the magnitude of fiscal multipliers, there is still a long way to go before a scientific consensus on their value can be reached. Blanchard and Perotti (2002) used SVAR models to estimate the magnitude of the fiscal multiplier in the United States. They found that the multiplier was 0.84 on impact, and 1.29 four years later. Ramey (2011) obtained a value of about 0.8 for military expenditures in the United States; Burriel et al. (2010) obtained a value of 0.75 for total expenditures in the Eurozone; Barro and Redlick (2011) obtained a value of 0.4-0.5 on impact and 0.6-0.7 two years after the shock. Later research has revealed that fiscal multipliers are state-dependent. They tend to be weaker during economic expansions and stronger during recessions (Auerbach and Gorodnicheko 2012). Additionally, and they are larger when the zero lower bound on the nominal interest rate binds (Christiano et al. 2011). Ilzetzki et al. (2013) discovered that in a sample of 44 countries, fiscal multipliers tend to be stronger in advanced economies, large countries, those with lower levels of debt, and countries without flexible exchange rates. Sheremirov and Spirovska (2022) further backed up these results by using the Local Projections method on a sample of 129 countries. However, Ramey and Zubairy (2018) used the Local Projections method and raised doubt on the state-dependence of fiscal multipliers. They found that for US military expenditures, the multipliers are between 0.6 and 1.0, regardless of whether the

economy is in an expansion or recession. Chodorow-Reich (2019) conducted a review of the literature and reported that the median multiplier value for the United States is around 1.8.

Given the differing estimates of the overall expenditure multiplier, numerous researchers have sought to calculate multipliers for particular categories of government revenue and expenditure. The most common categorization used in this research is the division between government consumption and government investment. Typically, it is assumed that government consumption (such as compensation of employees, intermediate consumption, and social transfers in kind) has mostly short-term effects on the economy, following Keynesian economics. Government investment expenditures (such as gross fixed capital formation) may have limited short-term effects (due to implementation lag: the long decision-making process, tenders, construction time, and delays), but they can have significant positive long-term impacts, as it increases the public capital stock, boosting the Total Factor Productivity.

Empirical results vary, but most often, researchers find values higher than 1. Burriel et al. (2010) estimated the fiscal multipliers for the euro area to be 1.56 for government investment and 0.86 for government consumption. Auerbach and Gorodnichenko (2012) calculated values of 2.12 for government investment and 1.21 for government consumption in the United States. Deleidi et al. (2021b) found that government expenditure multipliers in the euro area are greater than 1, with the multiplier for investment being higher than that for consumption. Amendola et al. (2019) estimated the investment multiplier for euro area countries to be around 1.5 on impact and 1.6 after five years in normal times, and 2.1 on impact and 2.9 after five years in conditions where the zero lower bounds are binding. Petrović et al. (2021) estimated that the government investment multiplier in Central and Eastern Europe is between 0.8 and 1.3, which is higher than the consumption multiplier. Masten and Grdović (2019), based on a sample of Balkan countries, estimated that investment and consumption multipliers are greater than 2.0. They argue that the main reason for high multipliers is the crowding-in effect of private investment, which is influenced by public investment. Gechert and Will (2012) concluded, based on a meta-analysis of 89 studies, that government investment has a higher multiplier than government consumption. Alichi et al. (2019) estimated an investment fiscal multiplier of approximately 0.6-1.1, based on a calibration of a DSGE model using data from 23 OECD countries. In contrast, Boehm (2020) found a lower investment multiplier of less than 0.2, and a consumption multiplier in the range of 0.6-1.0 for OECD countries.

Many researchers also suggest that fiscal multipliers may differ between local and central government revenue and expenditure, as the effectiveness of fiscal policy may vary between these two levels due to differences in the tools used and their potential efficiency. Nakamura and Steinsson (2014) estimated the magnitude of the state expenditure multiplier in the United States to be around 1.5. Acconcia et al. (2014) calculated a multiplier of 1.5-1.9 for infrastructure investment in Italy based on a quasi-experiment. Deleidi et al. (2021a) report that in Italy, the average multipliers over a 10-year horizon are 1.6 for government consumption and 2.9 for government investment. Shoag (2016) estimated the state-level fiscal multiplier in the United States to be 2.12. Auerbach et al. (2019) estimated the local fiscal multiplier of US military expenditure to be around 1.0, based on microdata analysis. Hollmayr and Kuckuck (2018) found that the fiscal multipliers for investment at the level of

German lands and local governments are just above zero in the short term (0.3-0.4) and close to zero in the long term. The results of Kameda et al. (2021) suggest that the regional fiscal multiplier for investment in Japan is estimated to be around 2.0.

Many studies have been published to date, estimated to be in the hundreds, that measure the magnitude of the fiscal multiplier. Despite this extensive body of research, there are still gaps in our understanding of the fiscal multiplier and areas where further study is needed. Despite the numerous studies, only a limited number of them utilize more detailed data, beyond just central and local government, by looking at specific components such as government consumption and government investment. The instruments of fiscal policy can be very different (social expenditure, government investment, increases for employees, capital transfers for companies, tax reliefs, etc.) and each of these instruments has a different short-term and long-term impact on the economy and GDP.

Brückner and Taladhar (2013) found that among a few exceptions, transfers to enterprises had the highest multiplier in local government expenditure in Japan. They broke down the expenditures into categories and concluded that the multiplier for local government investment was 0.7-1.0, which was higher than the central investment multiplier. Additionally, the work by Perez-Montiel and Manera (2021) found that in Spain, local investment multipliers were estimated to be 1.2 or higher. This is in addition to the exceptional studies by Hollmayr and Kuckuck (2018) and Deleidi et al. (2021a). To the best of the author's knowledge, the only instance of using the disaggregated investment to estimate the fiscal multiplier was in the work of Saccone et al. (2022). In their paper, Saccone et al. (2022) estimate investment expenditure multipliers by COFOG category for 31 European countries over the period of 1995 to 2019. They conclude that public investment seems to be particularly effective in fostering economic growth when it supports the creation of human capital and the functioning of economic affairs, public services, and promotion of health, public order and safety.

The use of disaggregated investment expenditure to estimate fiscal multipliers, with only one paper and only at the general government level, highlights a research gap that needs to be addressed. Indeed, investments can vary, and so can their impact on the economy.

3. Data

The fiscal multipliers of various local government investment expenditures in Poland were estimated using data published by the Polish Ministry of Finance and Statistics Poland. The study analysed annual data on local government investment in all 73 NUTS-3 sub-regions in Poland from 2007 to 2021.

Since 2007, the Polish Ministry of Finance has made detailed databases on local government revenues and expenditures in Poland (Rb-27s and Rb-28s databases) available to the public. All revenues and expenditure are categorized into specific budget divisions, sub-divisions, and paragraphs. Although the total number of budget divisions is nearly 40, investment expenditure of local governments is focused on 12-15 divisions because of the extent of fiscal federalism in Poland. In Poland, investment activities are carried out by local governments at three levels: municipalities (74.1% of investments), counties (11.1%), and provinces (14.8%). NUTS-3 sub-regions are comprised of one or more counties, and it is not feasible to allocate the investments of provinces into specific sub-regions. Therefore, this

study included investments in municipalities and counties (85.2% of all local government sub-sector investments in Poland) but excluded investments in provinces.

The study separated total investment expenditure and investment expenditure in budget divisions where average expenditures between 2007 and 2021 were more than PLN 1 billion. There are seven such divisions in total: Agriculture and hunting (hereafter: agriculture), Transport and communications (hereafter: transport), Housing (hereafter: public housing), Education and upbringing (hereafter: education), Public utilities and environmental protection (hereafter: public utilities), Culture and protection of national heritage (hereafter: culture) and Physical culture (hereafter: sport). The largest category of local government investment expenditure is in transport investment (25.4% of total investment value), which encompasses expenditures with varying potential impacts on the economy. For research purposes, it was divided into two categories: roads and other (including the purchase of rolling stock, trams, tube trains, and other public transport investments). The study also isolated investment expenditure funded by EU structural funds. These expenditures were not divided into budget divisions as it is negligible in many divisions. Other expenditures (i.e. total local government expenditures minus investment expenditures) were also used as a control variable in the study, as controlling for the impact of investment on output by the impact of other expenditures on output is necessary to obtain unbiased results.

Data on GDP for each of the 73 NUTS-3 sub-regions in Poland is published by Statistics Poland on an annual basis on regional accounts for the years 1999-2021. The data is published annually, not quarterly, so annual data was used to estimate the multipliers. To not account for inflation, investment and GDP values were deflated using the GDP deflator provided by Statistics Poland at the end of 2022 (for constant 2015 prices). All data were normalized to per capita values.

4. Identification Strategy

The researchers used two main methods for estimating fiscal multipliers: structural vector autoregression (SVAR) models and the Local Projections method (Jordà 2005). According to Caldara and Kamps (2017), the research on fiscal multipliers using SVAR modelling breaks down into three different model identification strategies: Ramey-Shapiro narrative approach with non-fiscal instrumental variables (e.g. Ramey 2011); penalty function approach with recursive ordering and restrictions on the sign of the response functions (e.g. Uhlig 2005); and Blanchard-Perotti approach, which adds to the recursive ordering and Cholesky decomposition an external coefficient representing the elasticity of taxes to other variables (e.g. Blanchard and Perotti 2002).

Another popular approach is the Local Projection method by Jordà (2005), which is used to determine the impact of fiscal shocks on economic outcomes. Several recent studies emphasize the advantages of the Local Projection method and the benefits it offers compared to SVAR models. According to Jordà (2005), the local projections can be estimated using simple regression techniques and are known for their robustness to misspecification and ability to handle non-linear and flexible specifications with ease. Auerbach and Gorodnichenko (2013, 2017) highlight that utilizing this method for estimating fiscal multipliers leads to quick estimation of models with numerous parameters and does not limit the estimated responses

to a specific shape. Furthermore, this method can easily be expanded to estimate the potentially non-linear effects of shocks and is ideal for dealing with error terms that are correlated across countries and over time.

The Local Projection method calculates Impulse Response Functions by estimating a series of regressions for each horizon, *h*. The linear model for each horizon $h = 0,1,2, \dots, H$ looks as follows:

$$y_{i,t+h} = \alpha_h + \psi_h(L) z_{i,t-1} + \beta_h x_{i,t} + \varepsilon_{i,t+h} \qquad (1)$$

where *y* is a variable of interest (sub-regional GDP in this article), *z* is a vector of control variables, *x* is a measure of a fiscal shock (selected fiscal variable), α_i are country fixed effects, γ_t are time effects, $\psi_h(L)$ is a polynomial in the lag operator and β_h is the response of *y* at horizon h. In the Local Projections method, the coefficients in the polynomial lag are not solely relied upon for determining the Impulse Response Functions. Instead, they serve as a means of controlling and minimizing the impact of control variables on the dynamics. Therefore, IRFs are directly built from the β_h coefficients. The Local Projection approach is based on regressing the variable of interest (output in this case) for each $t + h$ on a change of fiscal variable at time t and constructing in the next step the average response of the dependent variable periods after the shock (Deleidi et al. 2021b).

For this study, which uses panel data, a dynamic two-way fixed effects model was employed for estimation. By including sub-region-specific and time-specific effects, the substantial heterogeneity from the sample can be captured. A random effects model was not chosen due to the risk of higher bias that may arise from the presence of omitted variables. According to the studies conducted by Auerbach and Gorodnichenko (2017) and Deleidi et al. (2021b), the estimated model can be presented in the following form:

$$\Delta y_{i,t+h} = \alpha_i^h + \delta_t^h + \sum_{p=0}^{P} \beta_p^h \Delta x_{i,t-p} + \sum_{p=1}^{P} \psi_p^h \Delta y_{i,t-p} + \sum_{p=1}^{P} \phi_p^h z_{i,t-p} + \varepsilon_{ith} \qquad (2)$$

The estimation of parameters in this equation produces specific fiscal elasticities. After multiplying the estimated elasticities by the conversion factor ($\beta^h * {}^{Y_i}/_{X_i}$), where Y_i denotes GDP and X_i denotes analysed fiscal variable, the dynamic fiscal multiplier can be derived from the estimated elasticities. Number of lags *P* for each fiscal variable is chosen using Akaike Information Criterion. In order to determine the full impact of the fiscal variable on sub-regional GDP, the accumulated fiscal multipliers are calculated.

The fiscal multipliers were estimated for each type of local government investment. In each equation, the only control variable is other expenditure (i.e., total local government expenditures minus investment expenditures). The use of this fiscal variable helps to isolate the effect of changes in GDP due to other fiscal actions taken by local governments to some extent. Other control variables were not included due to the potential problems associated with them. The effects of central monetary and fiscal policies are captured by the time effects, so there is no need to include additional variables. The investment by the local sub-sector is the aggregate of investments made by multiple local governments, therefore, the introduction of other fiscal variables (such as deficit, debt, and interest costs) may lead to misleading

results. Many local governments in Poland have had zero debt for years, while others are heavily indebted, therefore calculating a single variable to describe the debt or the cost of servicing it would not accurately reflect the impact of large or small fiscal capacities. The use of sub-regional output gaps can also pose problems, as there is no universally accepted method for their estimation. For instance, the use of the Hodrick-Prescott filter may result in inaccurate findings, as filtered values at the end of the sample are characterised by spurious dynamics (Hamilton 2018). It is not feasible to include a variable that represents the fiscal forecasts of local governments or private investment, as the necessary data is not available.

The estimated values of accumulated multipliers are presented in Tables 1-2, and the Impulse Response Functions are depicted in Graphs 1-11. Typically, fiscal multipliers are presented within a 6-period horizon, but in this article, longer periods are also analysed, even though the values of multipliers beyond a 6-year horizon are usually insignificant. In the literature on fiscal policy, Impulse Response Functions are typically presented with 68% confidence bands, as is the case in this article.

<Tables 1-2 here>

<Graphs 1-11 here>

5. Results

From the results shown in Tables 1-2 and Graphs 1-11, it is evident that the fiscal multiplier of total investment is substantial. The fiscal multiplier of total investment is barely significant in the first and second years after the shock, which is likely due to the implementation lag frequently mentioned in literature. Investment expenditure on a cash basis is booked when investment payments are made, and these for multi-year constructions are made when they are completed or when a construction milestone is reached. This means that investments are often completed a year or two or more after payment has been made. During this period, the local economy may experience a short-term boost from the purchase of building materials and increased employment of workers at the construction site, as per Keynesian principles.

Only after the construction is finished does the investment start showing its long-term effects on the supply side. The total investment multipliers are statistically significant and are estimated to be 1.88 in the third year, 1.73 in the fourth year, and 0.92 in the fifth year after the investment payments are made. This indicates that public investment in Poland between 2007 and 2021 played a role in driving development and resulted in growth in GDP over a span of 3-5 years. Besides the improvement in business productivity from supply-side effects, the expansion of infrastructure may have also led to increased private investment through crowding-in effects. The estimated values of the investment expenditure multipliers are comparable to those found in previous research, such as the works of Masten and Grdović (2019) and Petrović et al. (2021) mentioned in Section 2.

Fiscal multipliers are even higher for EU-funded investments. During the 1-2 years of construction and implementation, the fiscal multipliers are insignificant, but over a 3-5 year

period they reach values of 1.24 to 3.00. This demonstrates that EU funds, usually disbursed through Regional Operational Programs, play a significant role in the development of Polish regions. EU investments are made primarily in the areas of agriculture, transport, education and public utilities. The construction and repair of roads, the construction of drainage ditches and irrigation systems, the construction of sewage treatment plants and the purchase of computers for schools, as well as many other similar EU-funded investments, therefore have a significantly positive impact on GDP growth. These results make an important contribution to the literature on EU expenditure efficiency (see e.g. Pellegrini et al. 2012 or Dall'Erba and Fang 2015).

After disaggregating total investment expenditure by budget division, the largest and most significant fiscal multipliers can be observed for investment in transport. This is in line with the work presented in Section 2, as it is precisely expenditure on 'core' infrastructure that is considered to have the greatest impact on public capital growth and thus on economic growth. The results also show that investments in road construction (frontage, local roads and those that are part of national routes) have the largest impact on growth, while investments in railways, trams, tube trains, rolling stock purchase and road safety have an insignificant or relatively small impact on long-term GDP growth.

In the rest of the budget categories, the fiscal multipliers are negligible. Investing in public housing has a fiscal multiplier that is close to being significant, but it's still less than 1. Investing in education shows a notable fiscal multiplier over a two-year period, but it is uncertain if this result will sustain over the long term with just a two-year observation. The reason for the lack of significance in other categories is partly because transport investments are the largest and the ratio of investment in these areas to sub-regional GDP is much lower compared to other categories. It is somewhat surprising that investment in public utilities shows no statistical significance, considering that investments in areas such as waste management, sewerage, building insulation, street lighting, and energy should have a considerable impact on economic growth. As shown in Gordon's book (2017), public provision of essential services such as sanitation, clean water, and electrical infrastructure played a significant role in driving economic growth in the United States during the first half of the 20th century. However, investments in areas such as decoration, urban greening, and city cleaning are also categorized under the 'Public utilities' section. Therefore, the positive impact of infrastructure investments can be offset by investments in aesthetics that have a lower or no economic impact.

6. Conclusions

Despite numerous studies being conducted on the magnitude of the fiscal multiplier, the findings remain inconclusive, and there is no clear consensus. Currently, there is a trend in research to estimate the fiscal multiplier for specific types of revenue or expenditure, including local government expenditure, to get a more accurate picture of their impact. The article under discussion is part of this ongoing research effort, presenting the results of estimating the fiscal multipliers of consolidated and disaggregated investment expenditures and investment expenditures funded by the European Union, using data from 73 Polish NUTS-3 sub-regions on investment expenditures by municipalities and counties from 2007 to 2021.

The results suggest that capital expenditures over a 1-2 year period have small and insignificant fiscal multipliers, which is a result of the implementation lag. This is because these expenditures are recorded when payments are made (e.g. when an investment milestone is reached) rather than at the time of completion. However, over a 3-5 year period, the fiscal multipliers become significantly higher (around 0.9-1.9) as the long-term supply effects are more likely to emerge at that point. Investment expenditures funded by EU structural funds have the highest fiscal multiplier by far, ranging from 1.2 to 3.0. Investment expenditures in the transport sector, specifically in road construction, are also notable and have a multiplier higher than 1. For other budgetary divisions, the results are inconclusive and remain challenging to assess.

This suggests that in Poland, which is a central and eastern European country that still has an infrastructure deficit compared to western countries, investment in road construction significantly increases the public capital stock and makes a significant contribution to economic growth. Sustained investment in public transportation, especially after the COVID-19 pandemic and the crisis related to Russian aggression against Ukraine, can be an effective way to stimulate the economy, as it has a lasting impact on economic growth. This also applies to expenditures funded by the European Union. European countries, including Poland, will be receiving grant funding worth EUR 338.0 billion through the Recovery and Resilience Facility which is the key instrument at the heart of NextGenerationEU. The results for Polish local governments indicate that this funding can play a crucial role in revitalizing the economies of other neighbouring countries as well.

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Table 1. Responses of GDP to selected investment expenditure shock, annual frequency

Fiscal variable	Local projection horizon									
	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years
Total investment expenditures	0,3908	0,4391**	1,8811***	1,7337***	0,9222***	0,0887	-0,4993	0,5153	-1,7269	-0,7001
EU-financed investment	0,6299	0,6150	2,9973***	2,0978***	1,2382**	-0,8567	-0,7075	1,2629	2,3977	-0,5816
Investment in agriculture	2,9614	2,4608	-0,1374	1,5660	-1,8238	-1,8892	0,9909	1,2662	-0,6735	-1,2370
Investment in transport (total)	0,2594	0,8161**	1,9706***	1,5721***	1,1421**	0,3410	-0,4780	0,0222	-0,2753	-0,3375
Investment in transport (roads)	-0,4099	1,039**	2,2335***	1,6244**	1,2782*	0,2956	-0,2575	-0,2927	-0,4487	-0,3052
Investment in transport (other)	0,4216***	0,1387	0,0194	0,0009	0,3643*	0,1577	-0,4196	0,7162*	-0,1709	-0,1693
Investment in public housing	0,8654	0,5964	0,5239	0,8643	0,5639	0,0465	-0,2829	1,1449	-0,2262	0,1925
Investment in education	0,4306	0,6289**	0,1786	-0,334	0,686	0,0458	0,3687	0,1824	-0,0789	0,4326***
Investment in public utilities	1,6644	1,0743	-1,4199	-0,6961	0,9452	-1,9823	0,2170	0,1479	-0,1176	1,1362
Investment in culture	0,4864	-0,7641	-0,3445	-0,6894	-0,4965	0,7985	-0,4108	-1,5977	0,0320	1,6749
Investment in sport	1,5111	1,6310	0,669	3,0373	3,0834	3,7094	-2,5240	0,2017	-0,2285	1,9263

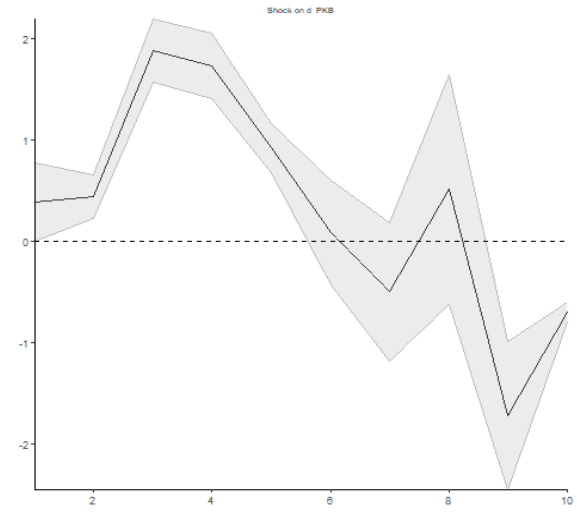
Note: Asterisks denotes the significance of a variable: * means p < 0.1, ** means p < 0.05, *** means p < 0.01.

Table 2. Accumulated fiscal multipliers (averages)

Fiscal variable	Average		
	3 years	5 years	10 years
Total investment expenditures	0.9037	1.0734	0.3045
EU-financed investment	1.4140	1.5156	0.9093
Investment in agriculture	1.7616	1.0054	0.3484
Investment in transport (total)	1.0154	1.1521	0.5033
Investment in transport (roads)	0.9542	1.1530	0.4757
Investment in transport (other)	0.1932	0.1890	0.1059
Investment in public housing	0.6619	0.6828	0.4289
Investment in education	0.4127	0.3180	0.2541
Investment in public utilities	0.4396	0.3136	0.0969
Investment in culture	-0.2074	-0.3616	-0.1311
Investment in sport	1.2704	1.9864	1.3017

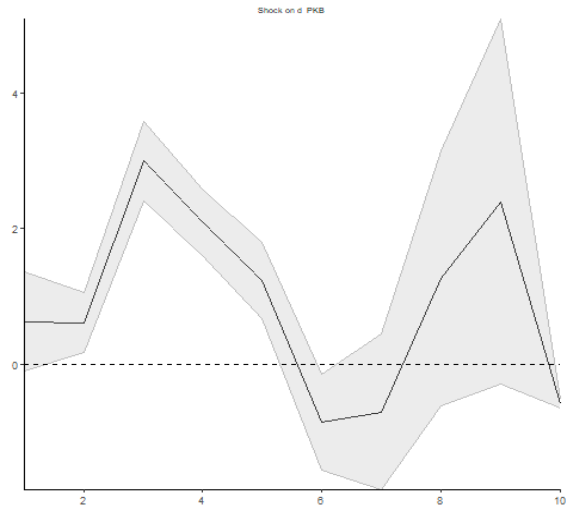
Graphs 1-11. Response of sub-regional GDP to shock in selected fiscal variables

GDP to Total investment expenditures



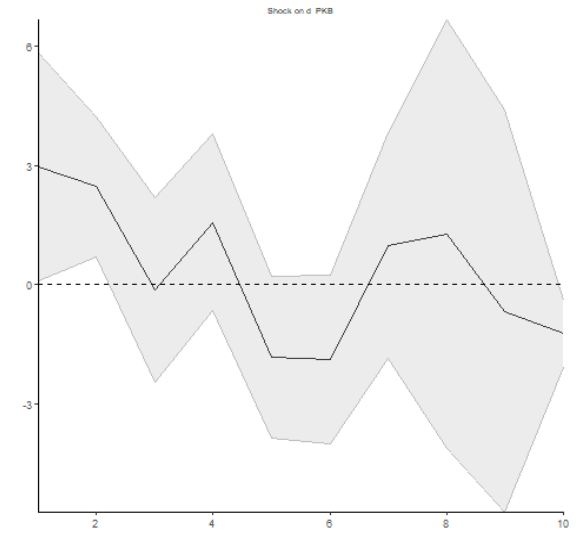
years after the shock

GDP to EU-financed investment



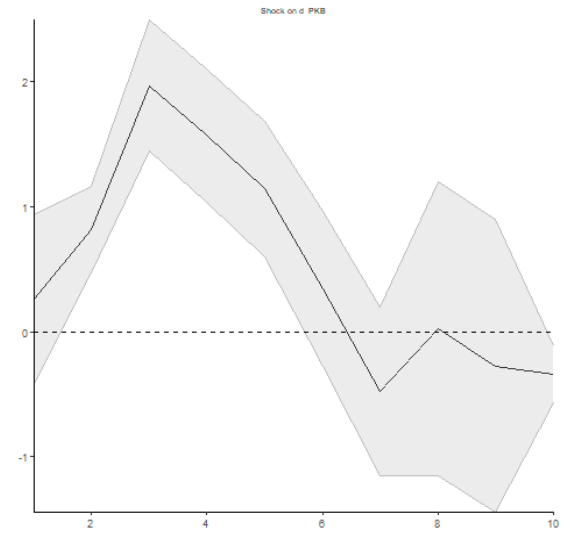
years after the shock

GDP to Investment in agriculture



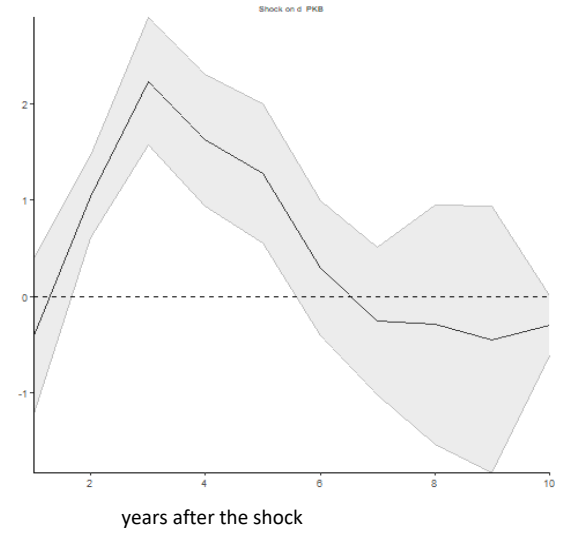
years after the shock

GDP to Investment in transport (total)



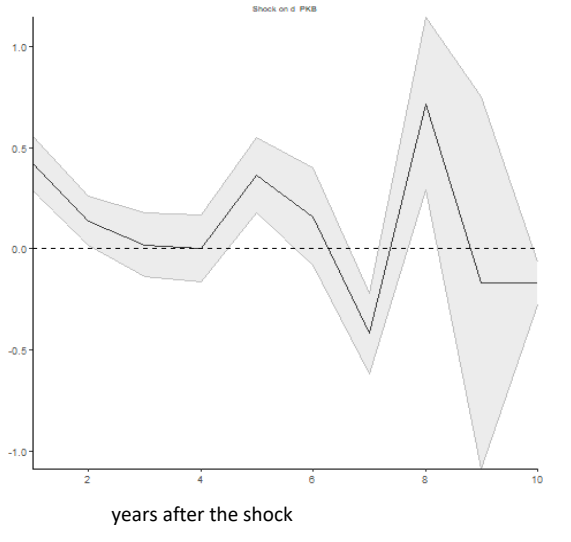
years after the shock

GDP to Investment in transport (roads)



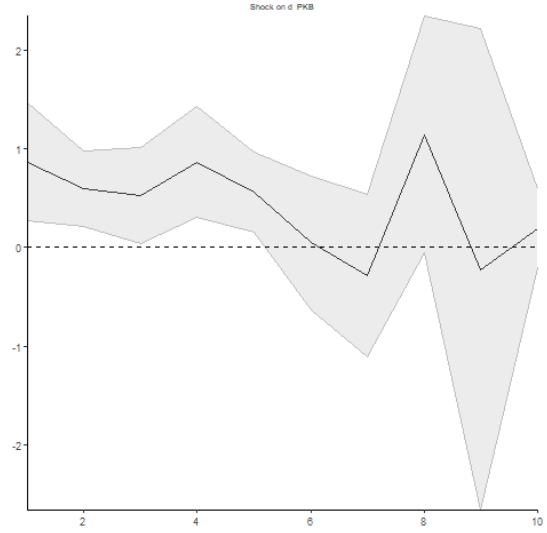
years after the shock

GDP to Investment in transport (other)



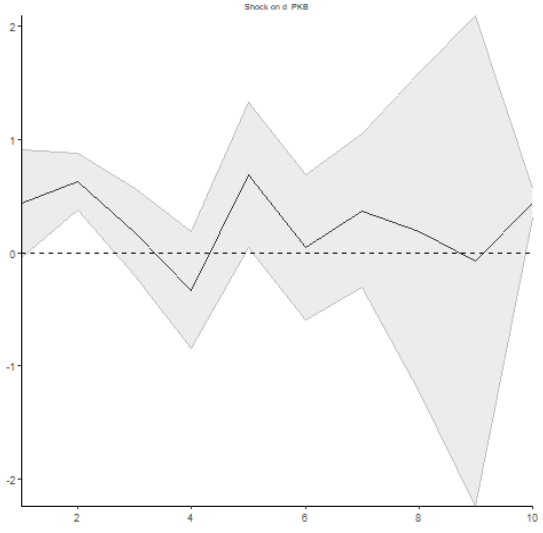
years after the shock

GDP to Investment in public housing



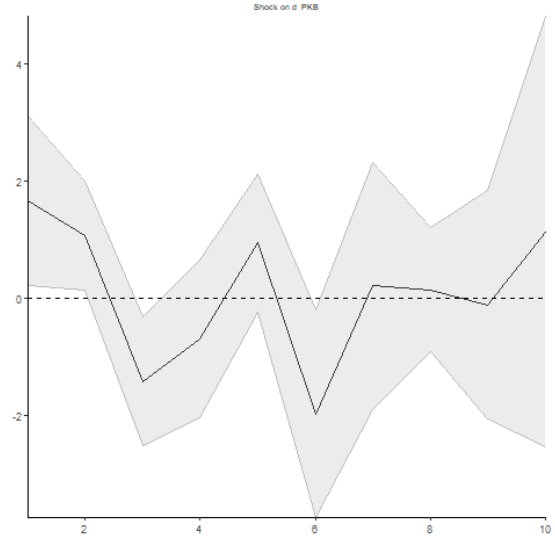
years after the shock

GDP to Investment in education



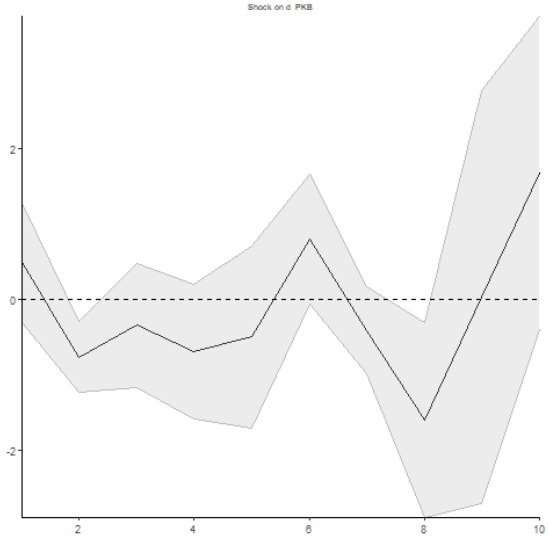
years after the shock

GDP to Investment in public utilities



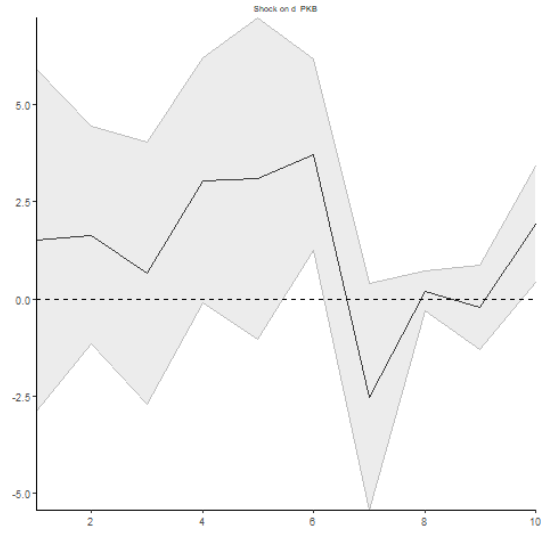
years after the shock

GDP to Investment in culture



years after the shock

GDP to Investment in sport



years after the shock