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Contact: monika.banaszewska@ue.poznan.pl, Poznań University of Economics and Business, al. Niepodległości 10 61-875 Poznań, Poland

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Monika Banaszewska

Poznań University of Economics and Business, Poland

The determinants of local public investments in Poland

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Abstract

Research background: Local public investments satisfy basic local communities' needs and are crucial from the perspective of regional convergence. Against this background, investments by the Polish local government pose as an interesting research subject. It is because, due to its size and dynamics, local public investments exert a considerably significant influence on the Polish economy. Self-government entities with primary responsibility for conducting local public investments in Poland are municipalities.

Purpose of the article: The paper aims to identify fiscal, demographic and infra-structural determinants of municipal investment spending in Poland.

Methods: We use panel data for 2,412 Polish municipalities over the period 2007–2014. For institutional reasons, the sample excludes cities with county rights. The baseline specification employs two-way fixed-effects (FE) estimation that controls both for municipality and year fixed effects. To test for robustness, the sample is restricted to municipalities with up to 20,000; 10,000 and 5,000 inhabitants. For each considered sample, there are four regression specifications.

Findings & Value added: Investment spending increases both in own revenues and grants. On the contrary, we document the negative impact of indebtedness level and the coverage of water supply and sewage systems. The coefficients on population size and the share of old inhabitants cease to be negative and statistically significant for municipalities with fewer than 10,000 inhabitants. The results indicate that, apart from fiscal capacity, the investment policies of Polish municipalities are affected by economies of scale, local communities' preferences and infrastructural endowment. The study also shows that incurring debt should be of particular concern for supervisory and control bodies.

Introduction

In decentralized countries subnational government units are responsible for constructing and maintaining technical and social infrastructure that satisfies local community's needs. There is some evidence that decentralization contributes to better tailoring of investment projects to local circumstances (Esteller & Solé, 2005).

Investment by the Polish local government is an interesting research subject for at least two reasons. Firstly, since 2005 Poland has experienced a marked increase in public investment spending (see Figure 1). Secondly, whereas the share of local public investment in total public investment in Poland is slightly below an average for subnational governments in OECD countries (see Figure 2), a ratio of subnational investment spending to GDP in Poland is among the highest ones¹. It follows that local investment in Poland exerts a considerably significant influence on the national economy.

The paper aims to identify fiscal, demographic and infrastructural determinants of municipal investment spending in Poland. Previous studies on the determinants of local investment spending in Poland focused on fiscal capacity and made use of aggregate time-series data (Sekuła, 2013; Sekuła & Basińska, 2014; Sekuła & Basińska, 2016) or panel data on urban municipalities (Bukowska & Siwińska 2016). In contrast, this paper employs panel regression estimation for the sample including urban, urban-rural and rural municipalities. The paper extends the empirical literature on determinants of local government spending in young democracies.

The paper is structured as follows. The next section discusses related literature. Then research methodology is presented. It is followed by the formulation of research hypotheses and the operationalization of independent variables. Next, empirical analyses' results and some robustness checks are reported. Finally, some concluding remarks are offered.

Related literature

The decline in public investments in developed countries since 1970s raised interest in the determinants of these expenditures. The downward trend in government investment activity was attributed inter alia to fiscal stringency and public investment — private investment complementarity (Sturm, 1998).

¹ As for 2014, Poland obtained 9th place out of 34 OECD countries.

Investment expenditures are considered as a relatively flexible component of public spending (Roubini & Sachs, 1989, p. 108, 109). Breunig and Busemeyer (2011) show that fiscal contractions rely more on cutting public investment than reducing entitlement spending. This effect is amplified by proportional political representation. Van Dalen and Swank (1996) provide evidence of the impact of political ideology, i.e. investment spending is more preferred by right-wing governments. Vuchelen and Caekelbergh (2010) point out that there is no offsetting increase in public investments at the time of fiscal expansion. As they indicate, voters assess incumbents on the basis of the relation between a current and the highest historical value of current expenditures. It follows that increasing current expenditures is more rewarded at the ballot box than fostering public investment projects.

Fiscal rules may induce policy makers to curb investment spending in order to retain spending in politically-sensitive areas (such as social assistance). Turrini (2004) verifies the conjecture that EU fiscal framework contributed to a decrease in public investment. The results are ambiguous. For 14 EU countries in the years 1970–2002, he finds that the negative impact of public debt on government investment activity strengthened after the year 1998. Nevertheless, only for this sub-period is there evidence of the positive association between lagged budget balances and investment spending. In a similar vein, Gali and Perotti (2003) show that investment spending decreased to a greater extent in countries not bound by EU fiscal rules and the reduction in investment spending among EU countries diminished after the introduction of Maastricht criteria.

Returns on investment projects and the sources of their financing are spread over time. This warrants an analysis from an intertemporal point of view. In essence, the burden on current generations increases in present investment spending, a past debt (interest payments paid on accumulated debt) and is reduced by past investments' proceeds and a present deficit (Balassone & Franco, 2000). Sturm (2001) reports that public capital spending increases in current deficits but decreases in past deficits.

Heinemann (2006) points out that accumulation of public capital and debt stock as well as rising capital mobility are key factors explaining the decline in OECD countries investment spending in the last two decades of 20th century. Vålilä and Mehrotra (2006) investigate both short-term and long term determinants of general government gross fixed capital formation in the 'old' EU countries in the years 1970–2003. They obtain significant coefficients for: GDP, output gap and various fiscal variables (budget deficit, public debt, current revenues, current expenditures, previous-year investment expenditures). According to their analyses, public capital should be considered as a luxury good. The study by Jäger and Schmidt (2015) on

panel of selected OECD countries indicates that population aging negatively affects public investments.

Besides cross-country studies on the drivers of public investments, there is also an increasing strand of literature consisting of intra-country local government analyses.

Since local investment projects often generate interjurisdictional positive externalities, the theory of fiscal federalism suggests subsidizing them by central government (e.g. Bailey, 1999, pp. 7–8; Oates, 1999, pp. 1126–1127). Other factors that justify upper-government support for local investments include high sunk costs and economies of scale (de Mello, 2012, pp. 117–118). Using the sample of Canadian provinces, Bojorquez *et al.* (2009) show that intergovernmental grants foster municipal investments.

Building on Grossman and Helpman (1996), Kondoh (2008) models the impact of a special interest group and median voter's preferences on local government investment policy. He provides empirical evidence that the construction industry influenced Japanese local public investments. At the same time, the predictions from median voter theorem occur not to be relevant.

Yu *et al.* (2011) employ spatial estimation to identify the determinants of local public infrastructure spending using the cross-section of Chinese cities in 2005. Their empirical model accounts for both horizontal (city — city) and vertical fiscal interactions (province — city and city — county). They find that investment spending in a city responds negatively to investment spending in neighbouring cities and responds positively to investment spending by lower-tier governments.

For regions in Russia over the period 1994–1997, Matheson (2005) points out that horizontal redistribution leads to a decrease in local public investment. Moreover, the strength of this relationship is found to be dependent on administrative status (republics vs. non-republics) and regional wealth.

The closest to this paper are empirical analyses of the relationship between revenue sources and investment expenditures in Polish municipalities. Previous studies explored time-series aggregated data for all municipalities (Sekuła, 2013; Sekuła & Basińska, 2016) and data broken down into broad subgroups of municipalities (such as rural municipalities) (Sekuła & Basińska, 2014). Thus, they did not account for inter-municipal variation. The exception is the paper by Bukowska and Siwińska (2016) that exploits the panel of urban municipalities (304 out of 2,479 municipalities) to investigate the impact of revenue decentralization and political competition. The bottom result of these studies is that higher own revenues translate into higher investment expenditures.

The empirical literature suggests that plenty of both fiscal and non-fiscal factors shape public sector investment policy. This paper considers the set of fiscal, demographic and infrastructural determinants of local government investment activity.

Research methodology

The paper investigates the determinants of local investment spending in Poland. The vast majority of local public investment projects in Poland are carried out by the lowest tier, i.e. municipalities. Over the period 2007–2014 municipal investment spending accounted for, on average, $\frac{3}{4}$ of total local government units' investment spending (Statistics Poland Local Data Bank). Therefore, the analysis in our paper is limited to this local government level.

The empirical analysis employs fixed effects panel regression estimator, controlling both for municipality and year fixed effect. As a result, we account for municipality-specific time-invariant and common time-varying heterogeneity. The standard errors are robust to autocorrelation and heteroskedasticity and clustered at municipal level.

The data on municipal investment spending encompass only money that flow via municipal budgets. Hence, the main possible bias in our regression results may stem from the fact that we underestimate investment spending for municipalities that finance investment projects beyond municipal budget. The extra-budgetary form of financing investment expenditures is more popular among more populated municipalities, especially in cities with county rights (Swianiewicz & Łukomska, 2015). Consequently, we exclude these municipalities in our baseline specifications. Our sample consists of 2,412 municipalities (out of 2,479 in total)². We verify the robustness of our baseline specifications by restricting the sample to municipalities with up to 20,000; 10,000 and 5,000 inhabitants (see Tables 4, 5 and 6). The numbers of municipalities remaining in the sample are respectively: 2,160; 1,646 and 648.

Investment expenditures consist of spending on both physical and financial fixed assets. In the sample period approximately 97 percent of these expenditures in municipalities other than cities with county rights referred to physical assets. In most cases investment expenditures accounted for between 10 and 20 percent of total expenditures. Since the distribution of

² The sample excludes Wałbrzych municipality that regained the city with county rights status in 2013 and Jasłiska municipality that was established only in 2010.

investment spending per capita is significantly right skewed and contains only one observation of value zero, we implement logarithmic transformation. Thanks to it, regression results are less sensitive to outlying observations (Wooldridge, 2013, p. 216). In addition, this transformation allows for interpretation of coefficients in terms of elasticities.

The data on dependent and independent variables were retrieved from Statistics Poland and the Ministry of Finance databases.

Research hypotheses and empirical model

Fiscal characteristics

Municipalities finance investment projects from internal as well as external sources. Typically, these expenditures are planned only after securing funds for the execution of mandatory own tasks. Therefore, we expect that investment expenditures are elastic to revenues. Even wealthy municipalities are expected to spend a lot on investments as they can afford higher quality materials etc. and because Poland still suffers from the infrastructure gap.

Municipalities in Poland are beneficiaries of both unconditional grants (on average 30 percent of total revenues) and conditional grants (on average 20 percent of total revenues). Unconditional grants are formula-based. They provide funds to execute a basic municipal task — the provision of public education, and reduce vertical and horizontal income disparities (for further discussion see e.g. (Sekuła, 2017)). Approximately $\frac{1}{4}$ of conditional grants constitute investment grants from the European Union, state budget, regional budget and extra-budgetary funds (e.g. the National Fund for Environmental Protection and Water Management). On the one hand, grants may increase investment spending directly by providing earmarked funds and imposing co-financing requirements or indirectly by providing funds that cover current operating costs. On the other hand, grants may substitute own revenues as a source of financing investment expenditures.

Investments are usually co-financed with returnable financial means. In Poland, municipalities are subject to rules limiting their indebtedness. According to rules that were binding until the year 2013, municipality's debt and debt repayments shall not exceed, respectively, 60 percent and 15 percent of its revenues (Public Finance Act 2005).

The hypotheses regarding municipal fiscal characteristics read:

Hypothesis 1a: *Own revenues per capita have a positive impact on municipal investment spending per capita.*

Hypothesis 1b: *Grants per capita have a positive impact on municipal investment spending per capita.*

Hypothesis 1c: *An indebtedness level has a negative impact on municipal investment spending per capita.*

Demographic characteristics

In general, municipal mandatory tasks in Poland are not differentiated according to population size. Therefore, more populated municipalities take advantage of economies of scale in the provision of public and social goods. Another demographic characteristics that may affect the size and structure of municipal spending is population density. A more densely populated municipality spends less funds per capita on linear infrastructure facilities. This relationship may reverse at a certain point. Summing up, population variables serve as proxies for economies of scale and congestion (Estache & Sinha, 1995, p. 11; Viñuela, 2016, p. 71).

Similarly to standard local government policies' analyses, we also take into account the age structure of local community. The higher share of the young may lead to higher investment spending because of the construction of social infrastructure (kindergartens, schools, sports facilities) and technical infrastructure (roads, water supply systems for new housing developments). In contrast, the old generation may expect higher current expenditures on social care and health protection.

The hypotheses referring to demographic characteristics are as follows:

Hypothesis 2a: *A population size has a negative impact on municipal investment spending per capita.*

Hypothesis 2b: *A population density has a negative impact on municipal investment spending per capita.*

Hypothesis 2c: *The share of young population has a positive impact on municipal investment spending per capita.*

Hypothesis 2d: *The share of old population has a negative impact on municipal investment spending per capita.*

Infrastructural characteristics

The majority of municipal investment spending in Poland supports the construction of infrastructure facilities³. One can expect that municipalities with better infrastructure endowment spend less on investments due to diminishing returns to scale. In addition, EU structural and cohesion funds that co-finance numerous local public investment projects are meant to reduce interregional disparities.

As for infrastructure endowment, we predict that:

Hypothesis 3: *Infrastructure endowment has a negative impact on municipal investment per capita.*

Summing up, the regression including all types of explanatory variables has the following formula:

$$\ln_{inv_{pc}}_{it} = \beta \sum fiscal_{variables}_{it} + \gamma \sum demographic_{variables}_{it} + \delta \sum infrastructural_{variables}_{it} + \alpha_i + l_t + \varepsilon_{it}, \quad (1)$$

where:

i – municipality,

t – year,

α_i – municipality fixed effect,

l_t – year fixed effect,

ε_{it} – error term.

Operationalization of explanatory variables

Table 1 reports the set of independent variables divided into three groups: fiscal, demographic and infrastructural characteristics. To diminish endogeneity concerns, fiscal, demographic and infrastructural variables are lagged by one period. It also reflects the fact that decisions on investment

³ Technical infrastructure includes: transport and communication, rural infrastructure, housing economy, electricity, gas and water supply, communal economy and environmental protection. Social infrastructure includes: education, healthcare, social protection, culture and national heritage protection, physical culture.

spending in a year t depend on explanatory variables from year $t - 1$. Moreover, public budgets are prepared before a given fiscal year (Välilä & Mehrotra, 2006, pp. 454, 456).

As for fiscal characteristics, we consider two sources of municipal revenues: own revenues and grants. We express them as the natural logarithms of per capita values. Consequently, the respective coefficients represent elasticities of investment expenditures to the two main sources of municipal financial means (in per capita terms). We also account for an indebtedness level which until 2013 was subject to the subnational fiscal rule.

As regards demographic characteristics, we take into account the size of population (in a logarithmic form), the density of population and the share of pre-working and post-working population.

Variables that describe infrastructure facilities include the percentage of population with access to water supply and sewage systems. Unfortunately, data on municipal local public roads with hard improved surface are not available.

For the sake of clarity, Table 2 reports all the dependent variables, research hypotheses that they refer to and the expected signs of respective coefficients.

Empirical results

The empirical results are reported in Tables 3, 4, 5 and 6. There are four regressions per each sample. Each specification contains a different set of explanatory variables. By so doing, we verify whether the empirical results are robust across various specifications and with respect to various samples. In general, we observe changes in the magnitude of analyzed coefficients whereas their signs remain stable.⁴ In all regressions coefficients on both own revenues and grants per capita are positive and statistically significant (in line with hypotheses 1a and 1b). The empirical results also support the prediction that investment expenditures per capita decreases in debt to revenues ratio (hypothesis 1c). This finding is consistent with Välilä and Mehrotra (2006) as well as Heinemann (2006). The negative impact of population size (hypothesis 2a) and the share of old inhabitants (hypothesis 2d) is found to be statistically significant only for samples including municipalities with more than 10,000 inhabitants. One can conclude that these

⁴ Breusch-Pagan Lagrange multiplier indicates that there are significant differences across municipalities (individual effects). Hausman test points to the use of fixed effects specification. These results are available from the author upon request.

effects are driven by relatively large municipalities⁵. There is no empirical evidence for the impact of population density (hypothesis 2b) and the share of young population (hypothesis 2c).

As predicted, we find out that investment spending per capita is negatively associated with the coverage of water supply and sewage systems (hypothesis 3). This result is in line with Heinemann (2006). It also corresponds with targeting investment grants to less developed municipalities.

Conclusions

The paper empirically investigates the determinants of municipal investment spending in Poland. The identification strategy exploits two-way fixed effects panel data model for 2,412 units over the period 2007–2014.

The study shows that investment spending increases both in own revenues and grants. On the contrary, we document the negative impact of indebtedness level and the coverage of water supply and sewage systems. The coefficients on population size and the share of old inhabitants cease to be negative and statistically significant for municipalities with fewer than 10,000 inhabitants.

The results indicate that, apart from fiscal capacity, the investment expenditures of Polish municipalities are affected by economies of scale, local communities' preferences and infrastructural endowment. Therefore, the paper provides an indirect support for the claim that the fiscal equalization system among Polish municipalities should account for disparities in expenditures needs (e.g. Kańduła, 2017, pp. 330–331). The study also shows that incurring debt should be of particular concern for supervisory and control bodies.

Our empirical analysis is limited to investment expenditures flowing through municipal budgets. This caveat is mitigated by reducing the sample of municipalities gradually to these with up to 20, 10 and 5 thousand inhabitants. More importantly, the current study does not control for relationships (substitution and/or complementarity) between investment activities among neighboring municipalities. An interesting avenue for further research would be an analysis of the determinants of local public investments in Poland focussing on spatial interdependencies.

⁵ The average size of Polish municipality (including cities with country rights) is approximately 15.5 thousand inhabitants.

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Annex

Table 1. Explanatory variables description and data sources

Group of variables	Variable label	Description	Source
Fiscal characteristics	ln_own_rev_pc	The natural logarithm of per capita own revenues (including shares in personal income tax and corporate income tax)	Statistics Poland Local Data Bank
	ln_grant_pc	The natural logarithm of per capita grants (both conditional and unconditional ones)	Statistics Poland Local Data Bank
	debt_to_rev	The end-of-year ratio of debt to revenues	Ministry of Finance database
Demographic characteristics	ln_pop	The natural logarithm of population according to actual place of residence	Statistics Poland Local Data Bank
	pop_dens	Population density (in persons per square kilometer)	Statistics Poland Local Data Bank
	young	The share of pre-working population (i.e. age group 0-17 years) in total population (in percentage)	Statistics Poland Local Data Bank
	old	The share of post-working population (i.e. for men – 65 years and more, for women – 60 years and more) in total population (in percentage)	Statistics Poland Local Data Bank
Infrastructural characteristics	water	Persons using water supply system (in percent of total population)	Statistics Poland Local Data Bank
	sewage	Persons using sewage system (in percent of total population)	Statistics Poland Local Data Bank

Table 2. Nexus between explanatory variables and research hypotheses

Explanatory variable	Research hypothesis	Expected coefficient sign
ln_own_rev_pc	Hypothesis 1a	+
ln_grant_pc	Hypothesis 1b	+
debt_to_rev	Hypothesis 1c	–
ln_pop	Hypothesis 2a	–
pop_dens	Hypothesis 2b	–
young	Hypothesis 2c	+
old	Hypothesis 2d	–
water	Hypothesis 3	–
sewage	Hypothesis 3	–

Table 3. Fixed effects (FE) regression results for municipalities excluding cities with county rights in the years 2007–2014

Variables	ln_exp_inv_pc			
	(1)	(2)	(3)	(4)
ln_own_rev_pc	0.34*** (0.039)			0.32*** (0.040)
ln_grant_pc	0.41*** (0.040)			0.39*** (0.040)
debt_to_rev	-1.24*** (0.071)			-1.19*** (0.071)
ln_pop		-1.48*** (0.28)		-0.54** (0.26)
pop_density		-0.00091 (0.00070)		-0.00058 (0.00055)
young		-0.022 (0.013)		-0.026** (0.013)
old		-0.064*** (0.011)		-0.064*** (0.011)
water			-0.0089*** (0.0031)	-0.0099*** (0.0030)
sewage			-0.015*** (0.0015)	-0.014*** (0.0014)
constant	0.73* (0.38)	20.6*** (2.41)	6.84*** (0.24)	8.75*** (2.39)
Observations	19,295	19,295	19,295	19,295
R-squared	0.209	0.169	0.173	0.221
Number of code	2,412	2,412	2,412	2,412

All regressions include fixed municipality effect and fixed year effect. Independent variables are lagged by one year. Robust standard errors clustered at municipal level are reported in parentheses. Statistical significance is denoted in the following way: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. Fixed effects (FE) regression results for municipalities with up to 20,000 inhabitants in the years 2007–2013

Variables	ln_exp_inv_pc			
	(1)	(2)	(3)	(4)
ln_own_rev_pc	0.31*** (0.040)			0.31*** (0.041)
ln_grant_pc	0.42*** (0.043)			0.39*** (0.043)
debt_to_rev	-1.23*** (0.077)			-1.19*** (0.076)
ln_pop		-1.57*** (0.37)		-0.72** (0.35)
pop_density		-0.0014 (0.0029)		-0.00070 (0.0026)
young		-0.0037 (0.015)		-0.010 (0.014)
old		-0.038*** (0.013)		-0.036*** (0.013)

Table 4. Continued

Variables	ln_exp_inv_pc			
	(1)	(2)	(3)	(4)
water			-0.011*** (0.0033)	-0.010*** (0.0031)
sewage			-0.016*** (0.0016)	-0.014*** (0.0015)
constant	0.86** (0.41)	20.4*** (3.09)	6.92*** (0.25)	9.53*** (3.00)
Observations	17,160	17,160	17,160	17,160
R-squared	0.212	0.172	0.181	0.224
Number of code	2,160	2,160	2,160	2,160

All regressions include fixed municipality effect and fixed year effect. Independent variables are lagged by one year. Robust standard errors clustered at municipal level are reported in parentheses. Statistical significance is denoted in the following way: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5. Fixed effects (FE) regression results for municipalities with up to 10,000 inhabitants in the years 2007–2013

Variables	ln_exp_inv_pc			
	(1)	(2)	(3)	(4)
ln_own_rev_pc	0.29*** (0.045)			0.29*** (0.045)
ln_grant_pc	0.42*** (0.051)			0.39*** (0.051)
debt_to_rev	-1.22*** (0.092)			-1.18*** (0.090)
ln_pop		-1.39** (0.66)		-0.63 (0.61)
pop_density		-0.00038 (0.0086)		-0.00016 (0.0077)
young		0.0075 (0.018)		0.0046 (0.017)
old		-0.015 (0.017)		-0.013 (0.016)
water			-0.012*** (0.0037)	-0.011*** (0.0035)
sewage			-0.017*** (0.0019)	-0.015*** (0.0018)
constant	0.95** (0.47)	17.7*** (5.22)	6.91*** (0.28)	7.77 (4.97)
Observations	12,906	12,906	12,906	12,906
R-squared	0.217	0.178	0.189	0.227
Number of code	1,646	1,646	1,646	1,646

All regressions include fixed municipality effect and fixed year effect. Independent variables are lagged by one year. Robust standard errors clustered at municipal level are reported in parentheses. Statistical significance is denoted in the following way: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Fixed effects (FE) regression results for municipalities with up to 5,000 inhabitants in the years 2007–2013

Variables	ln_exp_inv_pc			
	(1)	(2)	(3)	(4)
ln_own_rev_pc	0.32*** (0.074)			0.33*** (0.074)
ln_grant_pc	0.38*** (0.078)			0.38*** (0.077)
debt_to_rev	-1.12*** (0.15)			-1.06*** (0.14)
ln_pop		-1.02 (0.94)		-0.63 (0.89)
pop_density		0.0062 (0.0097)		0.011 (0.0097)
young		-0.0057 (0.027)		-0.0054 (0.026)
old		0.00091 (0.029)		0.015 (0.027)
water			-0.015** (0.0067)	-0.012** (0.0061)
sewage			-0.019*** (0.0031)	-0.018*** (0.0030)
constant	0.83 (0.74)	13.6* (7.42)	7.03*** (0.51)	6.49 (7.31)
Observations	4,939	4,939	4,939	4,939
R-squared	0.214	0.178	0.193	0.227
Number of code	648	648	648	648

All regressions include fixed municipality effect and fixed year effect. Independent variables are lagged by one year. Robust standard errors clustered at municipal level are reported in parentheses. Statistical significance is denoted in the following way: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure 1. Gross fixed capital formation by government sector in Poland and EU 28 countries in the years 2002–2014 (as a percentage of GDP)

Source: own calculations based on Eurostat (online).

Figure 2. Subnational investment as a share of public investment and GDP in OECD countries in 2014

Note: Dashed lines represent unweighted averages for all OECD countries.

Source: OECD (2016, p. 107).