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The Effects of Public Expenditures on Labour Productivity in Europe

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Abstract

In this paper, we analyse the effects of public expenditures and their structure on productivity growth in industry and services in the European Union (EU) countries. We also control for the share of expenditures made by central governments. We find that productivity growth in industry decreases with government expenditures on environmental protection and increases with the decentralisation of government expenditures on recreation, culture and religion. As for services, productivity growth declines with military expenditures and increases with the centralisation of expenditures on public order and safety, and with the decentralisation of expenditures on economic affairs. The former two effects are mainly noted in Eastern European countries, while the latter is stronger in Western Europe. Lower corruption increases productivity growth. Furthermore, our estimates suggest that there is a convergence in productivities across EU member states, with convergence faster in the service sector than in the industrial sector. These findings carry important policy implications.

Keywords: Labour productivity, government expenditures, decentralisation, services

JEL classification: E24, E62, H50, H76, O14.

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1. Introduction

Academic literature considers government expenditures an important determinant of productivity. These expenditures have several dimensions. First, they can be arranged in the Classification of the Functions of Government (COFOG). Furthermore, expenditures are made through diverse levels of government. However, do all public expenditures affect labour productivity in the same way? Are expenditures made by central governments as efficient as expenditures made by local governments? These questions are the focus of our study.

We estimate the effects of the structure of government expenditures on productivity growth in business services (private sectors) and industrial sectors using European Union (EU) data. Empirical estimates suggest that productivity growth in business services declines with government expenditures on military expenditures and increases with the centralisation of government expenditures on public order and safety. However, these results are more valid for the Eastern European countries than for Western Europe. Furthermore, productivity growth in business services increases with decentralisation of government expenditures on economic affairs. This result is stronger in the Western European countries.

Expenditures on environmental protection reduce productivity growth in industrial sectors. The improvement of government institutions and the reduction of corruption are, in general, associated with higher productivity growth. An additional finding is that there is a convergence in productivities in the EU countries: productivity grows faster in those countries with a lower productivity level. In business services, this convergence is faster than in industrial sectors.

In the literature, there is no consensus about the sign of the effect of government expenditures on productivity. Post-Keynesian literature often considers government expenditures as an additional demand for goods and services produced in the country and predicts a positive effect on firms' capacity utilisation and therefore productivity (Kregel 1994, Arestis 2011). Mainstream literature often emphasizes distortions created by government intervention not only in the form of expenditures, but also on taxes, which are collected to finance public expenditures (Burtless & Haveman 1987, Miron 2010, Ilzetzki 2011, Jajkowicz & Drobiszová 2015). See Irmen & Kuehnel (2009) for an extensive review of the theoretical literature. The empirical findings depend on the countries under analysis and methods employed. For example, Linnemann et al. (2016) showed that an increase in government spending leads to a growth in labour productivity in the US. Salotti and Trecroci (2016) reported a negative relation in the OECD countries, Sáez et al. (2017) and Dudzevičiūtė et al. (2018) found mixed results in different EU countries.

Productivity depends not only on the size of the public sector but also on the structure of government expenditures. The usual result is that productivity increases with government expenditures on investment and infrastructure (Aschauer 1989, Ramirez 1998, Linnemann & Schabert 2006, Mo 2007, Ramirez 2009). Sometimes productivity is affected by expenditures on education (Sanders 1992, Hansson and Henrekson, 1994; Bose et al. 2007, Yao 2019). However, there is no consensus on the sign of these effects. Hansson & Henrekson and Bose et al. reported a positive link between government expenditures on education and productivity. The interpretation of this result is rather straightforward: a better-educated population contributes to faster and more sustainable development (Soubbotina 2004). However, Yao (2019) found a negative relation between investment in education and productivity growth in China. This may be explained by a skills mismatch and inefficiencies in labour allocation. Using US data, Sanders (1992) reported that higher education expenditures on non-research activities stimulate economic activities in the short run, but have negative effects in the long run.

Government expenditures on healthcare are likely to increase productivity growth. Indeed, better health increases creativity, ability to cope with stress and adapt to the rapid technological change (Howitt 2005). Consequently, better health is considered to be one of the key factors affecting labour productivity growth (Strauss & Thomas 1998, Bloom & Canning 2000, Aguayo-Rico et al. 2005). Therefore, if government expenditures on healthcare increase the quality and/or affordability of medical treatment, we may expect a positive correlation between public health expenditures and labour productivity. The effects though, may be realised only after some time. However, Well (2007) found

that the impact of healthcare is of lesser importance for countries' economic development than that of education, but improved healthcare impacts education and gives rise to a larger percentage of educated people in a country. In our work, we analyse healthcare and education expenditures, but do not find a robust impact of government expenditures of healthcare and education on productivity.

Many authors report a negative relation between expenditures on environmental protection and productivity. Ada (2014) found a negative relation in Turkey and many EU countries (apart from Luxembourg). Albrizio et al. (2014) found that pollution abatement and control expenditures as well as stricter environmental policies result in productivity growth among the most technologically advanced firms, while most firms report lower productivity. For a more detailed review of the empirical findings, which relate to various measures of environment protection, we refer to Kozluk and Zipperer (2015). We confirm the negative link between expenditures on environmental protection and productivity for the industrial sector, but not for services.

The most relevant works for our study are those of Lupu et al. (2018) and Auci et al. (2020). Using time-series analysis, Lupu et al. found positive effects of expenditures on education and healthcare on economic growth in Central and Eastern European countries. They also showed that expenditures on defence, economic affairs, general public services and social protection have negative effects. Auci et al. (2020) received similar findings for technical efficiency, a component of total factor productivity (TFP), using a true random effect (RE) model for 15 European countries. Our results for labour productivity resemble the Lupu et al. and Auci et al. findings for military expenditures and social protection. However, our other findings diverge. To our mind, the diverse definitions of the variables under analysis play a secondary role since economic growth, TFP and labour productivity are interdependent factors. We attribute the difference in our findings to different methodologies. Instead of time-series analysis and the true RE models, we apply panel data techniques with fixed effects; this solves many endogeneity problems (Mundlak 1978). Furthermore, we extend the previous analysis by controlling for the governmental level at which expenses are made and show that some levels of governments could be more efficient at certain types of expenditures than others. In fact, if we use a RE model and do not control for the level of government, our results for business services resemble those received by Lupu et al. and Auci et al.

In general, the academic literature agrees that the decentralisation of government expenditures increases the decision makers' efficacy in the delivery of public services to consumers of these services. Local governments have better information about the needs of local populations and businesses, and so are better able to make informed decisions (Tiebout 1956, Bardhan & Mookherjee 2006, Hofman et al. 2009). It is not clear, however, if this decentralisation leads to an increase or decline in corruption. On the one hand, proximity between politicians and affected communities establishes greater incentives for citizens to participate in the decision-making processes and therefore better control the actions of local politicians. On the other hand, localised government can be less transparent; local institutions may be less able to monitor policies than at a more centralised level, local bureaucrats may be less competent and work inefficiently. Furthermore, local elites may capture local governments and deliver most public goods and services to themselves rather than to the electorate (Prud'Homme 1995, Fisman & Gatti 2002, Hofman et al. 2009). Nevertheless, there are various categories of public expenditures. Do they all have the same effects on productivity, or are central governments more efficient in providing some sorts of public goods, and local governments others? This question is rarely studied in the literature. We aim to fill this gap in our paper.

Based on the findings of previous research, we would expect that government expenditures on education and healthcare lead to an increase in productivity growth, while government expenditures on environmental protection reduce it. Decentralisation of government expenditures would lead to an increase in productivity growth. We make no specific assumptions about the other expenditures, which are relatively under-investigated in the literature. However, as we will later show, we do not confirm a number of these hypotheses for the EU data.

The contribution of our paper is twofold: First, we analyse the effects of government expenditures on labour productivity growth having distinguished between industrial and business services – previous research focused on aggregate labour productivity. Second, we study the effects of the decentralisation

of government expenditures distinguishing between the COFOG categories of these expenditures, as does the previous literature in this field, while also controlling for the level of government making these expenditures.

The rest of the paper is organised as follows: Section 2 presents the underlying theoretical model; Section 3 discusses the data and the empirical methodology; Section 4 provides the empirical results; Section 5 concludes with policy recommendations.

2. The model

First, we assume a production function of a Cobb-Douglass form:

$$Y_{c,t} = A_{c,t} K_{c,t}^{\alpha} H_{c,t}^{\beta} . \quad (1)$$

$Y_{c,t}$ denotes production output, $K_{c,t}$- capital input, $H_{c,t}$- labour input in terms of hours, $A_{c,t}$- TFP; c and t denote country- and time-specific indexes, $\alpha, \beta > 0$. We divide production function (1) by $H_{c,t}$:

$$y_{c,t} = A_{c,t} k_{c,t}^{\alpha} H_{c,t}^{\alpha+\beta-1}, \quad (2)$$

where $k_{c,t} = K_{c,t}/H_{c,t}$ and $y_{c,t} = Y_{c,t}/H_{c,t}$; $y_{c,t}$ can be interpreted as labour productivity. Note that $H_{c,t}^{\alpha+\beta-1}$ remains on the right side of equation (2) because we do not assume constant returns to scale in the production function. Alternatively, division by $H_{c,t}$ can be omitted. In this case, empirical estimates of all coefficients we are interested in remain similar. We take a logarithm of equation (2) and differentiate the result. We obtain:

$$\Delta log y_{c,t} = \Delta a_{c,t} + \alpha \Delta log\, k_{c,t} + (\alpha + \beta - 1)\Delta h_{c,t} , \quad (3)$$

where $a_{c,t} = log(A_{c,t})$ and $h_{c,t} = log(H_{c,t})$.

Next, we assume that changes in TFP depend on government expenditures and other control variables taken with a lag. Furthermore, TFP depends on the difference between labour productivity ($log\, y_{c,t-1}$) in a specific country and the average productivity in the region ($log\, \bar{y}_{c,t-1}$):

$$\Delta a_{c,t} = \mu_c + \mu_t + \gamma' X_{i,t-1} , \quad (4)$$

where μ_c is a country-specific fixed effect and μ_t- time fixed effect, γ is a vector of parameters, X - a vector containing government expenditures by category and other control variables. In fact, if we apply the Arellano-Bond estimator (Arellano & Bond 1991) to undifferentiated data, the coefficient corresponding to the lagged dependent variable becomes close to unity. This serves as an indicator of the need for differentiation. Furthermore, there is an economic justification: Having differentiated productivity levels in logarithmic form, and using undifferentiated government expenditures, we obtain flows on both sides of equation (3).

Combining equations (4) and (3), and adding an error term $\varepsilon_{c,t}$, the model becomes:

$$\Delta log y_{c,t} = \mu_c + \mu_t + \gamma' X_{c,t-1} + \alpha \Delta \log k_{c,t} + (\alpha + \beta - 1)\Delta h_{c,t} + \varepsilon_{c,t} . \quad (5)$$

This model forms the basis of our empirical analysis.

3. Data and Methodology

We used productivity data - amounts of capital and hours worked in business services and industrial sectors from the EU KLEMS 2019 release. In total, data for 21 EU countries are available[1]. The analysed period is 1996-2017. Our data constitutes an unbalanced panel. The definitions of all the variables are summarised in the appendix A (table A1).

Output in government-provided services, such as education and healthcare, are usually measured by the value of expenses in these services. Labour productivity, disposed on the left side of equation (5), is defined as output divided by hours worked. Consequently, there may be a trivial direct positive effect of some government expenditures on productivity. In order to exclude this trivial effect, we focus on productivity in the following services: wholesale and retail trade, automobile and motorcycle repair, transportation and storage, accommodation and food service activities, information and communication, financial and insurance activities, real estate activities, professional, scientific, technical, administrative and support service activities. Public administration and defence, compulsory social security, education, health and social work are excluded because these activities are often directly financed by governments. In the industrial sectors, we focus on manufacturing, construction, mining and quarrying, electricity, gas and water supply.

Government expenditure data are taken from Eurostat, which divides expenditures into a number of subcategories (COFOG): General public services, defence, public order and safety, economic affairs, environment protection, housing and community amenities, health, recreation culture and religion, education, social protection. It is important to stress that the category of recreation, culture and religion includes expenditures for sport events. The other definitions are rather intuitive.[2]

Government expenditures are measured in terms of percentage of GDP. In fact, in a few countries, some categories of government expenditures are nil. Furthermore, some budget expenditures assigned in one period may not be used completely and return to the budget in the next period, making negative expenditures possible. Indeed, data for expenditures on environmental protection contain two negative observations - taking a logarithm of a negative value is problematic; therefore, we add one to all government expenditures before logarithm transformation.

The data on central governments' shares in public expenditures is calculated from the Eurostat data. We define these shares as central government expenditures in a specific category divided by total public expenditures in that category and multiplied by 100. We excluded the share of central governments in military expenditures from the analysis because in most countries this share is close or equal to 100%. Insertion of this variable into regressions results in estimation problems.

One of the control variables used in our models is "*Convergence*". We define it as a lagged difference between productivity levels in a specific country and the average productivity in the European Monetary Union (EMU). We choose EMU instead of the whole European Union because this data contains fewer missing observations. Convergence reflects capital and labour flows between the countries, which supply their experience and practice. It also reflects the diffusion of knowledge and technologies. This variable is similar to an error correction term, widely used in productivity modelling (See Welfe 2010, Rath & Akram 2017, Burda & Severgnini 2018, for example). We expect that productivity growth in

[1] This includes: BG, CZ, DK, DE, EE, GR, ES, FR, IT, LV, LU, HU, NL, AT, PL, PT, SI, SK, FI, SE, UK.

[2] The exact definitions of COFOG categories of government expenditures can be found on the Eurostat page: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Classification_of_the_functions_of_government_(COFOG).

countries with a relatively low productivity level would be higher than in more developed countries due to knowledge diffusion. Therefore, the corresponding coefficient will be negative.

Government expenditures and productivity may depend on the quality of public institutions (Wu et al. 2017, Fadic et al. 2019). Therefore, in a few models we include control of corruption as an explanatory variable. This data comes from the World Bank Worldwide Governance Indicators. Theoretically, the variable may obtain values between -2.5 and 2.5; higher values correspond to lower corruption.

In this analysis, we address endogeneity problems in two ways. First, government expenditures are included in the model with a one-year lag, so that government expenditures made one year ago may affect productivity growth now, but not vice versa. This allows us to refer to Granger causality (Granger 1969). Second, we employ a panel data approach with individual (country-specific) and time-fixed effects. Individual fixed effects solve endogeneity problems, which could arise from time-invariant omitted variables, such as country-specific history, culture, climate, geographic location, etc. (Mundlak 1978). Time-fixed effects control for common structural breaks such as periods of economic crises, technological change, etc. Nevertheless, we accept that there may be omitted variables, which vary in time, and affect both explanatory and dependent variables. Therefore, we refer to our results as partial correlations.

Considering government expenditures with a lag is logical as it is unlikely that government expenditures could have an immediate effect on productivity. Furthermore, in some countries fiscal rules do not allow carrying forward unspent funds (Kopits & Symansky 1998, Brenton 2016). This provides incentives for higher spending at the end of a year. In such cases, productivity has insufficient time to adjust. Therefore, we believe that it is more logical to include government expenditures in the model with at least a one-year lag. However, for some government expenditures such as healthcare and education, even a one-year lag could be too short, because the effects of better healthcare and education may have long-lasting effects.

We employ a standard `within' estimation for static panel models. As a robustness check, we also present estimations of a dynamic panel model using the Arellano-Bond estimator (Arellano & Bond 1991); however, the dynamic term of the model remained insignificant. This fact justifies the usage of a static model.

Our estimation strategy is the following: first, we regress labour productivity on a small number of categories of public expenditures and shares of public expenditures made by the central government, i.e., those that appear to be the most significant. Next, we gradually add other public expenditures and control variables into the model in order to check the robustness of these results. If the size of a category of public expenditures is significant, we also control for the share of the central government in this category and vice versa. Most regressions also include a variable "*other expenditures*". This variable includes all expenditures made by a government apart from the expenditures controlled in the model. Therefore, this variable is model-specific. Similarly, "*Centr. other expenditures"* is the share of central government expenditures in the category of other expenditures, having excluded military expenditures. We exclude the military from calculations because in most countries the corresponding share of central government expenditures is close to 100%.

In all statistic models, the Breusch-Godfrey test (Breusch, 1987; Godfrey, 1978) rejects a hypothesis that the residuals are not auto-correlated at 5% significance level. The corresponding p-values differ from model to model, but most of them are around 0.0001-0.004. Therefore, in presenting results we use autocorrelation-robust standard errors of the Arellano type (Arellano, 1987). The usage of robust standard errors also accounts for possible heteroscedasticity problems.

4. Empirical Results

In this section, we first study productivity in business services and industry in the whole EU. Next, making robustness checks we split the sample into Western and Eastern Europe.

4.1. Main Results

4.1.1. Business Services

In Table 1, we present estimates of equation (5) for business services with individual fixed effects. Such models are usually interpreted as long-run dependence between the variables.

Higher defence expenditures are associated with a lower productivity growth in business services. Such a negative coefficient is not surprising. Academic literature suggests that military expenditures crowd out other components of GDP (Barro and Redlick, 2011). Furthermore, a strong link between military expenditures and the shadow economy was found: often agents do not receive direct tangible benefits from military expenditures made by governments and therefore prefer not to pay taxes (Fedotenkov and Schneider 2018). Military spending is usually opaque and military-controlled property, such as land, testing grounds, transport vehicles housing and training centres provide many opportunities for corruption (d'Agostino et al. 2012; Delavallade 2006; Gupta et al. 2001; Hessami 2014). However, in models (4-6), we control for corruption but expenditures for defence remain highly significant with the negative sign. In the robustness check, we will show that this result is mainly driven by the Eastern European countries.

[INSERT TABLE 1 HERE]

On the one hand, greater government expenditures on public order and safety may increase labour productivity growth because they reinforce legal rights, reduce crime (including economic crimes) and reduce the size of the shadow economy. On the other hand, the reverse effect is possible: larger expenditures on public order may indicate problems with crime, corruption or a shadow economy. Indeed, in our models, we receive a significant positive impact of expenditures on public order only if we include the control of corruption to the model, which also serves as a proxy to the number of economic crimes. The correlation between government expenditures on public order and control of corruption is -0.531, indicating that higher corruption is associated with larger public expenditures on order and safety. Having controlled for corruption we receive a positive link between government expenditures on public order and labour productivity in business services.

We also found some evidence (at 10% significance level) that greater centralised government expenditures on public order and safety are associated with higher labour productivity. We interpret this result as follows: if local governments finance police and other security services, this creates clientelistic links between them, so that security services have fewer incentives and abilities to fight corruption and economic crimes at the local level. Therefore, it is wiser to position this type of spending at the level of the central government, though undoubtedly, corruption and economic crimes at the level of the central government must be accounted for. However, it has been noted that more centralised corruption is less detrimental to economic growth (Wang 2020).

Expenditures on economic affairs include spending on transport infrastructure, general economic, commercial and labour affairs. Because local governments have more information about the needs of their inhabitants and enterprises, moving such types of expenditures to the local level leads to an increase in labour productivity in business services. In most models, the corresponding coefficients are significant at 1% significance level.

The coefficient corresponding to the EU convergence is negative and highly significant in all the models. This indicates knowledge spill overs between the countries. In fact, our finding of convergence in productivities is net of convergence in government expenditures, which also takes place in the EU (Ferreiro et al. 2009). Therefore, the gross convergence in productivities, having accounted for convergence in government expenditures can be higher.

There is also evidence that lower corruption (higher values of the control of corruption) increase labour productivity in business services. This result is rather intuitive.

We present estimates of a panel model with two-ways effects in table B1 of the Appendix. Because the inclusion of time-fixed effects controls for global trends such models show short-term dependence between the variables, with results similar to those presented in Table 1. This shows that both short- and long-run effects of government expenditures in services are similar.

4.1.2. Industry

In Table 2, we analyse labour productivity growth in industries. In contrast to the regressions for business services, military expenditures are positive here. In fact, apart from the negative effects of military spending explained above, military expenditures often include industrial goods (weapons, training centres, etc.). We excluded the military sector from the productivity data. Nevertheless, the production of military goods requires intermediate goods produced by non-military sectors (metals, construction materials, etc.), thus increasing demand for non-military industrial goods. Consequently, the effects of military expenditures on productivity growth in industrial sectors can be positive. However, our robustness check shows that this effect is determined mainly by military expenditures in western countries and is not robust. Splitting the sample into Eastern and Western European countries, the statistical significance disappears in a few models; moreover, the sign even changes to the negative.

[INSERT TABLE 2 HERE]

Our analysis also reveals that higher expenditures on environmental protection reduce productivity growth in industry. Environmental protection includes such subcategories as pollution abatement, protection of biodiversity and landscape, which may restrain economic development. This finding is in line with those of other authors. The coefficient corresponding to the share of central government expenditures on environmental protection is negative and statistically significant in the first three models. When we include control of corruption in the model, the share of central government expenditures on environmental protection loses its significance, but retains the negative sign.

Social protection may affect productivity via various channels. For example, better social protection may reduce agents' precautionary savings (Hubbard et al. 1995, Kazarosian 1997) and, hence, investments in physical capital, leading to a decline in productivity. At the same time, social protection provides collective insurance, lower inequality, and greater political stability - an important factor for investment attraction and economic growth (Harris, 2002). Furthermore, social protection increases the incomes of the most vulnerable categories of agents, leading to an increase in demand for various goods and services. We receive a significant positive effect of social protection on economic growth in industry when control of corruption is included in the regression. In fact, expenditures on social protection are highly correlated with the control of corruption (0.643) - reduced corruption being associated with more generous social protection.

The estimates presented in Table 2 suggest that productivity growth in industry increases with decentralisation of expenditures on recreation, culture and religion. It is likely that these expenditures are more efficient at the local level where local governments better understand the needs of locals.

There is also a convergence in labour productivities across the EU countries in industry, growing faster in countries with a relatively low productivity level. Convergence in industries, however, is slower than in services. This effect is of especial interest because the dispersion of labour productivities in industry is higher than that in services. Standard deviation of labour productivity in industry is 21.99% higher than that of business services.

In the Appendix B, Table B2, we present estimates of the model including both individual fixed effects and also time effects. The results are similar to those in Table 2; however, military expenditures are insignificant. In model 4, the sign has changed to negative. This implies that a short-run dependence

between military expenditures and productivity in industry has not been detected. As for time-fixed effects, the coefficients corresponding to productivity convergence across the EU countries are also lower in absolute terms than the corresponding coefficients in services. This confirms the finding that labour productivities in services converge faster than in industry.

4.2. Robustness

In Table 3, we split our sample into Eastern and Western Europe and re-estimate models 2 and 4 from Tables 1 and 2. As models 1-2 from table 3 imply, defence expenditures reduce productivity growth in business services in the Eastern European countries. This result does not hold in Western Europe, thus resembling the work of Fedotenkov & Schneider (2018), who found that military expenditures increase the size of the shadow economy in Eastern Europe, but not in Western Europe. The finding that there is a need for centralization of expenditures on public order is also valid only for the Eastern European countries. At the same time, models 3-4 imply that expenditures on economic affairs increase productivity growth in business services only in Western Europe.

[INSERT TABLE 3 HERE]

The result that the decentralisation of economic expenditures leads to an increase in productivity growth in business services is more robust in the Western countries. In Eastern Europe, the corresponding coefficient is significant when corruption control is omitted, and loses its significance when control of corruption is included in the model. Control of corruption is more important for Eastern Europe. Nevertheless, in the Western European countries the coefficient preserves its sign. A lower number of degrees of freedom can explain the loss of significance.

The result that an increase in environmental protection reduces productivity growth in industry is rather robust. It persists even when splitting the sample into Eastern and Western European countries. The positive effect of social protection also remains. The positive effects of military expenditures persist in western countries, however, only if control of corruption is not included in the model. In other cases, the coefficient loses its significance and the sign reverses. Therefore, the positive effects of military expenditures on productivity growth in industry are not very robust.

Besides using the control of corruption as a measure of institutional quality, we also evaluated the rule of law and government effectiveness as obtained from Worldwide Governance Indicators. These variables are highly correlated with the control of corruption and the main results have not changed (findings not presented here).

We also performed a robustness check applying dynamic panel model techniques with an Arellano-Bond estimator (Arellano & Bond 1991). Depending on AR(1) and AR(2) tests, we used 2-4 lags of the dependent variable as instruments. The results are presented in Tables C1 and C2 in Appendix C. The dynamic term remained insignificant in all the models. This indicates that static panel models are more suitable for our task. Despite a drastic decline in efficiency in comparison to the 'within' estimator used for static model estimation, our main conclusions for business services are confirmed. In industry, the results are less stable. The Blundell-Bond estimator (Blundell & Bond 1998) yielded residuals correlated with instrumental variables; therefore, we do not present its output.

5. Conclusions

Our robustness check showed that the positive impact of government expenditures on economic affairs in services is determined by the Western European countries, while the negative effects of defence expenditures are determined mainly by Eastern Europe. Therefore, more valid institutions allow Western European countries to gain from certain categories of public expenditures, while the effects

may be the reverse in Eastern Europe. These findings underline the need to improve the quality of institutions in the Eastern European countries. In particular, Eastern European countries should pay stricter attention to the efficiency of military expenditures - the negative economic effects of military expenditures in this region have also been found in previous studies. Furthermore, our estimates suggest that apart from the effects on the efficiency of public expenditures, superior institutions also have a direct positive effect on productivity growth; once again, this effect is stronger in the Eastern European countries. Our main policy suggestion for Eastern European countries therefore is to improve the quality of their institutions.

We also suggest Eastern European countries include greater centralization of expenditures on public order and safety and decentralization of expenditures on social protection, recreation, culture and religion. Western European countries promote the decentralization of public expenditures on economic affairs.

Our estimates also imply that larger expenditures on environmental protection are associated with lower productivity growth in industry both in Western and Eastern European countries. However, we abstain from suggesting governments reduce expenditures here because their positive effects may be realized after a longer term. Furthermore, expenditures on environmental protection may improve other aspects of life quality, such as lower pollution and greater agents' longevity - disregarded in our research. Clearly there is a need for more detailed research in this field.

Our research showed that the level at which governments make expenditures has significant impact on productivity growth. Therefore, future research on the effects of government expenditures should take this factor into account. Similar research can also be adapted to other groups of countries: CIS, MENA, Latin America, Sub-Saharan Africa, and Southeast Asia, where it is likely that different political regimes and institutional frameworks may play a role. Comparison of such results for different regions may provide a clearer picture of the links between government expenditures and productivity. It would also be interesting to track an evolution of these links in time, in light of the type and quality of public institutes and technological development.

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Tables

Table 1: Results for Business Services

	1	2	3	4	5	6
Defence	-0.0341**	-0.0708**	-0.0754***	-0.1074***	-0.1080***	-0.1081***
	(0.0141)	(0.0321)	(0.0356)	(0.0477)	(0.0338)	(0.0407)
Economic affairs	0.0039	0.0145	0.0104	0.0109	0.0147	0.0124
	(0.0157)	(0.0104)	(0.0137)	(0.0128)	(0.0144)	(0.0150)
Education		0.0307	0.0286	0.0297	0.0303	0.0248
		(0.0315)	(0.0271)	(0.0317)	(0.0324)	(0.0386)
Environmental protection					-0.0393	-0.0391
					(0.0294)	(0.0275)
Health					0.0018	0.0110
					(0.0186)	(0.0197)
Housing and community amenities						0.0277
						(0.0249)
Public order and Safety			0.0508	0.1021*	0.1188**	0.1121**
			(0.0532)	(0.0556)	(0.0528)	(0.0407)
General Public Services						0.0137
						(0.0384)
Recreation, culture and religion						-0.0132
						(0.0291)
Social protection						-0.0171
						(0.0194)
Other	-0.0012	0.0061	-0.0170	0.0004	-0.0134	
	(0.0621)	(0.0621)	(0.0411)	(0.0454)	(0.0677)	
Centr. Economic Affairs	-0.0245**	-0.0424***	-0.0429***	-0.0429***	-0.0447***	-0.0408***
	(0.0109)	(0.0110)	(0.0108)	(0.0093)	(0.0090)	(0.0087)
Centr. Education		-0.0670	-0.0577*	-0.0505*	-0.0400	-0.0443
		(0.0420)	(0.0344)	(0.0307)	(0.0331)	(0.0413)
Centr. Environmental prot.					-0.0038	-0.0051
					(0.0105)	(0.0087)
Centr. Health					-0.0246	-0.0223
					(0.0429)	(0.0450)
Centr. Housing and comm.						-0.0050
						(0.0156)
Centr. Public order and safety			0.0496	0.1011*	0.0997*	0.1067*
			(0.0491)	(0.0561)	(0.0506)	(0.0615)
Centr. General public services						0.0422
						(0.0953)
Centr. Recreation, culture, religion						-0.0262
						(0.0705)
Centr. Social protection						0.0088
						(0.0672)
Centr. Other expenditures	-0.0282	0.0545	0.0175	0.1009	0.0681	
	(0.1056)	(0.1385)	(0.1995)	(0.1022)	(0.0987)	
$\Delta log\ k$	0.1188***	0.1037***	0.1050***	0.1051***	0.1008***	0.1029***
	(0.0269)	(0.0273)	(0.0265)	(0.0262)	(0.0273)	(0.0269)
Δh	-0.2616***	-0.1605*	-0.1726	-0.1618	-0.1441	-0.1512
	(0.1141)	(0.0971)	(0.1050)	(0.1218)	(0.1330)	(0.1389)
EU convergence		-0.1331***	-0.1284**	-0.1565***	-0.1588***	-0.1583***
		(0.0428)	(0.0408)	(0.0471)	(0.0493)	(0.0488)
Control of corruption				0.0602**	0.0558**	0.0525**
				(0.0250)	(0.0264)	(0.0231)
R^2	0.1425	0.2195	0.2287	0.2653	0.2758	0.2862
Adj. R^2	0.0759	0.1520	0.1574	0.1867	0.1886	0.1852
N	403	403	403	364	364	364

* p<0.1; ** p<0.05; *** p<0.01

Table 2: Results for Industry

	1	2	3	4	5	6
Defence	0.0514***	0.0433***	0.0486***	0.0368**	0.0376**	0.0476***
	(0.0178)	(0.0159)	(0.0168)	(0.0180)	(0.0172)	(0.0159)
Economic affairs					0.0029	0.0055
					(0.0172)	(0.0172)
Education			0.0078	0.0363	0.0478	0.0420
			(0.0243)	(0.0346)	(0.0378)	(0.0343)
Environmental protection	-0.0659***	-0.0651**	-0.0640**	-0.0592**	-0.0642***	-0.0592**
	(0.0186)	(0.0261)	(0.0257)	(0.0270)	(0.0289)	(0.0284)
Health					0.0043	0.0137
					(0.0299)	(0.0311)
Housing and community amenities						-0.0114
						(0.0153)
Public order and safety						-0.0378
						(0.0383)
General Public Services						0.0406
						(0.0261)
Recreation, culture and religion	-0.0367	-0.0166	-0.0195	-0.0115	-0.0063	0.0051
	(0.0275)	(0.0246)	(0.0267)	(0.0277)	(0.0276)	(0.0311)
Social protection			0.0167	0.0313*	0.0423**	0.0404*
			(0.0150)	(0.0160)	(0.0203)	(0.0208)
Other	0.0548*	0.0431	0.0332	0.0381	0.0213	
	(0.0319)	(0.0299)	(0.0380)	(0.0369)	(0.0263)	
Centr. Economic affairs					-0.0130	-0.0153
					(0.0207)	(0.0214)
Centr. Education			0.0313	0.0097	0.0040	0.0075
			(0.0239)	(0.0336)	(0.0380)	(0.0356)
Centr. Environmental prot.	-0.0179***	-0.0157*	-0.0156*	-0.0107	-0.0116	-0.0100
	(0.0065)	(0.0086)	(0.0082)	(0.0077)	(0.0074)	(0.0075)
Centr. Health					-0.0264	-0.0206
					(0.0344)	(0.0295)
Centr. Housing and comm.						-0.0024
						(0.0133)
Centr. Public order and safety						0.0436
						(0.0728)
Centr. General public services						-0.0547
						(0.1180)
Centr. Recreation, culture, religion	-0.0525**	-0.0834***	-0.0854***	-0.0713***	-0.0619**	-0.0805**
	(0.0257)	(0.0219)	(0.0190)	(0.0267)	(0.0314)	(0.0370)
Centr. Social protection			0.0276	0.0259	0.0155	0.0228
			(0.0521)	(0.0506)	(0.0497)	(0.0456)
Centr. Other	-0.0808	-0.0040	-0.1428	-0.1576	0.0396	
	(0.1124)	(0.1297)	(0.1479)	(0.1532)	(0.1074)	
$\Delta log\ k$	0.0697*	0.0613*	0.0636**	0.0593	0.0575*	0.0570
	(0.0368)	(0.0326)	(0.0321)	(0.0360)	(0.0355)	(0.0355)
Δh	-0.1506**	-0.1259**	-0.1202*	-0.0964	-0.1021	-0.0874
	(0.0661)	(0.0633)	(0.0667)	(0.0771)	(0.0762)	(0.0740)
EU convergence		-0.0881***	-0.0895***	-0.1017***	-0.0987***	-0.1035***
		(0.0181)	(0.0189)	(0.0189)	(0.0242)	(0.0229)
Control of corruption				0.0306*	0.0290**	0.0300**
				(0.0157)	(0.0136)	(0.0141)
R^2	0.0983	0.1322	0.1379	0.1342	0.1358	0.1418
Adj. R^2	0.0229	0.0572	0.0531	0.0359	0.0258	0.0204
N	403	403	403	364	364	364

*p<0.1; **p<0.05; *** p<0.01

Table 3: Robustness, individual fixed effects

	1	2	3	4	5	6	7	8
	Services				Industry			
	East	East	West	West	East	East	West	West
Defence	-0.1099***	-0.1589***	0.0290	0.0201	0.0191	-0.0092	0.0895***	-0.0487
	(0.0357)	(0.0461)	(0.0181)	(0.2018)	(0.0148)	(0.0255)	(0.0328)	(0.1694)
Economic affairs	-0.0081	-0.0008	0.0358***	0.0331**				
	(0.0142)	(0.0167)	(0.0136)	(0.0136)				
Education	-0.0203	-0.0190	-0.0119	-0.0177				
	(0.0614)	(0.0435)	(0.0191)	(0.0175)				
Environmental protection					-0.0445*	-0.0333	-0.1023**	-0.1694***
					(0.0244)	(0.0248)	(0.0476)	(0.0628)
Public order and Safety		0.1524		-0.0189				
		(0.0637)		(0.0334)				
Recreation, culture and religion					0.0067	-0.0079	-0.0517	-0.0317
					(0.0261)	(0.0333)	(0.0435)	(0.0416)
Social protection						0.0747***		0.0463*
						(0.0252)		(0.0245)
Other	0.0815	-0.0102	-0.0446	-0.0517	0.0425	-0.0165	0.1078	0.0807
	(0.0852)	(0.0679)	(0.0549)	(0.0503)	(0.0326)	(0.0490)	(0.0737)	(0.0641)
Centr. Economic Affairs	-0.1493**	0.0437	-0.0479***	-0.0526***				
	(0.0605)	(0.1235)	(0.0091)	(0.0157)				
Centr. Education	-0.1845***	-0.0145	0.0043	0.0095				
	(0.0460)	(0.0615)	(0.0286)	(0.0253)				
Centr. Environmental protection					-0.0106**	0.0032	0.0027	0.0772*
					(0.0053)	(0.0080)	(0.0419)	(0.0459)
Centr. Public order and safety		0.2397*		0.0175				
		(0.1394)		(0.0426)				
Centr. Recreation, culture, religion					-0.1124***	0.0140	-0.1267***	-0.0632
					(0.0421)	(0.0554)	(0.0381)	(0.0499)
Social protection						-0.0943***		0.0719
						(0.0358)		(0.0937)
Centr. Other	0.2672	-0.0946	0.0162	0.0295	-0.0626	-0.1500	-0.1282	-0.2029
	(0.2200)	(0.1901)	(0.0553)	(0.0705)	(0.2195)	(0.1473)	(0.3011)	(0.1970)
$\Delta log\ k$	0.1198***	0.0490	0.0588**	0.0285	0.1034**	0.0248	-0.0160	-0.0054
	(0.0298)	(0.0325)	(0.0263)	(0.0227)	(0.0430)	(0.0268)	(0.0343)	(0.0369)
Δh	-0.3014**	-0.4916***	0.1357	-0.0408**	-0.1557**	-0.3796***	-0.0835	-0.3326***
	(0.1422)	(0.1591)	(0.1018)	(0.2191)	(0.0649)	(0.0726)	(0.1289)	(0.1274)
EU convergence	-0.2110***	-0.2979***	-0.0515	-0.0396**	-0.1485***	-0.2236***	-0.0316	-0.1980***
	(0.0629)	(0.0732)	(0.0331)	(0.0177)	(0.0121)	(0.0512)	(0.0380)	(0.0380)
Control of corruption		0.0906***		0.0136		0.0298		0.0019
		(0.0234)		(0.0108)		(0.0350)		(0.0139)
R^2	0.3279	0.3534	0.1860	0.1210	0.2585	0.3156	0.0904	0.2435
Adj. R^2	0.2386	0.1300	0.1034	-0.0873	0.1600	0.0792	-0.0018	0.0642
N	163	149	403	215	163	149	240	215

* p<0.1; ** p<0.05; *** p<0.01

Appendix A

Table A1. Definitions of variables

Variable	Definition	Source
Labour productivity (dependent variable)	Logarithm of labour productivity (total output of a specific sector divided by total hours worked in this sector)	EU Klems 2019, own computations
Defence	Government expenditures on defence (%GDP)	Eurostat
Economic affairs	Government expenditures on economic affairs (%GDP)	Eurostat
Education	Government expenditures on education (%GDP)	Eurostat
Environmental protection	Government expenditures on environment protection (%GDP)	Eurostat
Health	Government expenditures on health (%GDP)	Eurostat
Housing and community amenities	Government expenditures on housing and community amenities (%GDP)	Eurostat
Public order and safety	Government expenditures on public order and safety (%GDP)	Eurostat
General Public Services	Government expenditures on general public services (%GDP)	Eurostat
Recreation, culture and religion	Government expenditures on recreation, culture and religion (%GDP)	Eurostat
Social protection	Government expenditures on social protection (%GDP)	Eurostat
Other	Other expenditures (than those included into the model) (%GDP)	Eurostat
Centr. Economic affairs	Share of central governments' expenditures on economic affairs (% of total public expenditures in this category)	Eurostat
Centr. Education	Share of central governments' expenditures on education (% of total public expenditures in this category)	Eurostat
Centr. Environmental protection	Share of central governments' expenditures on environment protection (% of total public expenditures in this category)	Eurostat
Centr. Health	Share of central governments' expenditures on health (% of total public expenditures in this category)	Eurostat
Centr. Housing and comm.	Share of central governments' expenditures on housing and community amenities (% of total public expenditures in this category)	Eurostat
Centr. Public order and safety	Share of central governments' expenditures on public order and safety (% of total public expenditures in this category)	Eurostat
Centr. General public services	Share of central governments' expenditures on general public services (% of total public expenditures in this category)	Eurostat
Centr. Recreation, culture, religion	Share of central governments' expenditures on recreation, culture and religion (% of total public expenditures in this category)	Eurostat
Centr. Social protection	Share of central governments' expenditures on social protection (% of total public expenditures in this category)	Eurostat
Centr. Other	Share of central governments' expenditures on expenditures other than included into the model (% of total other public expenditures). Military expenditures are not included.	Eurostat
$\Delta \log k$	k - capital labour ratio, capital- the sum of all categories of capital employed in the sector; labour- total hours worked.	EU Klems 2019, own computations
Δh	h- total hours worked in a specific sector of economy	EU Klems 2019, own computations
EU convergence	Difference between the country-specific (log) labour productivity in a specific sector and average (log) labour productivity in the European Monetary Union in that sector.	EU Klems 2019, own computations
Control of corruption	Control of corruption, higher values correspond to lower corruption	Worldwide governance indicators

Appendix B

Table B1. Two-Way Effects Results for Services

	1	2	3	4	5	6
Defence	-0.0586***	-0.0779***	-0.0821***	-0.1031***	-0.1066***	-0.0960*
	(0.0144)	(0.0260)	(0.0283)	(0.0380)	(0.0375)	(0.0328)
Economic affairs	0.0073	0.0183	0.0139	0.0147	0.0172	0.0163
	(0.0157)	(0.0107)	(0.0133)	(0.0121)	(0.0130)	(0.0133)
Education			0.0156	0.0065	0.0054	-0.0058
			(0.0288)	(0.0307)	(0.0314)	(0.0385)
Environmental protection					-0.0339	-0.0390
					(0.0245)	(0.0264)
Health					0.0166	0.0207
					(0.0215)	(0.0232)
Housing and community amenities						0.0322
						(0.0215)
Public order and safety			0.0319	0.0757*	0.0876**	0.0812**
			(0.0432)	(0.0429)	(0.0412)	(0.0360)
General Public Services						0.0193
						(0.0430)
Recreation, culture and religion						-0.0060
						(0.0278)
Social protection						-0.0022
						(0.0259)
Other	0.0651	0.0455	0.0149	0.0296	0.0309	
	(0.0906)	(0.0872)	(0.0535)	(0.0646)	(0.0835)	
Centr. Economic affairs	-0.0192	-0.0416***	-0.0409***	-0.0424***	-0.0453***	-0.0452***
	(0.0154)	(0.0128)	(0.0132)	(0.0113)	(0.0117)	(0.0140)
Centr. Education			-0.0291	-0.0116	-0.0053	0.0032
			(0.0339)	(0.0360)	(0.0385)	(0.0512)
Centr. Environmental protection					-0.0020	-0.0049
					(0.0082)	(0.0071)
Centr. Health					-0.0279	-0.0268
					(0.0358)	(0.0360)
Centr. Housing and comm.						-0.0198
						(0.0161)
Centr. Public order and safety			0.0639	0.0984**	0.0891**	0.0937**
			(0.0409)	(0.0424)	(0.0376)	(0.0407)
Centr. General public services						0.0153
						(0.0871)
Centr. Recreation, culture, religion						-0.0355
						(0.0591)
Centr. Social protection						-0.0310
						(0.0674)
Centr. Other	-0.1088	-0.1420	-0.0993	-0.0114	-0.0257	
	(0.0935)	(0.1319)	(0.1017)	(0.0865)	(0.1108)	
$\Delta \log k$	0.0796***	0.0714***	0.0716***	0.0728***	0.0683***	0.0679***
	(0.0228)	(0.0297)	(0.0241)	(0.0231)	(0.0235)	(0.0248)
Δh	-0.4134***	-0.3264**	-0.3457***	-0.3217**	-0.3134**	-0.3165**
	(0.1052)	(0.1097)	(0.1197)	(0.1360)	(0.1391)	(0.1372)
EU convergence		-0.1068***	-0.1026**	-0.1346**	-0.1439***	-0.1473***
		(0.0384)	(0.0397)	(0.0491)	(0.0476)	(0.0481)
Control of corruption				0.0497	0.0481**	0.0483**
				(0.0235)	(0.0237)	(0.0216)
R^2	0.1374	0.1843	0.1903	0.2071	0.2199	0.2347
Adj. R^2	0.0232	0.0737	0.0700	0.077	0.0806	0.0802
N	403	403	403	364	364	364

* p<0.1; ** p<0.05; *** p<0.01

Table B2. Two-Way Effects Results for Industry

	1	2	3	4	5	6
Defence			0.0033	0.0051	-0.0034	0.0056
			(0.0120)	(0.0133)	(0.0138)	(0.0110)
Economic affairs					0.0142	0.0163
					(0.0129)	(0.0134)
Education			-0.0011	0.0127	0.0222	0.0064
			(0.0216)	(0.0327)	(0.0377)	(0.0334)
Environmental protection	-0.0675***	-0.0660***	-0.0650***	-0.0690***	-0.0703***	-0.0632**
	(0.0176)	(0.0239)	(0.0245)	(0.0249)	(0.0268)	(0.0261)
Health					0.0212	0.0312
					(0.0249)	(0.0246)
Housing and community amenities						-0.0125
						(0.0143)
Public order and safety						-0.0494
						(0.0472)
General Public Services						-0.0044
						(0.0174)
Recreation, culture and religion	-0.0379*	-0.0204	-0.0173	-0.0174	-0.0143	-0.0020
	(0.0210)	(0.0185)	(0.0204)	(0.0229)	(0.0225)	(0.0258)
Social protection	0.0604***	0.0346**	0.0399**	0.0406**	0.0426***	0.0511***
	(0.0137)	(0.0171)	(0.0169)	(0.0175)	(0.0161)	(0.0180)
Other	0.0132	0.0200	0.0190	0.0322	-0.0234	
	(0.0280)	(0.0331)	(0.0331)	(0.0382)	(0.0271)	
Centr. Economic affairs					-0.0200	-0.0231
					(0.0175)	(0.0192)
Centr. Education			0.0303	0.0287	0.0271	0.0425
			(0.0258)	(0.0349)	(0.0362)	(0.0324)
Centr. Environmental prot.	-0.0068	-0.0052	-0.0048	-0.0027	-0.0011	-0.0004
	(0.0059)	(0.0084)	(0.0084)	(0.0080)	(0.0075)	(0.0074)
Centr. Health					-0.0223	-0.0221
					(0.0324)	(0.0272)
Centr. Housing and comm.						-0.0167
						(0.0155)
Centr. Public order and safety						0.0525
						(0.0617)
Centr. General public services						-0.0023
						(0.0716)
Centr. Recreation, culture, religion	-0.0348*	-0.0706***	-0.0858***	-0.0861***	-0.0938***	-0.1123***
	(0.0195)	(0.0196)	(0.0228)	(0.0272)	(0.0301)	(0.0353)
Centr. Social protection	-0.0343	-0.0185	-0.0457	-0.0424	-0.0531	-0.0600*
	(0.0294)	(0.0279)	(0.0324)	(0.0347)	(0.0342)	(0.0333)
Centr. Other	0.0238	-0.0906	-0.1516	-0.1492	0.0756	
	(0.0882)	(0.1177)	(0.1325)	(0.1424)	(0.0756)	
$\Delta \log k$	0.0338	0.0262	0.0277	0.0200	0.0172	0.0182
	(0.0265)	(0.0244)	(0.0240)	(0.0288)	(0.0286)	(0.0290)
Δh	-0.3981***	-0.3530***	-0.3421***	-0.3247***	-0.3375***	-0.3285***
	(0.0498)	(0.0474)	(0.0507)	(0.0445)	(0.0407)	(0.0391)
EU convergence		-0.0881***	-0.0842***	-0.0972***	-0.0944***	-0.0953***
		(0.0105)	(0.0105)	(0.0213)	(0.0196)	(0.0187)
Control of corruption				0.0276*	0.0213*	0.0239*
				(0.0151)	(0.0120)	(0.0132)
R^2	0.1742	0.2138	0.2063	0.1974	0.2029	0.2130
Adj. R^2	0.0613	0.1039	0.0832	0.0602	0.0544	0.0540
N	403	403	403	364	364	364

* p<0.1; ** p<0.05; *** p<0.01

Appendix C

Table C1. Dynamic Model Results for Services

	1	2	3	4	5
Productivity (t-1)	0.0884	-0.0217	-0.0335	-0.0134	0.0749
	(0.0753)	(0.0405)	(0.0399)	(0.0414)	(0.0661)
Defence			-0.0472	-0.0605	-0.0178
			(0.0655)	(0.0668)	(0.0485)
Economic affairs	-0.0016	0.0155	0.0242***	0.0235***	0.0084
	(0.0180)	(0.0156)	(0.0082)	(0.0084)	(0.0134)
Environmental protection					-0.0242
					(0.0160)
Education				0.1017	0.1931
				(0.0854)	(0.1183)
Health				-0.0227	-0.0393
				(0.0274)	(0.0299)
Housing and community amenities					0.0031
					(0.0300)
Public order and safety	0.0217	-0.0161	0.0134	0.0207	0.0323
	(0.0269)	(0.0337)	(0.0415)	(0.0418)	(0.0299)
General Public Services					-0.0048
					(0.0037)
Recreation, culture and religion	-0.0897	-0.0053	-0.0073	-0.0159	-0.0991
	(0.0608)	(0.0352)	(0.0336)	(0.0406)	(0.0617)
Social protection					-0.0101
					(0.0416)
Other	0.0503	-0.0089	-0.0238	-0.0471	
	(0.0546)	(0.0429)	(0.0315)	(0.0546)	
Centr. Economic affairs	-0.0147	-0.0347***	-0.0342***	-0.0421***	-0.0399**
	(0.0142)	(0.0093)	(0.0066)	(0.0130)	(0.0136)
Centr. Education				-0.0306	-0.0587
				(0.0410)	(0.0551)
Centr. Environmental prot.					-0.0100
					(0.0089)
Centr. Health				-0.0314	-0.0566
				(0.0531)	(0.0489)
Centr. Housing and comm.					0.0158
					(0.0215)
Centr. Public order and safety	0.1054*	0.0867*	0.0941*	0.1178*	0.1200*
	(0.0569)	(0.0503)	(0.0560)	(0.0701)	(0.0701)
Centr. General public services					0.1997
					(0.1980)
Centr. Recreation, culture, religion	0.0509	-0.1010*	-0.0970**	-0.0673*	0.0828*
	(0.0534)	(0.0541)	(0.0419)	(0.0354)	(0.0451)
Centr. Social protection					0.0371
					(0.0763)
Centr. Other	-0.1518	0.1068	0.0526	0.4496**	
	(0.1691)	(0.1463)	(0.1617)	(0.1897)	
$\Delta \log k$	0.1420***	0.1139***	0.1145**	0.1045***	0.1325***
	(0.0277)	(0.0258)	(0.0265)	(0.0266)	(0.0279)
Δh	-0.4817***	-0.1854*	-0.1652	-0.1495*	-0.4404***
	(0.1285)	(0.1083)	(0.1038)	(0.0900)	(0.1176)
EU convergence		-0.3939***	-0.4048***	-0.4072***	
		(0.0680)	(0.0729)	(0.0680)	
Sargan	0.9993	0.9993	0.9996	0.9996	0.9996
AR(1)	0.0227	0.0162	0.0130	0.0051	0.0046
AR(2)	0.1973	0.1582	0.1666	0.2792	0.2266
N	380	380	360	360	360

* p<0.1; ** p<0.05; *** p<0.01

Table C2. Dynamic Model Results for Industry

	1	2	3	4	5
Productivity (t-1)	-0.1051	-0.2240	-0.1089	-0.1198	-0.1344
	(0.0674)	(0.1866)	(0.1872)	(0.1821)	(0.0851)
Defence			0.03759	0.0416	0.1092**
			(0.0464)	(0.0476)	(0.0444)
Education	0.1324**	0.2008***	0.1738*	0.1627***	0.0868
	(0.0550)	(0.0570)	(0.0650)	(0.0599)	(0.0553)
Economic affairs					-0.0173
					(0.0262)
Environmental protection			-0.0319	-0.0247	-0.0631
			(0.0441)	(0.0426)	(0.0408)
Health				0.0345	-0.0112
				(0.0589)	(0.0635)
Housing and community amenities					-0.0417
					(0.0416)
Public order and safety			-0.0716	-0.0743	0.1411*
			(0.1067)	(0.1113)	(0.0744)
General Public Services					-0.0129
					(0.0464)
Recreation, culture and religion				-0.0075	-0.0137**
				(0.0572)	(0.0553)
Social protection					0.1869
					(0.0320)
Other			0.1193*	0.0928	
			(0.0618)	(0.0591)	
Centr. Education	0.0096	-0.0078	-0.0037	0.0067	0.0574
	(0.0369)	(0.0649)	(0.0605)	(0.0583)	(0.0429)
Centr. Economic affairs					-0.0023
					(0.0295)
Centr. Environmental prot.			-0.0067	-0.0058	-0.0193
			(0.0203)	(0.0206)	(0.0146)
Centr. Health				-0.0252	-0.0974*
				(0.0760)	(0.0588)
Centr. Housing and comm.					0.0371
					(0.0302)
Centr. Public order and safety			0.0919	0.1059	0.2353**
			(0.0773)	(0.0723)	(0.1042)
Centr. General public services					0.0594
					(0.2093)
Centr. Recreation, culture, religion				-0.0430	-0.0514
				(0.0477)	(0.0532)
Centr. Social protection					0.0418
					(0.0516)
Centr. Other			0.0852	0.0991	
			(0.2154)	(0.2130)	
$\Delta log\ k$	0.0762**	0.0527	0.0429	0.0429	0.0703*
	(0.0377)	(0.0340)	(0.0326)	(0.0318)	(0.0367)
Δh	-0.1584	0.0688	0.0603	0.0673	-0.1121
	(0.1037)	(0.1121)	(0.0992)	(0.1028)	(0.1077)
EU convergence		-0.6564	-0.7724	-0.7601	
		(0.2163)	(0.2296)	(0.2158)	
Sargan	0.9993	0.6815	0.7330	0.7330	0.9996
AR(1)	0.0002	0.0294	0.0200	0.0164	0.0005
AR(2)	0.1064	0.0420	0.1441	0.1073	0.1846
N	360	360	360	360	360

* p<0.1; ** p<0.05; *** p<0.01