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Geographic Cross-Sectional Fiscal Spending Multipliers and the Role of Local Autonomy: Evidence from European Regions

Using a panel of 268 European regions during 1990–2014, we document that the degree of local government's autonomy, measured with the "Local Autonomy Index," has a significant positive effect on the fiscal spending multiplier. The estimated geographic cross-sectional fiscal spending multiplier is on average close to zero in countries with the lowest degree of local autonomy, and around unity in countries with the highest degree of local autonomy. Multipliers are state-dependent: larger when gross domestic product is below trend and when there is slack in the labor market; in those states, local autonomy has a particularly large positive effect on the multiplier. To interpret the empirical findings, we build a Dynamic Stochastic General Equilibrium (DSGE) model where both local and central government spending contribute to a public good that enhances private labor productivity. Local governments are more efficient in producing the public good and the multiplier is higher in countries where local government spending has a larger share in the production of the public good.

JEL codes: E12, E32, E62, F33, R12

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In this paper, we provide estimates of geographic cross-sectional fiscal spending multipliers for European regions and show how these multipliers depend on the degree of local government's autonomy. Our paper contributes to the relatively recent and by now well-established literature on geographic cross-sectional fiscal spending multipliers, see Chodorow-Reich (2019) for a review. Our main contribution to that literature is to examine, both empirically and through the lens of a Dynamic Stochastic General Equilibrium (DSGE) model, the role that the degree of local government's autonomy has on the geographic cross-sectional fiscal spending multiplier. In that regard, our paper combines insights from two strands of literature: the relatively recent literature on the geographic cross-sectional fiscal spending multiplier; and a literature that dates back at least to the 50s and 60s—namely, the literature on the theory of fiscal federalism in public finance.

In the empirical part of our paper, we use panel data to estimate the effect that regional government spending has on regional gross value added (GVA). Two main novelties of our empirical analysis are as follows: First, we measure the degree of local autonomy with a novel index, the so-called "Local Autonomy Index" (LAI). This country-specific index was constructed by a panel of experts under the auspices of the European Commission. The index not only encompasses fiscal autonomy (FA), but also legal, organizational, institutional, and policy autonomy. To our knowledge, we are the first to use this data set to estimate how geographic cross-sectional government spending multipliers vary with the degree of local autonomy. This is a more comprehensive measure of local autonomy than measures based on subnational expenditures and revenues relative to the government expenditures and revenues. Second, to overcome the lack of data on government spending in a region, we use regional GVA of the nonmarket sector as a proxy for government spending in a region. We show that government spending in the national accounts is closely linked to the GVA of the nonmarket sector and demonstrate that the statistical properties of the two time series are very similar at the national level.

Our main empirical finding is that the government spending multiplier is increasing in the degree of local autonomy. Estimates of panel models for annual data for 268 European regions during 1990–2014 show that, at the sample mean of the LAI, a 1 euro increase of government spending in a region raises output in that region by around 0.3 euros on impact; in the long run, the effect is around 0.7 euros. At the sample minimum of the LAI, both the impact and the long-run multiplier are close to zero. At the sample maximum of the LAI, the impact multiplier is 0.5 and the long-run multiplier is 1.1.

In order to shed some light on the mechanism, we provide estimates of the effects that local government spending has on the capital stock and total factor productivity. Our panel data model estimates show that local government spending has a significant positive effect on capital. And this effect is significantly increasing in local autonomy. There are no significant effects on total factor productivity.

We document that our main finding is robust to using alternative data and estimation methods. The paper that is most closely related to our empirical analysis—in terms of using regional data for Europe—is Coelho (2019). Coelho (2019) uses European Commission commitments as instruments for annual realized expenditure. We replicate Coelho's baseline and then construct instrumental variables (IV) estimates for two subsamples: the first subsample includes the group of countries with below median local autonomy; the second subsample includes those countries with above median local autonomy. The IV estimates show that in the group of countries with above median local autonomy, the effect of government spending is about three times larger than in the group of countries with below median local autonomy.

We also find evidence that local autonomy increases the national government spending multiplier. Using quarterly, country-level data Amendola et al. (2020) provide estimates of government spending multipliers for European countries. Amendola et al. (2020) employ a factor-augmented interacted panel vector-autoregressive model. Estimating Amendola et al.'s model on two subsamples, we find that during normal times, the cumulative government spending multiplier is around 1.1 over a 1-year horizon in the group of countries with below median local autonomy. In the group of countries with above median local autonomy, the 1-year horizon multiplier is around 1.5. Over a 5-year horizon, the multiplier is around 0.9 in the group of countries with below median local autonomy and about 1.7 in the group of countries with above median local autonomy. Hence, local autonomy raises the national government spending multiplier; and more so, the longer is the horizon.

Boehm (2020) emphasizes that there is a difference on the macroeconomic effects of government consumption and government investment. Boehm's empirical analysis uses quarterly, national accounts data for OECD countries. We replicate Boehm's baseline and estimate Boehm's baseline model for European countries, separating countries into two groups based on the LAI, that is, those with high and low local autonomy. Boehm's data and estimation framework shows that local autonomy has a significant impact on the government investment multiplier but not on the government consumption multiplier. The government investment multiplier is significantly larger in the group of countries with above median local autonomy.

To rationalize our empirical findings, we build a DSGE model of a monetary union where both local and central government spending contributes to a public good. Following Barro (1990) and Aschauer (1989b), we assume that the government provides public goods that positively affect labor productivity of the private sector; there is no effect of public goods on total factor productivity. An innovation of our model is that both local and central government contribute to the production of the public goods. We interpret the weight parameter on local government spending in the production function of the public good as a measure of the degree of local autonomy. Local and central government spending are imperfect substitutes in the production function of the public good. Both local and central government spending are financed through lump-sum taxes at the central government level. Financial markets are assumed to be complete and prices to be sticky. The price stickiness ensures that government spending at any government level generates a demand effect that stimulates output. At the

same time, the increase in government spending generates an additional expansionary effect on output. This is because increases in government spending increase the production of a public good that enhances labor productivity of the private sector. In the theoretical model, as long as the public good is productive, multipliers of output and capital at the local and at the country level are an increasing function of the degree of local autonomy.

Our DSGE model integrates a key insight from the theory of fiscal federalism:[1] We specify the production function of the public good so that productivity of the region-specific public good is increasing in local autonomy. According to Oates (1999, p. 1123): "There are important informational and political constraints that are likely to prevent central programs from generating an optimal pattern of local outputs." While in our DSGE model, we do not take a stand on why regional public goods are more efficiently provided by the local government, the specification of the production function of the regional public good is consistent with the basic theory of fiscal federalism. That local autonomy has a positive impact on the multiplier is not, however, straightforward to derive from the basic theory of the fiscal federalism. The theory of fiscal federalism assigns different roles to different levels of government. Oates (1999, p. 1121) writes that: "At the most general level, this theory contends that the central government should have the basic responsibility for the macroeconomic stabilization function." The argument of Oates is based on the existing constraints on both redistributive and macroeconomic stabilization policies at decentralized levels of government. Without access to monetary prerogatives and with highly open local economies, decentralized governments have only a very limited capacity to influence local levels of employment and prices. That is, reading Oates (1999), one would expect geographic cross-sectional government spending multipliers to decrease (and not increase) in local autonomy. The empirical results of our paper show that for the sample of European countries during 1990–2014, the geographic cross-sectional government spending multiplier is larger in countries with greater local autonomy, that is, stabilization policies are more effective when local governments have greater autonomy.

The DSGE model we provide clarifies why cross-sectional government spending multipliers are increasing in local autonomy. Oates (1999, p. 1121) wrote that: "In the absence of monetary and exchange-rate prerogatives and with highly open economies that cannot contain much of the expansionary impact of fiscal stimuli, provincial, state, and local governments simply have very limited means for traditional macroeconomic control of their economies." That was the argument Oates put forward in the review essay on fiscal federalism for why, according to the basic theory of fiscal federalism, stabilization policies should be the responsibility of the central government, and, not of the local government. The DSGE model for a monetary union that we construct clarifies why the argument in Oates (1999) for delegating stabilization policies to the central government is not quite right. The intuition is as follows: A

1. See Musgrave (1959) and Oates (1972) for seminal contributions in the theory of fiscal federalism.

region is part of a monetary union (i.e., in this case, regions are part of a country). With perfect financial integration and sticky prices, the interest rate is fixed (so there is no crowding out of investment due to pressures for interest rates to rise); the real exchange is fixed in the short run (so there is no crowding out of net exports due to pressures for the real exchange rate to appreciate). The result is reminiscent of the basic open economy macromodel: government spending has the largest effect on output when both the real exchange rate and the real interest rate are constant.

In sum: our model shares the view in Oates (1999) that local governments are more efficient for providing regional public goods. We integrate that view in what is, by now, a standard DSGE model for geographic cross-sectional government spending multipliers. We show that with the assumption of local governments being more efficient in providing regional public goods than the central government, geographic cross-sectional government spending multipliers are increasing in the degree of local autonomy.

The remainder of the paper is organized follows. In Section 2, we present the data and in Section 3 the empirical model. Section 4 discusses the empirical findings and provides extensive sensitivity analysis. Section 5 presents the theoretical model and Section 6 concludes.

1. THE DATA

1.1 The Local Autonomy Index

A basic obstacle to analyze the macroeconomic effects of fiscal autonomy from an empirical standpoint is its measurement. Ideally, fiscal autonomy or decentralization measures should consider its multidimensional nature, including political, institutional, and organizational aspects. But it also should look at both sides of the budget (expenditure and tax decentralization) and the actual degree of autonomy given to subnational governments over tax and spending decisions. However, the existing literature uses measures of fiscal decentralization based on the expenditure and tax revenue ratios: the share of subnational government expenditures/revenues in general government expenditures/revenues; net of intergovernmental transfers. Some authors adopt alternative measurements for the independence of subnational governments, such as the self-reliance ratio, measured as the share of own local revenues in total revenues (see, e.g., Oates (1995)); and the share of grants over revenues (see, e.g., Rodden (2002)). Yet, larger subnational revenue and spending shares do not necessarily mean greater local autonomy. Thus, a unified index of fiscal decentralization is desirable.

For this reason, in the current study, we use the LAI, which was constructed by a panel of experts under the auspices of the European Commission, and which is available in annual basis from 1990 to 2014 (Ladner, Keuffer, and Baldersheim 2015) to measure the degree of local autonomy within the European Union. This measure of decentralization goes beyond the share of funds managed by local authorities and captures the extent to which local authorities can decide on how to spend these funds.

The conceptualization of the LAI follows closely the methodology of the Regional Authority Index constructed by Hooghe, Marks, and Schakel (2010).[2]

We describe now the LAI in more detail. The code book for the index contains 11 variables: (i) institutional depth (ID), (ii) policy scope (PolS); (iii) effective political discretion (EPD); (iv) fiscal autonomy (FIN) ; (v) financial transfer system (FTS); (vi) financial self-reliance (FSR); (vii) borrowing autonomy (BA); (viii) organizational autonomy (OA); (ix) legal protection (LP); (x) administrative supervision (AS); and (xi) central or regional access (CRA).

1. *ID*. This index refers to the extent to which a local government is formally autonomous and has a choice regarding which tasks to perform. The overall *ID* scores range from 0 to 3: "0 = local authorities can only perform mandated tasks" and "3 = local authorities are free to take on any new tasks (residual competences) not assigned to other levels of government."
2. *PolS*. This index measures the range of functions (tasks) where the local government is effectively involved in the delivery of the services, be it through own financial resources and/or through own staff. Ladner, Keuffer, and Baldersheim (2015) chose the eight main public policies that European local governments are responsible for—primary education, social assistance, primary health services, land use, public transport, housing, police, and caring functions. The score 0 stands for "not at all," 0.5 for partly, and 1 for fully responsible. The scores are added up, and normalized in such a way that the overall *PolS* score is between 0 and 4.
3. *EPD*. This index refers to the extent to which a local government can decide on service aspects of the same eight public functions defined in the previous index. Local authorities may have no (0), some (0.5), or real authoritative control (1) over the eight tasks. The scores are added up across the eight aspects of public services, and normalized such a way that the overall *EPD* score is between 0 and 4.
4. *FIN*. This index represents the extent to which the local government can independently tax its population. It ranges from "0 = local authorities set base or rate of minor taxes" to "4 = local authorities set base and rate of more than one major tax (personal income, corporate, value added, property or sales tax)." The overall *FIN* score is between 0 and 4.
5. *FTS*. This index indicates the proportion of unconditional financial transfers to total financial transfers received by the local government. It ranges from "0 = conditional transfers are dominant (unconditional = 0–40% of total transfers)" to "3 = nearly all transfers are unconditional (unconditional = 80–100%)." The overall *FTS* score is between 0 and 3.

2. Some adaptions were made to capture the specific characteristics of local authorities and additional variables are included relative to Hooghe, Marks, and Schakel (2010) and the data are produced in a form that the two indexes can be easily matched.

6. *FSR*. This index measures the proportion of local government revenues derived from own/local sources (taxes, fees, charges). It ranges from "0 = own sources yield less than 10% of total revenues" to "3 = own sources yield more than 50%." The overall *FSR* score is between 0 and 3.
7. *BA*. This index refers to the extent to which local government can borrow. It ranges from "0 = local authorities cannot borrow" to "3 = local authorities may borrow without restriction imposed by higher-level authorities." The overall *BA* score is between 0 and 3.
8. *OA*. This index depicts the extent to which local governments are free to decide about their own organization and electoral system. It ranges from "0 = local executives are appointed by higher-level authorities and local authorities cannot determine core elements of their political systems (electoral districts, number of seats, electoral system)" to "4 = executives are elected by the citizens or the council and the municipality may decide some elements of the electoral system, and local authorities hire their own staff, fix the salary of their employees, choose their organizational structure and establish legal entities and municipal enterprises." The overall *OA* score is between 0 and 4.
9. *LP*. This index refers to the existence of constitutional or legal means to assert local autonomy. It ranges from "0 = no legal remedy for the protection of local autonomy exists" to "3 = remedies of constitutional clauses or statutory regulations and recourse to the judicial system, plus other means that protect local autonomy such as e.g. listing of all municipalities in the constitution or the impossibility to force them to merge." The overall *LP* score is between 0 and 3.
10. *AS*. This index represents the unobtrusive AS of local government. It ranges from "0 = administrative supervision reviews legality as well as merits/expediency of municipal decisions" to "3 = there is very limited administrative supervision." The overall *AS* score is between 0 and 3.
11 *CRA*. This index measures the extent to which local authorities are consulted to influence higher-level governments' policymaking. It ranges from "0 = local authorities are never consulted by higher-level governments and there are no formal mechanisms of representation" to "3 = local authorities are either consulted or have access to higher-level decision-making through formal representation; and substantial influence." The overall *CRA* score is between 0 and 3.

The *LAI* is a weighted average of the above 11 indexes

$$LAI = \frac{1}{13}\left(\frac{LA}{3} + 2\frac{OA}{4} + 2\frac{PS}{4} + 3\frac{ID + 3EPD}{16} + 3\frac{3FIN + 3FSR + BA}{16} + \frac{FTS + AS}{7} + \frac{CRA}{3}\right).$$

The weights in the formula were determined by the panel of experts. To divide the sum in the bracket by 13 makes the value of *LAI* to be between 0 and 1. The higher is the index, the more autonomy the local authorities have. The level of coding varied from country to country depending on the nature of local autonomy. In a unitary country where all municipalities have the same autonomy, all variables and the LAI have the same value at municipal, regional, and country level. In other countries, there are asymmetries across municipalities or regions within country. Given the heterogeneity in terms of available level of aggregation across countries in the data set, we decide to use the country level LAI. Thus, we assigned the country-level LAI to each region of that country in each year. This country-level index was either constructed as such, or if the index was constructed at the lower territorial level, it was aggregated from the lower to higher territorial level with population weights.

1.2 Regional European Data

Our regional data come from Cambridge Econometrics' European Regional Database (ERD), which is a highly disaggregated data set across both sectoral and subregional dimensions. Eurostat's REGIO database is the primary source of data for the ERD. The database consists of a wide range of economic and demographic indicators for the EU28 and Norway.[3] The data are published at the NUTS3 level of disaggregation although some indicators are limited to the NUTS2 level. The ERD uses the NUTS 2010 regional classification and the 2010 version of the European System of Regional and National Accounts (ESA2010). The data set includes among others GVA, gross domestic product (GDP), and gross fixed capital formation (GFCF), and hours worked by six sectors. The six sectors are (1) agriculture, forestry, and fishing; (2) industry excluding construction; (3) construction, (4) wholesale, retail, transport, accommodation and food services, information and communication; (5) financial and business services; and (6) nonmarket services. ERD data are annual and cover the period 1980–2014 for old member states of the EU (countries joined up until 1995) and 1990–2014 for the new member states of the EU (countries joined after 1995). ERD is constructed in such a way that the country aggregates of its various time series equal to the corresponding time series in the AMECO data set, the macroeconomic data set provided by the European Commission's Directorate General Economic and Financial Affairs (DG ECFIN). The ERD includes only real variables expressed in 2005 constant price euros. They were obtained by deflating the nominal variables using price deflators from the AMECO data set. However, the sectoral price deflators from AMECO are limited in disaggregation to national data only for agriculture and industry excluding construction and services. This means that, for any given country, the price index for any subsector within industry or services will be the same as a result of the limitations in consistent data availability.

3. We exclude Switzerland and Norway from our regression analysis.

1.3 Government Spending Data

Ideally, we would like to use real "final consumption expenditure of general government." Unfortunately, such data are not available at the regional level. However, real value added of the nonmarket sector is available, and we will use it as a proxy for government spending. We do so, since we argue that there is a close link in the national accounts between government spending and the value added of the nonmarket sector. Moreover, we demonstrate with country-level aggregate data that the value added of the nonmarket sector is indeed a good proxy for government spending. First, we establish the link between government spending (final consumption expenditure of general government) and the value added of the nonmarket sector in the national accounts (See Lequiller and Blades 2014 for more details). The nonmarket sector in ERD consists of the following subsectors: "Public administration and defense," "Education," "Human health and social work," "Arts, entertainment and recreation," "Other service activities," and "Activities of household and extra-territorial organizations and bodies." The value added of the first subsector, "Publicadministration and defense," is the value added of the general government. The next two subsectors, "Education" and "Human health and social work," are closely linked to the government in the national accounts, while the last three linked only loosely. The system of national accounts defines government spending as

Final consumption expenditure of general government
= Gross value added of the general government
+ Intermediate inputs of the general government
+ Social transfers in kind purchased market production
− Market output and output for own final use
− Payments for nonmarket output

The difference between government spending and the gross value added of the general government is largely due to intermediate inputs and social transfers in kind. However, intermediate inputs and social transfers in kind constitute government purchases from "Education" and "Human health and social work." Hence government purchases generate primarily the value added of these two sectors in addition to the value added of "Public administration and defense."

However, it is still an empirical question to what extent the value added of the nonmarket sector is a good proxy of government spending. We take national aggregates time series data of government spending from the AMECO database and time series of the value added of nonmarket sector from the ERD. Then, to answer the question, first, we construct a scatter plot where we plot the log of government spending data against the log of value added of the nonmarket sector (see Figure 1). The dots closely align with the 45-degree line with the government spending tending to be slightly above the line. This implies that on average government spending is higher than the value added of nonmarket services. Nevertheless, they are closely aligned and comparable. The only exceptions are five outliers for Bulgaria. However, this does not change the overall conclusion about the relationship between the two variables. This is important because if the two variables were not comparable, the multiplier would be only identified up to scale and the interpretation of the multiplier estimates would

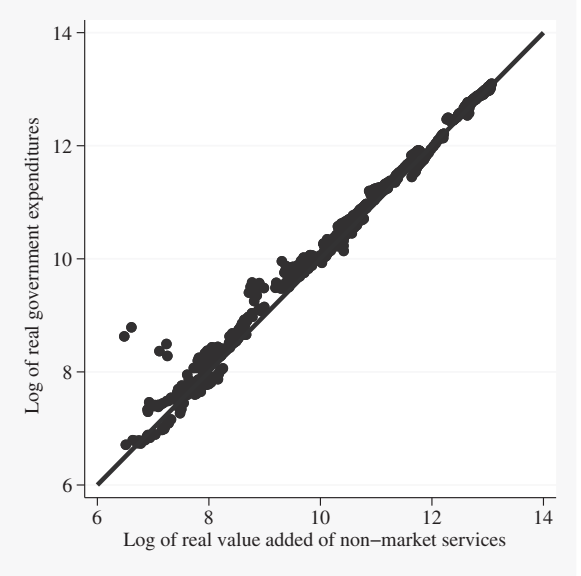

Fig 1. Scatterplot of Value Added of Nonmarket Services and Government Expenditures of the Pooled Data.

be difficult. Although this would be sufficient to identify whether the multiplier is increasing with local autonomy or not, but Figure 1 gives us some confidence that our estimates can actually be interpreted as multipliers.

Second, we turn to the time series properties of the national time series of the value added of nonmarket sector and government spending. The correlation between value added of nonmarket sector per hour and government spending per hour is 0.987, while the correlation between the log of these two variables is 0.981. The correlation between the nonnormalized variables is somewhat higher. Next, we regress government spending on the value added of non-market sector with and without country and time fixed effects. We also run the regressions in logs. And we run the regression both on the nonnormalized variables and the variables normalized with hours. All 12 regressions indicate a significant and strong relationship between these two variables. The regression coefficients are statistically significantly different from zero at the 1% level (see Table 1).

2. ECONOMETRIC MODEL

Our baseline econometric model that enables to obtain estimates of how the effect of government spending on output depends on the degree of local autonomy is:

$$\ln(y_{it}) = a_i + b_t + \phi \ln(y_{it-1}) + \alpha \ln(g_{it}^{cyc}) + \beta \ln(g_{it}^{cyc}) \times LAI_{it} + \gamma LAI_{it} + u_{it}, \qquad (1)$$

TABLE 1

VALUE ADDED OF NONMARKET SECTOR AND GOVERNMENT SPENDING

		Government spending	
Value added of nonmarket sector	1.02 ***	0.93 ***	0.92 ***
	(0.004)	(0.011)	(0.013)
Country fixed effects	No	Yes	Yes
Time fixed effects	No	No	Yes
		Log of government spending	
Log of value added	0.97***	0.60***	0.09***
	(0.006)	(0.020)	(0.035)
Country fixed effects	No	Yes	Yes
Time fixed effects	No	No	Yes
		Government spending per hour	
Value added of nonmarket sector per hour	1.09***	0.83***	0.72***
	(0.007)	(0.014)	(0.025)
Country fixed effects	No	Yes	Yes
Time fixed effects	No	No	Yes
		Log of government spending per hour	
Log of value added per hour	0.89***	0.50***	0.08***
	0.016	0.019	0.026
Country fixed effects	No	Yes	Yes
Time fixed effects	No	No	Yes

NOTE: Stars denote significance: * 10% level; ** 5% level; *** 1% level.

where i denotes region i at the NUTS2 level; t denotes year t; $\ln(y)$ is the natural logarithm of value added per hour; $\ln(g^{cyc})$ is the variation in government expenditures per hour that is exogenous to output per hour (see equation (2), below); *LAI* represents the LAI; a_i are region fixed effects and b_t are year fixed effects.

We generate variations in government expenditures that are exogenous to output by estimating the following equation:

$$\ln(g_{it}) = c_i + d_t + \theta \ln(y_{it}) + r_{it}, \tag{2}$$

where $g_i^{cyc} = \hat{r}_{it}$ is the residual obtained from estimating equation (2). In equation (2), we instrument output by the interaction between the natural logarithm of the international oil price and region's average value added share of industrial production.[4] Table D1 in the online appendix shows two-stage least squares estimates of equation (2). The F-statistics on the null that the instrument has in the first stage a zero effect are large: the Cragg–Donald F-statistic is 424 and the Kleibergen–Paap F-statistic is 33.4. These test statistics suggest that the Two Stage Least Square (2SLS) estimate of θ is identified. An underidentification test based on the Kleibergen–Paap LM statistic rejects underidentification at the 1% level (p-value 0.000).

In dynamic panel models with fixed effects, as in equation (1), least squares estimates are biased (see, e.g., Wooldridge 2002). To avoid that bias, we instrument $\ln(y_{it-1})$ with the lag of its first difference. To assess instrument relevance, we com-

4. For an example of a paper that uses variation in the international oil price as an instrument for output when computing exogenous variation in government spending, see Fatás and Mihov (2013).

pute the Cragg–Donald and Kleibergen–Paap F-statistic. The Kleibergen–Paap F-statistic on the null hypothesis that the first-stage effect on the lagged first difference is equal to zero is 64; the Cragg–Donald F-statistic is 299. According to Andrews and Stock (2005), we can reject that the maximal IV size distortion is larger than 10% at the 5% significance level.

Differentiating in equation (1) $\ln(y)$ with respect to $\ln(g^{cyc})$, one obtains an impact (period t) and long-run elasticity:

$$\varepsilon^{impact} = \alpha + \beta LAI_{it} \qquad \varepsilon^{long-run} = \frac{\alpha + \beta LAI_{it}}{1 - \phi}. \tag{3}$$

The coefficient α measures the impact elasticity when $LAI = 0$. The coefficient β measures how this elasticity changes when LAI, the LAI varies.

The government spending multipliers are calculated by multiplying the elasticities in equation (3) with the inverse of the average share of government spending in GVA

$$\left.\frac{dy}{dg}\right|_i = \varepsilon^i \frac{y}{g} i \in \{impact, long - run\}. \tag{4}$$

For a kernel density plot of the LAI and the share of government spending in GVA, see Panels A and B of Figure D1 in the online appendix.

3. RESULTS

3.1 Baseline Model Estimates

Table 2 reports estimates of equation (1). The table shows that the estimated coefficient α is negative and significantly different from zero at the 5% level, while the estimated coefficient β is positive and significantly different from zero at the 1% level. The positive β suggests that the impact of government spending on output is increasing in local autonomy. The coefficient γ is not significantly different from zero at the conventional significance levels. Note that in equation (1), γ measures the effect of a 1-unit change in LAI on the natural logarithm of output when government spending is zero. The interpretation is that local autonomy only impacts output through its interaction with government spending. The estimated coefficients imply that at sample mean of the LAI, a 1 euro increase in government spending per hour increases output per hour by around 0.29 euros on impact. The long-run effect is larger, 0.68 euros. The government spending multiplier is [0.21,0.35] on impact, and [0.48,0.82] in the long run.

Figure 2 plots regional government spending multipliers based on the estimates in Table 2. On the y-axis of Figure 2 is the effect of regional government spending per hour on regional output per hour (dy/dg^{cyc}); on the x-axis are sample values of the LAI. The figure shows that at sample minimum of the LAI, the regional government spending multiplier is close to zero. As the LAI increases, the regional government

TABLE 2

BASELINE ESTIMATES FOR THE GEOGRAPHIC CROSS-SECTIONAL MULTIPLIER

	At LAI mean	At LAI median	At LAI interquartile range
Impact multiplier	0.29	0.30	[0.21, 0.35]
Long-run multiplier	0.68	0.70	[0.48, 0.82]
Model estimates: Dependent variable is $\ln(y_{it})$			
$\ln(g_{it}^{cyc})$			-0.05^{**}
$[\alpha]$			(0.02)
$\ln(g_{it}^{cyc}) \times LAI_{it}$			0.19^{***}
$[\beta]$			(0.07)
LAI_{it}			-0.16
$[\gamma]$			(0.17)
$\ln(y_{it-1})$			0.57^{***}
$[\phi]$			(0.10)
Region fixed effects			Yes
Time fixed effects			Yes
Observations			6,563
Regions			268

NOTE: Huber robust standard errors (clustered at the region level) are shown in parentheses. Stars denote significance: * 10% level; ** 5% level; *** 1% level.

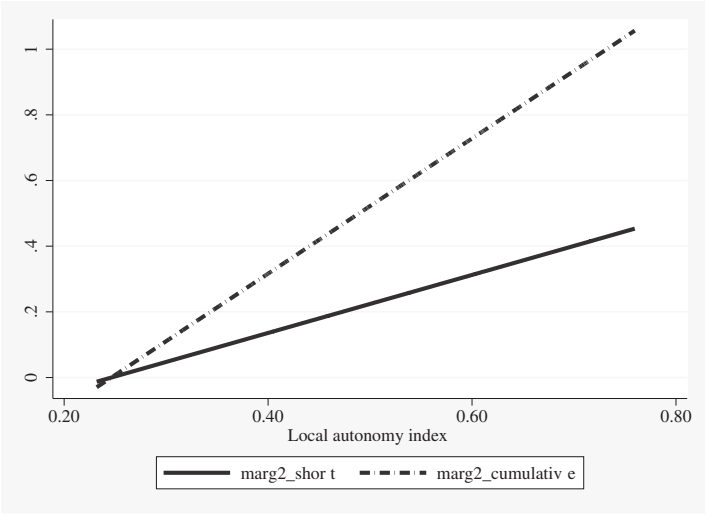

Fig 2. The Geographic Cross-Sectional Government Spending Multiplier and Local Autonomy.

spending multiplier increases. At sample maximum of the LAI, the impact multiplier is around 0.5; the long-run multiplier is around 1.1. At sample mean of the LAI, the impact multiplier is around 0.3; the long-run multiplier is around 0.7.

An alternative is to estimate equation (1) without the interaction term for different groups and define groups based on values of the LAI. As a robustness check, we strat-

ified regions into four groups based on the LAI, and estimated equation (1) without the interaction term. This yielded qualitatively similar results, that is, the multiplier is increasing in the LAI. Specifically, we obtained the following multipliers when estimating equation (1) without the interaction term: 0.56 for the first quartile (i.e., bottom 25th percentile of the LAI), 0.62 for the second quartile; 0.78 for the third quartile; and 1.01 for the fourth.

3.2 Additional Controls

Government quality. The response of private demand to a fiscal intervention may also depend on the quality of government. In this section, we discuss estimates when we add an interaction term between government spending and the quality of government to the baseline model. Our measure of the quality of government is the European Quality of Government Index (*EQI*). This index is based on survey data on corruption and governance at the regional level within the EU. The data focus on both perceptions and experiences with public sector corruption, along with the extent to which citizens believe that various public sector services are impartially allocated and of good quality.[5] It is the first source of data to date that allows researchers to compare quality of government within and across countries in such a multicountry context. The index is reported for 2010 and 2013 when the two rounds of surveys have been conducted. We took the average of the two indexes. The final index is between 0 and 1 where quality of government is increasing in the value of the index. This variable is time-invariant. Consequently, in the model with fixed effects, we only include the interaction term (the effect of *EQI* is absorbed by the fixed effects).

Table 3 reports the relevant estimates. One can see that the estimated β coefficient is almost identical to Table 2. The coefficient on the interaction between government spending and *EQI* is significantly positive. Specifically, this coefficient is 0.21. It can be interpreted as follows: a one-standard-deviation (0.18) increase in the quality of government raises the regional output elasticity of regional government spending by around 4 percentage points. If Greece, for example, were to improve its average *EQI* (0.37) to the average *EQI* prevalent in Germany (0.72), it would result in an increase of the regional output elasticity of regional government spending by around 8 percentage points; this amounts to an increase of the regional government spend-

5. With the support of Directorate-General for Regional Policy of the European Union, two rounds of surveys have been carried out. The first one was carried out in 2010 when 34,000 citizens were surveyed across European regions, and the second one was carried out in 2013 when 85,000 citizens were surveyed. The samples were constructed in such a way that they allowed to construct QoG indexes at the NUTS2 regional level for 24 EU countries. There were sixteen survey questions incorporated in the regional QoG indexes that can be divided into three groups. The first group is the "Quality Pillar" that includes questions on citizens' perception about the quality of government services, about trustworthiness of local media and corruption in local elections. The second group is the "Impartiality Pillar" that includes questions on citizens' perception about impartiality of government services, that is, equality in access to government services. The third group is the "Corruption Pillar" that includes questions on citizens' perception about their experience with corruption in government services. Answers to these 16 questions are aggregated to one index both in 2010 and 2013. For more details about the surveys and the methodology, see Charron, Dijkstra, and Lapuente (2014), 2015).

TABLE 3

CONTROLLING FOR GOVERNMENT QUALITY

	At LAI mean	At LAI median	At LAI interquartile Range
Impact multiplier	0.38	0.39	[0.30, 0.44]
Long-run multiplier	0.84	0.85	[0.67, 0.96]
Model estimates: Dependent variable is $\ln(y_{it})$			
$\ln(g_{it}^{cyc})$			−0.02
$[\alpha]$			(0.02)
$\ln(g_{it}^{cyc}) \times LAI_{it}$			0.18***
$[\beta]$			(0.08)
LAI_{it}			−0.06
$[\gamma]$			(0.18)
$\ln(y_{it-1})$			0.54***
$[\varphi]$			(0.09)
$\ln(g_{it}^{cyc}) \times (EOI_i - AVG(EOI_i))$			0.21***
$[\zeta]$			(0.06)
Region fixed effects			Yes
Time fixed effects			Yes
Observations			6,563
Regions			268

NOTE: Huber robust standard errors (clustered at the region level) are shown in parentheses. Stars denote significance: * 10% level; ** 5% level; *** 1% level.

ing multiplier of around 0.4 units. Thus, overall, the results in Table 3 suggest that regional government spending multipliers are an increasing function of local autonomy and government quality.

Lagged output, trade openness, and population density. Table 4 shows estimates of an econometric model that includes interaction terms between government spending and variables proxying for economic characteristics of regions such as lagged output per hour, trade openness, and population density. From Table 3,4, one can see that in the model that controls for these potential confounders, the estimated β coefficient is around 0.23 and has a standard error of 0.11. For comparison, in our baseline model that does not control for these potential confounders (see Table 2), the estimated β coefficient is around 0.19 and has a standard error of 0.07. Thus, with regard to the impact that local autonomy has on the geographic cross-sectional multiplier: our baseline model yields similar results to an econometric model where the geographic cross-sectional multiplier can vary as a function of lagged output, trade openness, and population density.

3.3 State-Dependent Multipliers

A number of empirical papers have documented that government spending multipliers are state-dependent (see, e.g., Auerbach and Gorodnichenko 2012, Brueckner and Tuladhar 2014, Nakamura and Steinsson 2014, Ramey and Zubairy 2018). In this section, we examine how the effects of regional government spending on regional output depend on the state of the economy and the degree of local autonomy.

TABLE 4

CONTROLLING FOR LAGGED OUTPUT, TRADE OPENNESS, AND POPULATION DENSITY

	At LAI mean	At LAI median	At LAI interquartile range
Impact multiplier	0.18	0.19	[0.09, 0.25]
Long-run multiplier	0.36	0.38	[0.17, 0.51]
Model estimates: Dependent variable is $\ln(y_{it})$			
$\ln(g_{it}^{cyc})$			-0.09^{***}
$[\alpha]$			(0.03)
$\ln(g_{it}^{cyc}) \times LAI_{it}$			0.23^{***}
$[\beta]$			(0.11)
LAI_{it}			-0.29
$[\gamma]$			(0.30)
$\ln(y_{it-1})$			0.50^{***}
$[\varphi]$			(0.10)
$\ln(g_{it}^{cyc}) \times (ln(y_{it-1}) - AVG(ln(y_{it-1})))$			0.03
$[\zeta_1]$			(0.02)
$\ln(g_{it}^{cyc}) \times (Trade_{it} - AVG(Trade_{it}))$			0.24^{***}
$[\zeta_2]$			(0.07)
$\ln(g_{it}^{cyc}) \times (PopDensity_{it} - AVG(PopDensity_{it}))$			-0.02
$[\zeta_3]$			(0.02)
$Trade_{it}$			1.01^{***}
$[\zeta_4]$			(0.19)
$PopDensity_{it}$			-2.07^{***}
$[\zeta_5]$			(0.59)
Region fixed effects			Yes
Time fixed effects			Yes
Observations			6, 490
Regions			268

NOTE: Huber robust standard errors (clustered at the region level) are shown in parentheses. Stars denote significance: * 10% level; ** 5% level; *** 1% level.

Expansions versus contractions. We define expansions (contractions) as those periods when output is above (below) its region-specific trend. That is, we estimated $\ln(y_{it}) = a_i + a_i t + b_t + e_{it}$ and then obtained the detrended, that is, residual, output series, $\hat{e}_{it}$. Output expansions are those periods in which $\hat{e}_{it} > 0$; contractions are when $\hat{e}_{it} < 0$.

Table 5 shows that the regional output effects of regional government spending are larger during contractions than expansions. To start with, the estimated α is negative and significantly different from zero at the 1% level in expansions, while it is positive and significantly different than zero at the 5% significance level in contractions. Moreover, β is also estimated to be positive and significantly different from zero at the 5% significance level. As a result, at sample mean of the *LAI*, during contractions, the impact multiplier is around 0.7, while during expansions, it is around -0.6. Thus, the first result of Table 5 is that the regional government spending multiplier is nearly 1.3 units larger during contractions than expansions.

One can also see from Table 5 that local autonomy raises the government spending multiplier in both states. At the 25th percentile of the *LAI*, the impact multiplier is around 0.61 during contractions; during expansions, it is around -0.61. At the

TABLE 5

STATE DEPENDENCE: EXPANSIONS VS. CONTRACTIONS

Panel A: Expansions	At LAI mean	At LAI median	At LAI interquartile range
Impact multiplier	−0.55	−0.55	[−0.61, − 0.50]
Long-run multiplier	−0.54	−0.53	[−0.59, −0.49]
Panel B: Contractions	**At LAI mean**	**At LAI median**	**At LAI interquartile range**
Impact multiplier	0.71	0.70	[0.61, 0.76]
Long-run multiplier	1.30	1.30	[1.13, 1.41]
Model estimates: Dependent variable is $\ln(y_{it})$		Expansions	Contractions
$\ln(g_{it}^{cyc})$		−0.20***	0.04**
$[\alpha]$		(0.06)	(0.02)
$\ln(g_{it}^{cyc}) \times LAI_{it}$		0.13	0.20**
$[\beta]$		(0.16)	(0.10)
LAI_{it}		0.14	−0.05
$[\gamma]$		(0.46)	(0.18)
$\ln(y_{it-1})$		−0.03	0.46***
$[\varphi]$		(0.12)	(0.14)
Region fixed effects		Yes	Yes
Time fixed effects		Yes	Yes
Observations		4,419	1,876
Regions		268	268

NOTE: Huber robust standard errors (clustered at the region level) are shown in parentheses. Stars denote significance: * 10% level; ** 5% level; *** 1% level.

75th percentile of the *LAI*, the impact multiplier is around 0.76 during contractions and −0.50 during expansions. The long-run multiplier is 1.13 during contractions at the 25th percentile of the *LAI*; at the 75th percentile of the *LAI*, the long-run multiplier during contractions is 1.41. During expansions, the long-run multiplier at the 25th percentile of the *LAI* is −0.59; at the 75th percentile of the *LAI*, the long-run multiplier is −0.49. Figure 3A visualizes the difference in the regional government spending multiplier for expansions and contractions across sample values of the *LAI*.

3.3.1 Slack versus tight labor markets. We now examine how the effects of local government spending on regional output differ depending on the slack in the labor market. Our (inverse) proxy for slackness in the labor market is the employment rate. We split the sample into observations with above mean employment rates (tight labor market) and below mean employment rates (slack labor market).

Table 6 shows that slackness in the labor market increases the spending multiplier. In region-years with below mean employment rates, the impact multiplier is around 0.75 at sample mean of the *LAI*. In region-years with above mean employment rates, it is around 0.2.

One can also see from Table 6 that slack in the labor market raises the effect that local autonomy has on the multiplier. At sample minimum of the *LAI*, the impact

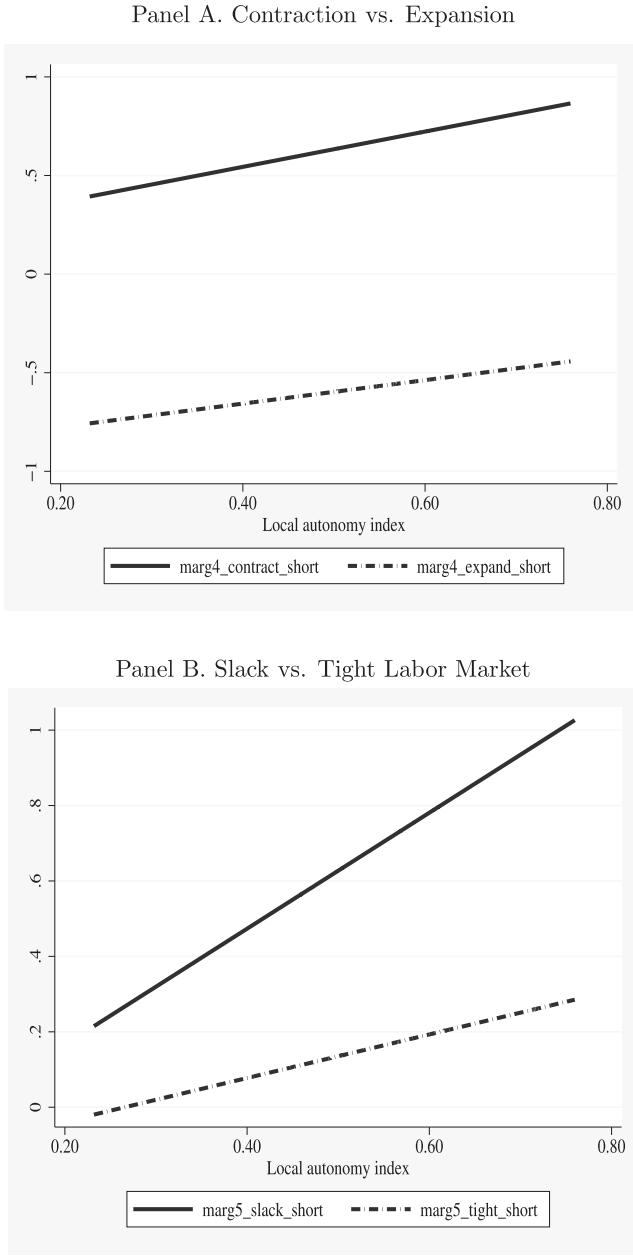

Fig 3. The Geographic Cross-Sectional Government Spending Multiplier and Local Autonomy: State-Dependence.

TABLE 6

STATE DEPENDENCE: SLACK VS. TIGHT LABOR MARKET

Panel A: Slack labor market	At LAI mean	At LAI median	At LAI interquartile range
Impact multiplier	0.75	0.76	[0.60, 0.85]
Long-run multiplier	1.50	1.52	[1.21, 1.71]
Panel B: Tight labor market	**At LAI mean**	**At LAI median**	**At LAI interquartile range**
Impact multiplier	0.18	0.18	[0.13, 0.22]
Long-run multiplier	0.41	0.42	[0.29, 0.51]
Model estimates: Dependent variable is $\ln(y_{it})$		Slack labor market	Tight labor market
$\ln(g_{it}^{cyc})$		−0.03	−0.03
$[\alpha]$		(0.03)	(0.02)
$\ln(g_{it}^{cyc}) \times LAI_{it}$		0.34***	0.13
$[\beta]$		(0.11)	(0.10)
LAI_{it}		−0.58**	0.03
$[\gamma]$		(0.24)	(0.23)
$\ln(y_{it-1})$		0.50***	0.57***
$[\varphi]$		(0.13)	(0.14)
Region fixed effects		Yes	Yes
Time fixed effects		Yes	Yes
Observations		3,018	3,531
Regions		175	191

NOTE: Huber robust standard errors (clustered at the region level) are shown in parentheses. Stars denote significance: * 10% level; ** 5% level; *** 1% level.

multiplier is around 0.2 in region-years with below mean employment rates; in region-years with above mean employment rates, the multiplier is around 0. At sample maximum of the *LAI*, the impact multiplier is around 1.0 in region-years with below mean employment rates; while in region-years with above mean employment rates, the multiplier is around 0.3. Figure 3B visualizes the difference in the regional government spending multiplier for slack and tight labor markets across sample values of the *LAI*.

3.4 Country versus Regional Data

In this section, we discuss how effects differ depending on whether country or regional data are used for the estimation. Country level data enable to obtain estimates of national multipliers, that is, multipliers that measure the effect that government spending in a country has on the output of that country. Regional data enable to obtain estimates of so-called geographic cross-sectional multipliers, that is, multipliers that measure the effect that government spending in a region has on output in that region. In other words, estimating our econometric model on regional data yields estimates of regional effects; estimating our econometric model on country data yields estimates of country-wide effects. The country-wide effect could be larger than the regional effect because of positive spillovers that arise from interregional trade, labor, and

TABLE 7

National Multipliers

	At LAI mean	At LAI median	At LAI interquartile range
Impact multiplier	0.37	0.38	[0.28, 0.44]
Long-run multiplier	1.84	1.87	[1.39, 2.17]
Model estimates: Dependent variable is $Ln(y_{it})$			
$\ln(g_{it}^{cyc})$			−0.04
$[\alpha]$			(0.05)
$\ln(g_{it}^{cyc}) \times LAI_{it}$			0.21*
$[\beta]$			(0.13)
LAI_{it}			−0.31
$[\gamma]$			(0.30)
$\ln(y_{it-1})$			0.80***
$[\varphi]$			(0.07)
Region fixed effects			Yes
Time fixed effects			Yes
Observations			639
Regions			27

Note: Huber robust standard errors (clustered at the region level) are shown in parentheses. Stars denote significance: * 10% level; ** 5% level; *** 1% level.

capital flows: local government spending raises output of a region (as found in our baseline analysis), and this might have positive effects on the output of other regions.

Table 7 shows results when estimating our econometric model on country data. Comparing the results in Table 7 to Table 2, one can see that estimating the model on country data yields slightly larger estimates of β than when the model is estimated on regional data. Standard errors on β are also somewhat larger when the model is estimated on country data.[6]

At the median of the LAI, the impact national multiplier is around 0.38. This is about 30% larger than the impact geographic cross-sectional multiplier. The long-run national multiplier at median of the LAI is around 1.87, which is more than two-and-a-half times larger than the long-run geographic cross-sectional multiplier. At the 25th percentile of the *LAI*, the national multiplier is around 0.28 on impact and 1.39 in the long-run. At the 75th percentile of the *LAI*, the national multiplier is around 0.44 on impact and 2.17 in the long run.

Figure 4 plots the national multiplier and the geographic cross-sectional multiplier across sample values of the *LAI*. Panel A shows the impact multiplier; Panel B the long-run multiplier. One can see that for all values of the *LAI*, the national multiplier is larger than the geographic cross-sectional multiplier.

In sum, the two main results from Table 7 are that: (i) the geographic cross-sectional multiplier is a lower bound of the national multiplier; (ii) the national multiplier is increasing in the degree of local autonomy. The first result is consistent with the

6. This is expected since there are a lot more observations when regional data are used compared to country data.

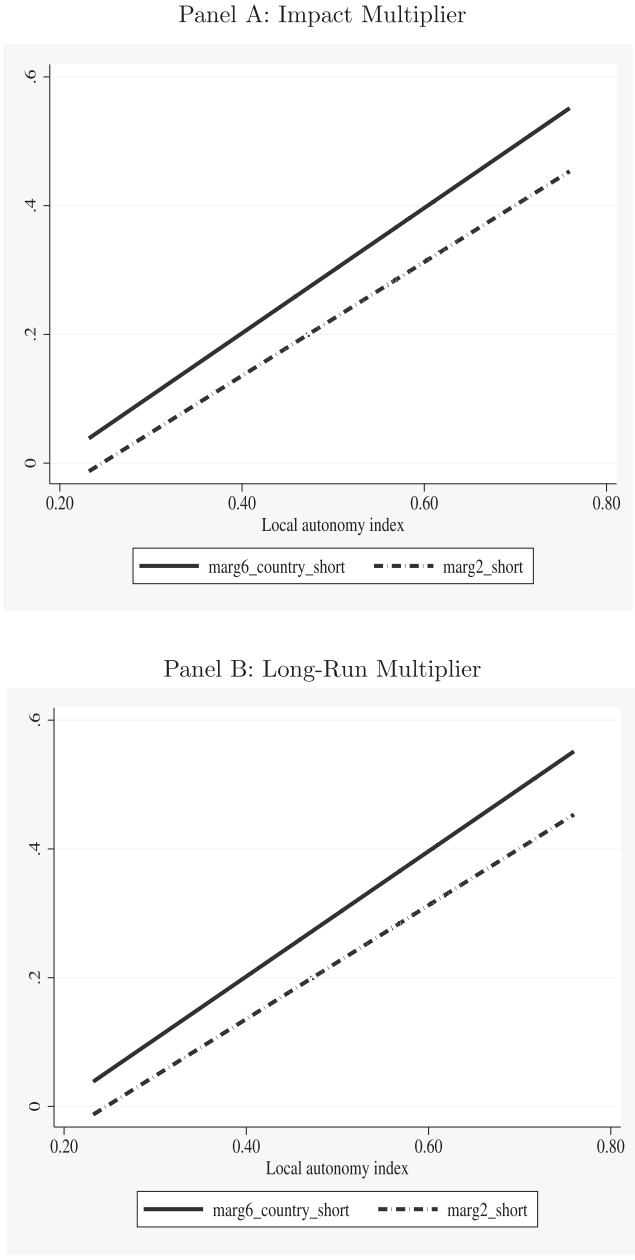

Fig 4. National vs. Geographic Cross-Sectional Multipliers.

TABLE 8

EFFECTS ON CAPITAL AND TFP

Panel A: Capital $d\ln(k)/d\ln(g^{cyc})$	At LAI mean	At LAI median	At LAI interquartile range
Impact elasticity	0.065	0.066	[0.055, 0.072]
Long-run elasticity	0.681	0.688	[0.585, 0.752]
Panel B: TFP $d\ln(TFP)/d\ln(g^{cyc})$	**At LAI mean**	**At LAI median**	**At LAI interquartile range**
Impact elasticity	0.248	0.251	[0.203, 0.281]
Long-run elasticity	1.219	1.233	[1.000, 1.542]
Estimated β coefficients		Capital	TFP
$Ln(g_{it}^{cyc}) \times LAI_{it}$		0.10^{***}	0.47
$[\beta]$		(0.02)	(0.31)
Region fixed effects		Yes	Yes
Time fixed effects		Yes	Yes
Observations		5,064	5,064
Regions		268	268

NOTE: Stars denote significance: * 10% level; ** 5% level; *** 1% level.

literature, see, for example, Chodorow-Reich (2019), who argues that the cross-sectional multiplier provides a rough lower bound for the national, no-monetary-policy-response multiplier. The second result is novel.

3.5 Effects on Capital and Total Factor Productivity

In order to shed some light on the mechanisms through which local government spending affects output, we examine the effects of local government spending on capital and total factor productivity. TFP is defined as a residual after accounting for the effects of capital, labor, and government spending on output.[7] Table 8 shows estimates of the β coefficient as well as the elasticity effects at *LAI* mean, median, and its interquartile range when the dependent variables are private capital (column 1) and total factor productivity (column 2). Figure 5 plots the short-run elasticity effects across the sample range of the *LAI*.

The estimated β coefficient is significantly positive when the dependent variable is the private capital stock. This suggests that the impact of local government spending on private capital is significantly increasing in local government's autonomy. At the 25th percentile of the LAI, a 1% increase in government spending increases the private capital stock over a one year period by around 0.055%; the long-run elasticity effect is larger, amounting to around 0.585%. At the median (75th percentile) of the

7. TFP is calculated as a residual with a capital share of 0.3: $TFP = \ln(Y) - 0.3\ln(K) - 0.7\ln(L) - 0.2ln(G)$, where Y is GVA, K is private capital, L is hours worked, and G is government spending. Capital is calculated from the regional investment series with the perpetual inventory method, depreciation, $\delta = 0.06$.

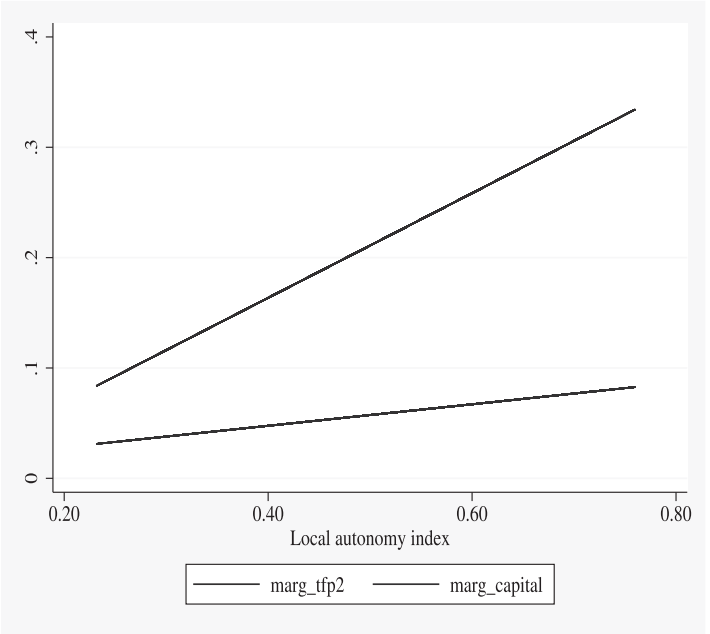

Fig 5. Elasticity Effects of Government Spending on Capital and TFP.

LAI, the elasticity effects of government spending on the private capital stock are about 20% (30%) larger than at the 25th percentile of the LAI. At the median of the LAI, a 1% increase in government spending increases the private capital stock over a 1 year period by around 0.065%; the long-run elasticity effect is around 0.688%. At the 75th percentile of the LAI, a 1% increase in government spending increases the private capital stock over a one year period by around 0.072%; the long-run elasticity effect is around 0.752%.

For TFP the estimated β coefficient is positive but not significantly different from zero at the conventional significance levels. One reason for this could be that TFP is mismeasured: The larger the measurement error of the dependent variable, the larger the standard errors on the estimated coefficients of the right-hand-side variables. The insignificant β coefficient could also be the result of more private investment due to government outsourcing and not more efficient government spending. To check this, we calculated the nonpublic administration intermediate input share in public administration gross output in 2010 and 2015 from the input–output tables of 27 EU countries as the measure of the degree of outsourcing. We did not find a significant correlation between the degree of government outsourcing and the degree of FA. This suggests that more local autonomy is unlikely to lead to more private investment via government outsourcing.

The results in Table 8 are consistent with the view that public services—such as law and order, or public administration—have a positive effect on private capital. A higher level of public services is expected to raise the marginal product of private capital, and this effect is significantly larger in more decentralized regions. In the theoretical model that we develop in Section 5, we incorporate this empirical result in the production function.

3.6 Robustness: Alternative Data Sets and Estimation Methods

In this section, we show that there is also evidence of multipliers being larger in countries with greater local autonomy when using alternative data sets and estimation methods. Specifically, we draw on three recently published papers. The papers are Coelho (2019), Amendola et al. (2020), and Boehm (2020). We downloaded the data and do-files of the relevant papers from the journals' websites. We first estimated the baseline model and report the results. Then, using the same data and baseline econometric model, we generate estimates for two subsamples: one subsample with high local autonomy (above median LAI); and another subsample with low local autonomy (below median LAI).

Coelho (2019). Coelho (2019) uses regional data for Europe and employs an IV approach to obtain estimates of geographic cross-sectional multipliers for European regions. Specifically, Coelho (2019) uses European Commission commitments as instruments for annual realized government expenditure. Column (1) of Table D2 in the online appendix replicates column (2) of Table 3 of Coelho (2019). The replication is exact. Coelho (2019) uses two instruments: European Commission commitments in year t and $t-1$. As can be seen from Panel B, only the instrument in year t has a significant first stage effect on government expenditures. In column (2), we show that using only the significant instrument yields similar second-stage estimates, that is, the impact multiplier is around 3.3. The t-stat on the first-stage coefficient on EC commitments in year t is around 11. Column (3) reports estimates for the subsample where there are observations for the LAI. In that subsample, the impact multiplier is around 2.6. In column (4), we report estimates for the regions of European countries where the LAI is below median (low local autonomy); in column (5), we report estimates for the regions of European countries with LAI at or above median (high local autonomy). One can see that in the group of countries with low local autonomy, the multiplier is around 1.7; in the group of countries with high local autonomy, the multiplier is around 5.0. That is, in the group of countries with high local autonomy, the geographic cross-sectional multiplier is about three times larger than in the group of countries with low local autonomy.

Important to note is that Coelho (2019) estimates a particular type of multiplier. Coelho uses shocks to the supply of federal transfers (European Commission commitments) of structural fund spending by subnational region as instruments for annual realized expenditure. One issue is with regard to financing: with EU funding, the national government has to complement it, or the EU funds cofinance some local

projects. Second, Coelho (2019) has annual data of spending of EU funds at the national level only. At the regional level, only the planning period totals are available (there are two planning periods). Coelho (2019) assumes that the regional evolution of the funds is the same as the national one. Third, the estimates reported in the online appendix Table D2 are for Objective 1 funds only. That is, the objective is to achieve convergence among European regions, meaning, that the funds are targeted at the poorest regions. Therefore, the resulting multipliers are difficult to compare to multipliers of other studies. However, our exercise is still valid as we simply analyze how local autonomy affects the specific multiplier under the same identification strategy.

Amendola et al. (2020). Based on quarterly, country-level data Amendola et al. (2020) provide estimates of government spending multipliers for European countries. Amendola et al. (2020) employ a factor-augmented interacted panel vector-autoregressive model. Column (1) of Table D3 in the online appendix replicates Table 1 of Amendola et al. (2020). The replication is exact. In columns (2) and (3) of Table D3 in the online appendix, we report estimates, using Amendola et al.'s baseline model (i.e., the model underlying the estimates in column (1)), on two subsamples: Column (2) reports estimates for the group of countries with below median LAI; column (3) reports estimates for the group of countries with above median LAI. Panel A of Table D3 in the online appendix reports estimates in normal times. Panel B of Table D3 in the online appendix reports estimates at the effective lower bound.

Comparing columns (2) and (3) of Table D3 in the online appendix, one sees that government spending multipliers are larger in the group of countries with above median local autonomy. During normal times, the cumulative government spending multiplier is around 1.1 over a 1-year horizon in the group of countries with below median local autonomy. In the group of countries with above median local autonomy, the 1-year horizon multiplier is around 1.5. Over a 5-year horizon, the multiplier is around 0.9 in the group of countries with below median local autonomy. And about 1.7 in the group of countries with above median local autonomy. Thus, local autonomy raises the government spending multiplier; and more so, the longer is the horizon. That result also holds for the effective lower bound, although quantitatively the difference is somewhat smaller. At the effective lower bound, the cumulative government spending multiplier is around 1.4 over a 1-year horizon in the group of countries with below median local autonomy. In the group of countries with above median local autonomy, the 1-year horizon multiplier is 1.65. Over a 5-year horizon, the multiplier is around 1.3 in the group of countries with below median local autonomy; and about 1.8 in the group of countries with above median local autonomy.

Boehm (2020). Boehm (2020) emphasizes that there is a difference between government consumption and government investment multipliers. Boehm's empirical analysis uses quarterly, national accounts data for OECD countries. Column (1) of Table D4 in the online appendix replicates the baseline, that is, table 1 of Boehm (2020). The replication is exact. In column (2) of Table D in the online appendix, we report estimates of Boehm's baseline model for the subset of countries for which we have data on the LAI. Comparing columns (1) and (2), one can see that results are

similar for the subsample that includes only the European countries and the entire set of OECD countries in Boehm's panel. Columns (3) and (4) show estimates of Boehm's baseline model for two groups of countries: above median local autonomy and below median local autonomy.

Local autonomy has a significant impact on the government investment multiplier but not on the government consumption multiplier. This can be seen from the estimates reported in columns (3) and (4) of Table D4 in the online appendix. The government investment multiplier is significantly larger in the group of countries with above median local autonomy. In the group of countries with below median local autonomy, the cumulative government investment multiplier is around -2.1 over a 1-year horizon. For the group of countries with above median local autonomy, the cumulative government investment multiplier over a 1-year horizon is around 1.1. For government consumption, the 1-year cumulative multiplier is around 1.0 for the group of countries with below median local autonomy and around 1.1 in the group of countries with above median local autonomy.

4. HOW CAN LOCAL AUTONOMY AFFECT GOVERNMENT SPENDING MULTIPLIERS? A THEORETICAL MODEL

In this section, we sketch a theoretical framework to help us interpret our empirical findings. The model we construct shares a lot of similarities with the model developed in Nakamura and Steinsson (2014) (and earlier work by Pappa and Vassilatos 2007, Benigno and Benigno 2003, Gali and Monacelli 2008, and Corsetti, Kuester, and Muller 2017). We differentiate from the existing literature by modeling local autonomy and investigating how it affects spending multipliers in our theoretical framework.

The economy is a monetary union which consists of two regions, home, and foreign, each populated by a continuum of identical, infinitely lived agents. The population of the entire economy is normalized to one. The population of the home region is denoted by n . Regions are otherwise symmetric. The representative household in each region is endowed with one unit of time and derives utility from consuming a basket of goods produced in both regions. There is no migration, so households supply labor and capital to domestic firms only. Time is discrete. Firms produce output using capital and labor inputs. We assume that the local public good affects firms' productivity positively. Firms and households make their decisions after observing the government spending shocks. Financial markets are complete. That is, all agents have access to the financial market of the monetary union, where they can trade state-contingent nominal bonds. Monetary policy is conducted at the union level by a central bank who sets the union-wide interest rate. Tax collection is also achieved at the union level, while regional spending is split between the regional and the central government and is entirely financed by transfers at the central level. The public good is produced using regional and central spending as inputs. The weight

parameter of regional spending in the production technology of the local public good defines the degree of local autonomy. For countries with a lot of autonomy, this parameter is high, while in countries that are more centralized, the public good is produced mostly through spending by the central government. Since the model is standard, we describe briefly the economy of the home region, we refer the reader to the online appendix for the model details.

4.1 Households

There is a large number of households in each region. The utility of the home region's household is characterized by:

$$E_0 \sum \beta^t u(C_t, L_t), \tag{5}$$

where $0 < \beta < 1$ stands for the household's discount factor, consumption of the composite good is denoted by $C_t > 0$, $0 < L_t < 1$ stands for hours worked, and E is an expectation operator. Households own the capital stock, they choose how much to invest and the rate of utilization of the capital stock. Capital investment is subject to adjustment costs.

The purchase of consumption and investment goods is financed by after-tax labor and capital income, profit income, and lump-sum transfers. The household has also access to the union financial market, where state-contingent nominal bonds can be traded.[8] The private consumption basket consists of domestically produced and imported goods. Denote C_{Ht} the composite of domestically produced goods, and C_{Ft} the composite of goods that are imported. Then, we define the composite consumption good as:

$$C_t = \left[\varphi_H^{\frac{1}{\eta}} C_{Ht}^{\frac{\eta-1}{\eta}} + \varphi_F^{\frac{1}{\eta}} C_{Ft}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}, \tag{6}$$

where parameter $\eta > 0$ denotes the intraregional elasticity of substitution and parameters $0 < \varphi_H, \varphi_F < 1$ with $\varphi_H + \varphi_F = 1$ represent preferences for domestic versus foreign goods. Notice that if $\varphi_H > n$, household preferences are characterized by home bias[9].

The home price level P_t is given by:

$$P_t = \left[\varphi_H P_{Ht}^{1-\eta} + \varphi_F P_{Ft}^{1-\eta} \right]^{\frac{1}{1-\eta}}. \tag{7}$$

8. Given that in our empirical analysis the union represents, a country is difficult to believe that within a country, financial markets are incomplete. However, we show in experiments, we omit here for the sake of of brevity, market incompleteness does not change qualitatively our results.

9. Following Nakamura and Steinsson (2014), we assume that also investment is a composite good given by an index of all the products produced in the economy analogous to the composition of consumption goods.

Throughout the analysis, we assume that firms set prices in the sellers' local currency and the law-of-one-price holds, so that the cost of imported goods in the home consumption basket is simply the price charged by foreign exporting firms since the exchange rate is fixed in a monetary union.

4.2 Firms

There is a continuum of firms producing differentiated goods indexed in the interval [0, 1]. The production of goods requires labor input and effective capital stock. The production function of firm j is given by:

$$Y_{Ht}(j) + Y^*_{Ht}(j) + Y^G_{Ht}(j) = K_t^{1-\alpha} L_t^{\alpha} \left(Y^G_{t-1}\right)^{\mu}, \tag{8}$$

where $Y_{Ht}(j)$ is the output of type j goods sold in the domestic market; $Y^*_{Ht}(j)$ is the output of type-j goods exported to the foreign market; $Y^G_{Ht}(j)$ is the output of type-j goods sold to the government; and L_t and $K_t = u_t \tilde{K}_t$ are the labor and effective capital inputs, respectively. The variable Y^G_{t-1} denotes the public good produced in the region that whenever $\mu \geq 0$ is assumed to increase labor productivity with a lag.[10] Following Arrow and Kurz (1970), Aschauer (1989b), and Aschauer (1989a), we assume that the public good, Y^G_{t-1}, enters the private production function and is taken as exogenous by the firms.

The goods produced by the continuum of firms in the local economy are transformed into final consumption and investment according to a standard CES with elasticity of substitution, θ, between differentiated products.

Firms are price takers in the input market and monopolistic competitors in the product markets. Following Calvo (1983), at each t, each domestic producer is allowed to reset her price with a constant probability, $(1 - \gamma)$, independently of the time elapsed since the last adjustment. Producers face domestic (private and public) and foreign demand for their product. Since all firms face the same production function and wage, they have the same marginal costs and they will set the same price when the probability of changing their price appears.

4.3 Regional Governments

Total government spending in the home region is nG_{Ht}. G_{Ht} is the composite of domestically produced goods purchased by the local and the central government. These expenditures are split between the local and the central government, a percentage ξ of those purchases are directed to the local government, that is, $G^L_{Ht} = \xi G_{Ht}$ and $G^C_{Ht} = (1 - \xi) G_{Ht}$. In other words, ξ represents the amount of steady-state govern-

10. The lagged effect of the public good in the private production function tries to capture the fact that public goods affect the private production function over time horizons longer than 12 months; for example, legal contracts have to be written and permits from government obtained before investments are made in the private sector. In Bruckner, Pappa, and Valentinyi (2019), we present similar results when the public good affects the private production contemporaneously.

ment spending administered by the local government. However, ξ does not measure the degree of local autonomy in the region. The fact that the local government controls a part of government purchases to spend locally does not talk to the autonomy of the local government. Were government spending to be thrown into the ocean, the size of the fiscal multiplier would only depend on the size of the region, not whether the local or the central government would throw this money to the sea. To make local autonomy meaningful we assume, first, that public spending is not useless, but that instead, it serves as an input for the production of the public good in the home region. Second, we assume that the public good can be produced using local government expenditures and central expenditures. We assume that in more autonomous regions, local expenditures have a higher share in the production of the local public good. In particular, we assume that the regional public good is produced through the following technology:

$$Y_t^G = \left[\lambda\left(G_{Ht}^L\right)^{\psi} + (1-\lambda)\left(G_t^C\right)^{\psi}\right]^{\frac{1}{\psi}}, \tag{9}$$

where parameter $\psi \in (-\infty, 1]$ is the substitution parameter between the local spending and the central spending in the production of the local public good and λ characterizes the amount of local spending used in the local good's production and $G_t^C = (1-\xi)(nP_{Ht}G_{Ht}^C + (1-n)P_{Ft}G_{Ht}^{C*})$. The elasticity of substitution between local and central spending is zero when $\psi = -\infty$, and we have the Leontief case, when $\psi = 0$, the public good production function is a Cobb Douglas, while when $\psi = 1$, local and central government spending are perfect substitutes.

Here, the crucial parameter is λ since it determines how much local spending contributes to the production of the public good. For $\lambda = 0$, regional spending is useless for the production of public good, whereas $\lambda = 1$ implies that what matters for the production of the public good in the domestic region is solely the expenses of the local government and the central government contributions are a pure waste. We postulate that λ in our theoretical model represents the degree of the local autonomy since in more local autonomous regions, the public good is mostly produced and decided by the regional governments, while in more central regions, it is the central government responsible for the production of the public good.

This is a parsimonious way to model the production of the regional public good using the local and central government spending as inputs. We intend to develop a simple framework for our quantitative exercise, and not to develop a new theory of local public good production.

4.4 The Federal Government

The Federal government keeps taxes fixed and finances government spending through lump-sum taxes.[11] Since financial markets are complete, any risk associ-

11. We have also considered a balanced budget rule where the central government moves taxes to balance the budget after increases in government spending. The central government budget constraint in

ated with variation in lump-sum taxes and transfers across the two regions is undone through risk-sharing and Ricardian equivalence holds.

We assume that the government spending in each region follows an AR(1) process and estimate the persistence of this process using our data on real value added of the nonmarket sector in our sample.

$$G_{Ht} = (1 - \varrho_{GH})G_H + \varrho_{GH}G_{Ht-1} + \epsilon_t^{GH},$$

where ϵ_t^{GH} is white noise.

4.5 Monetary Policy

Finally, we model the behavior of the central bank by assuming a Taylor-type of rule for the setting of the union-wide interest rate.

4.6 Calibration

We calibrate the model using the annual European regional data. Table 9 displays the values used. We set $n = 0.08$ to match the average size of a region in our sample between 1990 and 2012 in terms of share of total GDP. We assume nonseparable preferences between consumption and labor (see Greenwood, Hercowitz, and Huffman 1988) for which consumption and labor are complements for households.[12] Many studies emphasize the importance of complementarity between consumption and hours worked for generating higher fiscal multipliers.[13] With such preferences, a government expenditure shock generates a need for higher labor supply. If consumption and hours worked are complements, the surge in labor supply further stimulates output and consumption.

case of a balanced budget is given by: $nP_{Ht}G_{Ht} + (1-n)P_{Ft}G_{Ft} = \tau W_t L_t + \tau^* W_t^* L_t^*$. Finally, we have also considered a third alternative in which the central government issues nominal debt, B_t, taxes nominal wage income at the rate τ_t in both regions and has access to lump-sum taxes to finance both local and central government expenditures and interest payments on debt. Labor taxes are used to keep debt from exploding. Results are similar qualitatively with the ones presented here.

12. Notice that when we assume separable preferences for the utility function, the positive dependence of the multiplier on the degree of local autonomy does not change. However, the size of both the capital and output multipliers is lower than the one we obtain when we use GHH preferences, since with separable preferences, the increase in public spending generates weaker demand effects. As we show in Figure D4 in the online appendix, assuming GHH preferences helps us match numerically the positive values of the capital multipliers we report in our empirical exercise.

13. See, for example, Bilbiie (2011), Nakamura and Steinsson (2014), and Monacelli and Perotti (2008), among others. Gnocchi, Hauser, and Pappa (2016) build an otherwise-standard business cycle model with housework, calibrated consistently with data on time use, in order to discipline complementarity between consumption and hours worked and relate its strength to the size of fiscal multipliers.

TABLE 9

CALIBRATED PARAMETERS

Calibration		
Parameter	Description	Value
β	Discount factor	0.96
n	Home size	0.08
η	Elasticity of substitution between regional goods	4
ν	Frisch elasticity	1
σ	Inverse of relative risk aversion	1
φ_H	Weight of home goods in home consumption basket	0.66
θ	Elasticity of substitution between varieties	6
δ	Capital depreciation rate	0.06
φ	Investment adjustment costs parameter	0.10
cc_u	Elasticity of capital utilization cost	1.1
γ	Calvo parameter	0.32
α	Production function curvature	0.7
μ	Productivity of regional public good	0.2
ξ	Share of local spending on total regional spending	0.28
ψ	Substitution of regional and central spending in production of local public good	0
G_H/Y	Share of spending in regional output	0.23
ρ_G	Persistence of spending shock	0.87
ψ_{phi}	Inflation coefficient in Taylor rule	1.5
ψ_R	Interest rate coefficient in Taylor rule	0.95

NOTE: Stars denote significance: * 10% level; ** 5% level; *** 1% level.

The utility function is described by:

$$u(C_t, L_t) = \frac{\left(C_t - \Xi L_t^{1+1/\nu}/(1+1/\nu)\right)^{1-\sigma}}{1-\sigma}.$$

Table 9 reports our calibrated parameters. The subjective discount factor is set to $\beta = 0.96$. We set the Frisch elasticity of labor supply and the risk aversion parameter to one. The estimates of the elasticity of substitution between home and foreign goods vary substantially in the literature. For example, Hooper, Johnson, and Marquez (2000) estimate trade elasticities for the G7 countries in the interval (0, 0.6), while Bodenstein (2010) report mean estimates between 4 and 6. Given that our union concerns regions in the same country, we allow this elasticity to be on the higher range and we set $\eta = 4$. Following the evidence presented in Alvarez et al. (2006) for European countries, we assume that prices change, on average, every 12 months and we set the Calvo parameter equal to 0.32. We set the elasticity of substitution across varieties j = 6, implying a steady-state markup of 20%. To set the home bias parameter, following Nakamura and Steinsson (2014), we calculate the average share of services in regional nominal GVA and set $\varphi_H = 0.66$. We investigate the robustness of our results to the choice of this variable. We set the rate of depreciation of capital

equal to 6%. The investment adjustment costs function is parameterized as follows:

$$\Phi(I_t, I_{t-1}) = \left[1 - \phi\left(\frac{I_t}{I_{t-1}}\right)\right] I_t,$$

where $\phi(1) = \phi'(1) = 0$ and $\phi''(1) = 0.1$. In the steady state, capital utilization equals 1 and the elasticity of capital utilization cost is set to 1.1.

As for the government parameters, the steady-steady state share of government spending to GDP, in the data, corresponds to the nonmarket services nominal GVA to the regions' nominal GVA and its average between 1990 and 2012 is 0.23. To set the persistence of regional spending shocks, we have performed fixed-effect panel regressions with year dummies on the log nonmarket GVA per hour regressed on its lagged value, and the estimated coefficient is 0.87. As for the split of government expenditures between the local and the central government, the average share of local government expenditure relative to general government expenditure in our sample equals 0.28 and we set parameter ξ accordingly. Finally, for the substitution parameter between the regional spending and the central spending in the production of the local public good, we assume a Cobb–Douglas production, setting $\psi = 0$.[14] The coefficient regarding the productivity of the regional public good is set to 0.2, and in the next session, we investigate the sensitivity of our results to the value of this parameter. The central monetary authority follows a Taylor rule with the standard coefficients for inflation and interest rate smoothing, $\psi_\pi = 1.5$ and $\rho_R = 0.95$.

The parameter λ varies on the [0,1] interval in our simulations since it is the model equivalent of the degree of local autonomy in public spending.

5. RESULTS

5.1 A Regional Government Spending Shock

Before reporting the values of the country and regional multipliers we present in Figure 6, the transmission of regional fiscal shocks in our model economy when $\lambda = 0.25$ (circled lines) and for a high level of $\lambda = 0.75$ (crossed lines). Continuous lines present the dynamics for the home economy, while dotted lines represent the responses of the foreign economy's variables.

In general, a shock to the regional government spending in our economy results to an output expansion that is accompanied by increases in home inputs, investment is not crowded out on impact by the fiscal shock, and consumption also increases due to our assumption of GHH preferences. The increase in domestic consumption is short lived given the assumed degree of price stickiness and because foreign output

14. Differing ψ changes the curvature of the results presented in Figure 7. We show in the Figure D4 in the online appendix that assuming that local and central spending are imperfect substitutes or complements by setting $\psi = 0.5$ and $\psi = -0.5$, respectively, does not change qualitatively our predictions about the positive dependence of the output and capital multipliers on the degree of local autonomy. Since in the data, this relationship is linear, the Cobb–Douglas matched best qualitatively our empirical findings.

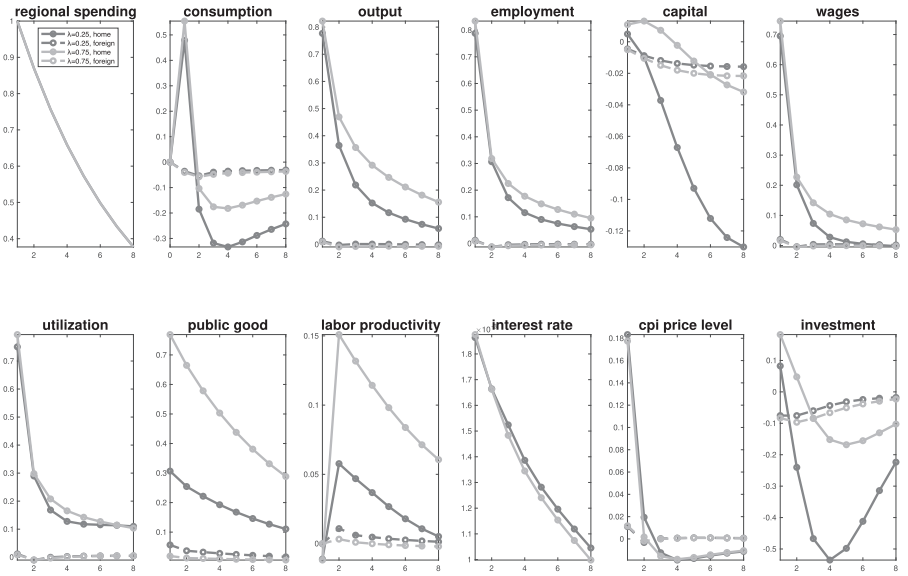

Fig 6. Impulse Responses to a Regional Government Spending Shock.

NOTES: The graph presents IRFs of the home and the foreign region to a shock in the home government spending. The responses of home variables appear with continuous lines, while foreign responses are depicted by dotted lines. The IRFs are plotted for different values of $\lambda = 0.1$ (circled), $\lambda = 0.5$ (squared), and $\lambda = 0.9$ (diamond).

and demand remain almost unchanged. (Recall that the home region is very small relative to the foreign region. Although both investment and consumption demand increase at home, foreign consumption, and investment fall because the home region is very small. Consequently, the increase in output is less than one). Now, turning to the productivity of the public good, the increases in regional spending increase the productivity of the home economy (and the foreign economy, yet since the size of the home economy is very small, the latter effect is small as well); however, the higher is the share of local goods in the production of the public good, that is, the higher is the degree of local autonomy, l, the higher the production of the public good and the higher the increase in the productive capacity of the local economy. This is clearly seen both in the impulse responses of labor productivity and capital and investment. When the local government can produce more public good, it increases with a lag labor productivity and this results in increases in investment demand and more capital accumulation.

In other words, the regional government spending shock increases demand in the local economy without generating a negative wealth effect and this tends to increase local output. Yet, when this spending is used to produce the public good directly from the regional government, this results into higher productivity of the local public good that, in turn, also stimulates the supply side of the economy increasing investment. The higher the local input in the production of the public good, the bigger the pro-

ductive effect of regional spending. Finally, notice that the increases in the regional spending also raise spending and labor productivity in the foreign region, since part (a very small one) of those expenses increase the production of the public spending in the foreign region. Yet, with no changes in foreign demand, the supply effect of the increase in the regional spending results in excess supply of production abroad and a drop in investment.

5.2 Regional and Country Government Spending Multipliers

We compute impact regional government spending multipliers as the ratio of the response of regional GDP or capital at the impact period to the initial movement of the regional fiscal variable and we refer to this as the regional impact multiplier. We also calculate similarly the country, or aggregate, impact multiplier as the ratio of total output or physical capital (i.e., the weighted sum of the GDP [or physical capital] responses in the two regions) to the initial movement of total government spending (i.e., the weighted sum of regional government spending).

As mentioned earlier, the mechanism through which local autonomy affects the size of the multipliers comes entirely from the productive nature of the local government spending. If the public good would not enhance private production, the regional multiplier would not vary with the degree of local autonomy. Since local spending enhances the production of the public good that, in turn, increases private productivity, increases in λ translate into increases of the size of the regional multiplier both on impact and cumulative. Figure 7 presents aggregate (blue circled lines) and regional (blue diamond lines) output multipliers as a function of parameter λ. Clearly, regional multipliers are a positive function of the degree of local autonomy. For $\lambda = 0$, local spending is useless for the production of public good and only central spending contributes to the production of the public good, and for that reason, the regional multiplier is much lower in that case, as it relates only to the local demand effects of the spending shock. As the share of local spending in the production of the local public good increases, the regional multiplier increases. Aggregate (country) multipliers are also a positive function of λ.

The red crossed lines measured on the right axes in Figure 7 present regional impact capital multipliers.[15] Qualitatively, the picture is similar to the case of output multipliers. Since government spending affects the marginal return on capital, a government spending shock in this framework should lead to higher capital multipliers for $\mu > 0$. Yet, the increase in public spending crowds out private investment and, as a result, the capital multiplier could be lower. The former effect seems to dominate

15. Country capital multipliers are much smaller than regional multipliers and follow the same pattern as the ones presented in Figure 7, but we do no present them here since in the empirical exercise, we only compute regional capital multipliers. The reason why country capital multipliers are lower comes from the fact that when government spending is productive, an increase in home regional spending crowds out foreign capital; as a result, country multipliers due to the small size of the home region are smaller and they can even be negative.

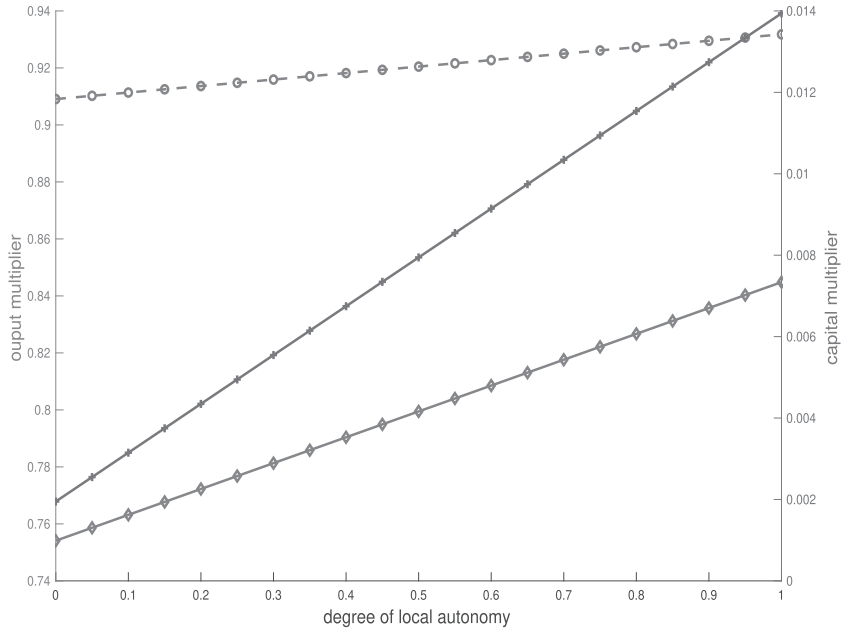

Fig 7. Government Spending Multipliers as a Function of Local Autonomy.

NOTES: The graph presents the impact government spending multipliers for output (blue circled and diamond lines) and capital (red crossed lines). We report the values of the multipliers as functions of parameter λ that captures the share of local spending used in the production of the local public good that we take it captures the degree of local autonomy.

in our calibration and capital multipliers are positive and increase with the degree of local autonomy.

5.3 Sensitivity Analysis

In this section, we examine the sensitivity of our results to various assumptions and parameters that are difficult to calibrate, or for which we cannot take a steady stance about how they should be modeled in our theoretical framework.

To start with, we have set the size of the region equal to the average size of a region in our sample. Most of the regions in our empirical analysis are small, yet bigger regions also exist in our sample (Catalonia and Lombardy, for example, represent approximately 20% of Spanish and Italian GDP, respectively). Figure D2 in the online appendix reports output and capital multipliers when we vary the degree of local autonomy together with the size of the home region from 5% to 45%. For any size of the region, multipliers are a positive function of the degree of local autonomy.

In the baseline analysis, we have set the home bias parameter equal to 0.66 to account for the fact that a substantial amount of goods produced regionally involves services that are mostly local. Yet, within a country, many services are tradable. When

we analyze the sensitivity of our results to the degree of home bias, we show that home bias is crucial in determining the size of the regional output multiplier but not in affecting its relationship with the degree of local autonomy (see Figure D2 in the online appendix).

The analysis of the productive role of public capital accumulation and public services has been established in the mainstream economic literature by the seminal work of Arrow and Kurz (1970).[16] Empirically, Holtz-Eakin (1994) casted doubt in these results by showing that in the data, the marginal product of public capital is uniformly lower than the marginal product of private capital.[17] Since the existing literature has not reached a consensus about the size of the productivity of the public good in the private production function, we analyze in the online appendix how the productivity of the public good affects the size of regional multiplier. Similarly, with our empirical findings, if we only consider local autonomy, without interacting it with the goods and services provided by the government at the local level, we would have ended up concluding that local autonomy does not matter. In our theoretical model, when the public good is not productive (i.e., $\mu = 0$), increases in the degree of local autonomy do not translate in increases in the regional multiplier, since the additional supply side effect from the regional fiscal expansion is nullified in this calibration. On the contrary, it is obvious that for higher productivity of the public good, the regional multipliers for both output and capital increase more steeply with the degree of local autonomy, since in that case, the size of μ determines the size of the positive output effect stemming from the regional fiscal expansion.

We next examine the sensitivity of our results, when we vary the degree of price stickiness in the model. Price stickiness determines the size of the demand effect generated by the fiscal expansion, the stronger the increase in demand the bigger the multiplier independently of the value of the degree of local autonomy. Yet, the relationship between the degree of local autonomy and multipliers for output and capital remains always a positive one (see Figure D3 in the online appendix).

Finally, in the existing literature that concerns the economic effects of decentralization, most authors use the budget data approach and approximate the degree of fiscal decentralization using the share of subnational government expenditures/revenues in general government expenditures/revenues; net of intergovernmental transfers (see, e.g., Xie and Zou 1999). In our model, such a measure corresponds to the parameter ξ, which denotes the share of spending that the local government receives from the total spending in the region. In the online appendix, we show that the relationship between regional multipliers and degree of local autonomy is not affected when we vary ξ. It is key to emphasize that in the model, higher values of ξ, for a given degree of local autonomy, decrease the capital and output multipliers (see Figure D3 in the online appendix). This theoretical prediction is important to understand why measur-

16. Followed by contributions by Aschauer (1989b), Barro (1990), Baxter and King (1993), Fisher and Turnovsky (1995), Corsetti and Roubini (1996), Turnovsky (1996), among others.

17. Kocherlakota and Yi (1996) later questioned these results.

ing local autonomy as the share of subnational government expenditures in general government expenditures can be misleading. To understand the intuition behind this result, consider the limiting case of $\lambda = 0$. For $\lambda = 0$, increases in ξ decrease the regional spending multiplier. Naturally, if $\lambda = 0$, the regional spending is unproductive, so the more is spent by the local government, the more the central spending that is useful for the production of the public good is crowded out and the smaller is the regional multiplier. Given that our assumed region is small, the gradual increase in the share of local spending decreases further central spending. Moreover, given the assumed Cobb–Douglas production for the public good, this decreases local public output and, as a result, the size of the capital and output multipliers in equilibrium.

6. CONCLUSION

This paper examined the effect of local autonomy on the government spending multiplier. Our empirical analysis revealed that government spending in more autonomous regions (i) delivers a higher multiplier; (ii) is more effective during recessions; and (iii) has a more positive effect on private capital.

We have built a general equilibrium model of a region in a monetary union to structurally interpret our empirical findings. The model is standard, and we differentiate from the existing literature by assuming that the local public good, which enhances local private productivity, is produced using regional and central spending as inputs. In the model, the multiplier increases with the weight of local spending in the production technology of the local public good. Hence, the model implies that governments that are more autonomous build more efficiently public goods and this induces supply side effects from government spending that increase the size of the government spending multiplier. By enhancing private productivity, the production of the public good also stimulates the accumulation of private capital. Hence, in regions with more local autonomy, that produce more efficiently public goods, the effects of government spending on private capital are also higher.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table A1: The Correlation between the Local Autonomy Index and the Share of General and Local Government Consumption Expenditure in GDP across 27 EU Countries and the UK for the Period 1995–2014

Table D1: 2SLS Estimates of Equation (2)

Table D2: Replication of Coelho (2019) and Sample Split by Low vs. High Local Autonomy

Table D3: Replication of Amendola et al. (2020) and Sample Split by Low vs. High Local Autonomy

Table D4: Replication of Boehm (2020) and Sample Split by Low vs. High Local Autonomy

Figure D1 Panel A: Distribution of Local Autonomy Index

Figure D2: Sensitivity analysis A.

Figure D3: Sensitivity analysis B.

Figure D4: Sensitivity analysis C.