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STRUCTURAL REFORMS DURING THE GREEK ECONOMIC ADJUSTMENT PROGRAMME: THE AMALGAMATION OF MUNICIPALITIES

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JEL Classification: H72; H77; R51; R53

Keywords: difference-in-differences, matching, amalgamation, current costs, investments

Structural reforms during the Greek economic adjustment programme: the amalgamation of municipalities[1]

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Abstract

Amalgamation reforms have been extensively implemented in several countries as policy instruments to improve local government service provision and reduce costs based on scale economies. However, their effectiveness has proved ambiguous in practice. We investigate the impact of a substantial large-scale amalgamation that took place in Greek municipalities in 2010, and its effect on per-capita current costs and investments. Using data for the 2005-2018 period, we find very weak evidence of the reform on current costs, while the amalgamation of municipalities is associated with a significant decrease in per capita investment around 31%. This effect is robust, persistent, and associated with a substantial decline in GDP per capita of about 13% over the sample period.

Keywords: difference-in-differences, matching, amalgamation, current costs, investments

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1. Introduction

In the last 50 years, municipalities across Europe have faced diverse economic and government budget challenges that put pressure on their performance in terms of efficiency, effectiveness, and quality of public services. On the one hand, the demand for the provision of public goods has registered a general increase. Citizens are more conscious and demand a wider and more specialized set of public goods, together with greater accountability and transparency than in the past. On the other hand, the fulfilment of the EU requirements for fiscal discipline in public finance, imposed by central governments to local governments, has led municipalities to reduce their expenditures. Therefore, municipalities - especially small ones, in terms of populations - often find it difficult to meet the demands for generally acceptable levels of local public goods while reducing their expenditures.

To deal with these issues, central governments have been experimenting with institutional tools, such as the amalgamation of municipalities and intermunicipal cooperation in an effort to exploit scale economies. The main objective of such reforms is to gain benefits from economies of scale, as per capita public expenditures are expected to decrease for the amalgamated municipalities since larger administrative units could be able to provide public goods and services with significantly lower average unit costs (Blesse and Baskaran, 2016; Lima & Silveira Neto, 2018). Conversely, reduced levels of services could lead to lower expenditures even if scale economies are absent. The amalgamation of municipalities could also improve public services by reducing tax rivalry between municipalities (Lima & Silveira Neto, 2018).

In particular, there is a recent strand of literature investigating the effect of amalgamation on municipal financial outcomes. Reingewertz (2012), using Israeli data, found that amalgamated municipalities display lower per capita expenditure after amalgamation relative to non-amalgamated ones. The same results are observed for German (Blesse and Baskaran, 2016) and

Swedish municipalities, although the results for the latter hold only if municipalities do not exceed a critical population size (Hanes, 2015). Ferraresi, Migali and Rizzo (2018) examined whether intermunicipal cooperation has an impact on the level of per-capita expenditure of the single municipalities using evidence from the Emilia Romagna region, Italy. They found that municipal union reduces the total per capita current expenditures without affecting the level of local public services.

By way of contrast, Moisio and Uusitalo (2013) noticed that Finnish municipalities' spending was higher in merged municipalities, even 10 years after amalgamation. Roesel (2017) found that mergers of large local governments do not reduce per capita total expenditures as well as specific categories, such as social care, education, or administration, in German districts. Finally, Allers and Geertsema (2016), using data on Dutch municipalities, found no significant effect of amalgamation on aggregate spending, taxation and the provision of public services. Interestingly, in a recent paper for Brazilian local governments Lima & Silveira Neto (2018) investigated the impact of the municipal secessions on local expenditure, showing that municipalities involved in the secession process increase per capita capital expenditure.

Our study aims to shed fresh light to this debate by investigating the municipal amalgamation process that initiated in 2010 in Greece and was put into effect on January 1, 2011. Overall, this municipal amalgamation reduced the number of municipalities from 1,034 (910 municipalities and 134 communities) to 325. In total, 86 municipalities were not affected from this mass reform. This policy intervention was aimed to improve the public financial management and administration of local governments and was part of the economic adjustment programme of the country (European, Commission, 2011). Given the overall expenditure reduction purpose of the programme, in this study we focus on the amalgamation effect on current costs and investments.

Specifically, our objective is to identify the impact of the amalgamation process by implementing a Difference-in-Differences (DiD) approach. Yet, to control for various potential sources of

biases that may arise due to the heterogeneity of the municipalities in our sample, we adopt parametric and nonparametric DiD matching methods. In order to improve the reliability of our empirical results, as well as validate our research design, we also carry out a large battery of robustness checks. First, we perform a classical placebo test; moreover, we trim the data by removing possible outliers in terms of expenditure, which shows that results on per capita investment do not depend on outliers. Third, we show that main results are robust to the implementation of the DiD research design to the subset of municipalities in the common support[7].

This study takes advantage of the program evaluation literature and employs a unique dataset created by compiling the annual municipal financial reports of Greek municipalities. Following the empirical literature, we identify the impact of the amalgamation process on various items of government expenditure using both a conventional DiD research design as well as a DiD with matching, in order to increase the likelihood that municipalities in the treatment and control groups are similar along a rich set of observable characteristics

Our findings provide sparse evidence of a statistically significant decline of current costs after the amalgamation reform; importantly, the results are not robust when we trim the sample by excluding the municipalities with the highest and lowest per capita current costs. By way of contrast, in the case of per capita investment spending, we find a robust decline following the amalgamation in the order of 11 to 31%.

While there is a vast body of empirical literature engaged in analyzing the impact of municipal amalgamation processes[8], evidence aimed to directly evaluate the efficiency in the provision of

[7] To the best of our knowledge, there is only one study examining the effect of the amalgamation process in Greece (Pazarskis et al., 2019). Relying on financial indicators such as cash holdings and debt, they show that, after the amalgamation, treated municipalities increased their cash holdings and reduced their short-term debt. However, their statistical analysis mainly rests on various t tests for the equality of means.

[8] See for example Tavares (2018) for a comprehensive literature review on the effects of municipal amalgamation.

local services is rather limited, with the exception of Reingewertz (2012). Furthermore, we use nighttime light from satellites to gauge per capital GDP differentials at local level, as a proxy of local conditions and we assess whether the observed reduction of expenditure after the amalgamation process led to a deterioration of local economic output. Conversely to Reingewertz (2012), we do observe a statistically significant decrease in local GDP due to the amalgamation, implying that local economic growth has declined as a result of lower public investment in the merged municipalities after amalgamation. We interpret this result by arguing that the fall in investment spending may not be due to higher efficiency – allowing the same investment projects to be realized at lower costs or to avoid some duplications – but to a decrease in the accumulation of productive capital by local municipalities, which in turn might have resulted in a deterioration on their economic performance.

In addition, the amalgamation reform took place at the beginning of the Greek sovereign debt crisis, while a perquisite of the economic adjustment programme for Greece established that "parliament should adopt legislation to reform public administration at the local level, notably by merging municipalities, prefectures and regions with the aim of reducing operating costs and the wage bill" (European Commission, 2011; Chortareas and Logothetis, 2016). Nevertheless, in light of our findings, it can be inferred that this component of the economic adjustment programme for Greece appears to have been ineffective, as we found very weak evidence that it brought about a reduction in current costs due Moreover, we observe that the amalgamation reform is associated with a significant reduction in per capita investment, possibly impairing the competitiveness of local municipalities, as the evidence on local GDP, proxied by satellite nights, seems to suggest

The structure of the paper is as follows. Section 2 describes the institutional framework of the administrative structure in Greece; Section 3 gives an overview of the data used in this study, while Section 4 illustrates the empirical strategy. Sections 5, 6 and 7 present and discuss the

results, robustness checks and heterogeneous effects, respectively. Finally. Section 8 reports the results for output and Section 9 concludes.

2. Institutional framework

The idea of decentralized responsibilities among different levels of central and local governments emerges mainly from the fiscal federalism theory, assuming that a federal system can be efficient and effective in addressing challenges, such as equitable income distribution, efficient and effective resource allocation, and economic stability (Kapucu, 2016). It is important to note here that the effective amount of local public goods is likely to differ across different administrative levels, due to discrepancies in both preferences and costs (Oates, 1999).

The implementation of fiscal federalism theory could lead to lower planning and administrative costs as differences among local administrative levels are taken into account, while competition among local governments supports organizational and political innovations and more efficient politics (Kapucu, 2016). Nevertheless, the lack of accountability of central and local governments, the lack of qualified personnel and unavailability of infrastructure at the local level could be significant obstacles in the success of a decentralised administrative system.

Grounded on the fiscal federalism theory as described above, a new strand of fiscal federalism literature -named second generation fiscal federalism- explores the functionality of different political and fiscal institutions in a context of imperfect information and control (Oates, 2005, p. 356). Second generation fiscal federalism implies that political institutions impose priorities on public officials that frequently differ from the maximization of social welfare (Brueckner, 2006).

Finally, quite an extensive strand of literature has investigated the impact of decentralized public spending on economic growth. Many scholars confirmed a positive relationship between decentralization and growth (Yilmaz, 1999; Lin and Liu, 2000; Akai and Sakata, 2002; Thiessen,

2003; Stansel, 2005; Iimi, 2005; Brueckner, 2006). On the contrary, zero or negative association between fiscal decentralization and growth has been identified in several other studies (Davoodi and Zou, 1998; Zhang and Zou, 1998; Woller and Phillips, 1998; Xie et al., 1999).

In this context, the federalist organization of central governments is undergoing many adjustments in order to cope with the changing environment (Soguel, 2006). Considering the fiscal constraints, "each government level has to a certain extent, attempted to delegate tasks and costs to the lower fiscal tier while preserving its responsibility to decide if the service has to be provided and according to which standards" (Soguel, 2006).

In Greece, the implementation of fiscal federalism theory through the compulsory amalgamation reform called "Kallikratis" programme, led to three levels of administration: central state, regions, and municipalities. Another administration unit, named Decentralized Administration Authorities exist between the central state and the regions but it is not a level of local government but a purely administrative one (Government Gazette 87A/2010, 2010).

In brief, the administrative division of Greece after the 2010 reform was transformed as:

1. At the first-tier local government, the number of municipalities and communities reduced from 1,034 (910 municipalities and 124 communities) to 325 municipalities (Government Gazette 87A/2010, 2010).
2. At the second-tier local government, 13 administrative regions have been established replacing the 54 prefectures.
3. Simultaneously, seven decentralized administration units have been instituted, to supervise the first and second-tier local governments.

Overall, the "Kallikratis" programme introduced 239 amalgamations, while 86 municipalities were not affected from this mass reform. In fact, this was not the first amalgamation process that took place in Greece. Another amalgamation process took place in 1998, called

"Kapodistrias" reform, which both increased the total number of the Greek municipalities from 441 (and 5,823 communities) to 910 municipalities (and 124 communities) and also increase their average size, in terms of area and population, by incorporating former communities (Government Gazette 244A/1997, 1997). The local administrative structure that existed before the two aforementioned amalgamation processes included 7 regions, 56 prefectures and 441 municipalities (and 5,823 communities) until 1998. In addition, some thousand communities existed, which were incorporated in nearby municipalities during the amalgamations.

The criteria for the establishment of the administrative boundaries of the new local authorities were the following (Ministry of Interior, 2010a):

- Population factors i.e., number of citizens, number of inhabitants, population density.
- Social factors i.e., average household size, educational indicators, percentage of foreigners.
- Economic factors i.e., employment, employment structure, labour mobility, income.
- Geographic factors i.e., area and morphology, shape, accessibility, infrastructure networks.
- Development factors i.e., the structure of local economic activity and local development in general, the existence of educational and research bodies, participation in European and National Programmes.
- Operational and sustainability factors in terms of resources and endogenous working personnel.
- Cultural, historical, and other spatial factors.

In addition, following the implementation of the aforementioned reform, the criterion of a minimum population size of 10,000 permanent residents for the new municipalities was introduced (Ministry of Interior, 2010b). For the metropolitan areas of the urban complexes of

Athens and Thessaloniki this limit was set at 25,000 permanent residents. Exceptions were made only for the mountainous areas, where the population threshold was set at 2,000 inhabitants and on the islands, where the rule of one municipality per island was adopted, except for the two big ones of Crete and Evia (Ministry of Interior, 2010a).

In the light of the implementation of the reform, the population variance of the Greek municipalities after the Kallikratis reform was very large, as municipal population in 2011 ranged from 81 people, for the remote island of Gavdos to 789 thousands, for the municipality of Athens (Hellenic Statistical Authority, 2011).

Municipalities, which form the lowest level of local authorities, are responsible for managing community affairs (Government Gazette 87A/2010, 2010). They manage and regulate all local issues in accordance with the principles of subsidiarity and proximity in order to protect, develop and continuously improve the interests and quality of life of the local community. In particular, a set of responsibilities has been formulated in 8 pillars of activities in diverse fields, namely development, environment, quality of life and proper functioning of cities and settlements, employment, social protection and solidarity, education, culture, and sports, civil protection and rural development-livestock-fisheries (Kyvelou and Marava, 2017).

The "Kallikratis" reform was introduced, as mentioned before, in 2010, amid the beginning of the Greek sovereign debt crisis and coincided with the economic adjustment programme for Greece. In fact, the economic adjustment programme provided detailed steps of structural reforms on public services in Greece (European Commission, 2011; Ladi, 2012). In addition, the economic adjustment programme presupposes the reduction of the salaries of all political officials at the local level, i.e., the elected and related staff, by 10%, as well as the decrease of the number of deputy mayors and related staff (European Commission, 2011; Dimitropoulos, 2012). Indeed, the economic adjustment programme clearly stated that "parliament should adopt legislation to reform public administration at the local level, notably by merging municipalities,

prefectures and regions with the aim of reducing operating costs and the wage bill" (European Commission, 2011; Chortareas and Logothetis, 2016).

3. Data

For this study we rely on a unique dataset on expenditures and revenues of Greek municipalities by incorporating data from 2005 to 2018. A unique dataset has been assembled for the very first time, by compiling the annual municipal financial reports, coming from different sources upon special access request. The data on municipal revenues and expenditures were obtained by the Hellenic Statistical Authority for the period 2005-2009 and the Ministry of Interior for the period 2011-2018 (Hellenic Statistical Authority, 2019; Ministry of Interior, 2019) by means of financial reports[9].

The dataset includes detailed disaggregation on both expenditures and revenues, for all municipalities in the sample period. Each category, is subsequently broken down in two subgroups, including five sub-categories for revenues (regular revenues, extraordinary revenues, income from past financial years, receivables from loans and previous financial years, receipts for the State or third parties and refunds, cash balance) and four for the expenditures (current costs, investments, payments from previous financial years returns and forecasts, reserves)[10].

However, along with the transfer of responsibility for the Hellenic Statistical Authority to the Ministry of Interior, a new encoding system was introduced. In fact, the implications of the new encoding system included the further disaggregation of the sub-categories in several lower-level clusters. In order to harmonize and correspond the new system with the previous one, we summarize the lower-level clusters to sub-categories. Finally, the revenues and expenditure of each respective reference year, were reported on different files after the amalgamation. Hence,

[9] The respective authority collecting the data changed in 2010, and thus no reliable data are available for this year.

[10] For further details about the categories and their definitions, see Appendix A.

we had to integrate them to a unique dataset per year and afterwards merge the annual files into the unique database.

In 2009, just before the implementation of the "Kallikratis" reform, the total expenditures of the local administration in Greece were 4.1% of GDP, while in 2011, they reduced to 3.2% of GDP. Similarly, total revenues were 4.1% of GDP in 2009 and dropped to 3.4% of GDP in 2011 (Eurostat, 2021a). In terms of the overall budget of the general government, in 2009 the total local administration's revenues represented the 19.45% of general government's revenues, while total expenditures accounted for 11.67% of general government's expenditures. In 2011, the corresponding shares of total revenues and total expenditures were 12.47% and 8.22%, respectively (Ministry of Finance, 2011; 2013).

While this might be considered as a minor part of the public sector in Greece, the municipalities are highly dependent on the state, as over the 2005-2018 period, almost 50% of their total revenues came from intergovernmental grants. The other half of their revenues came from taxation, fees, and other independent resources[11]. Figures 1 and 2 below present the evolution of current costs and investments over the period of analysis. As it is evident, both indicators present a significant drop after 2011, for both amalgamated and non-amalgamated municipalities.

[11] For a full description of total revenues please see Table A.1 in Appendix A.

Figure 1. Current costs per capita in amalgamated and non-amalgamated municipalities (2005-2018)

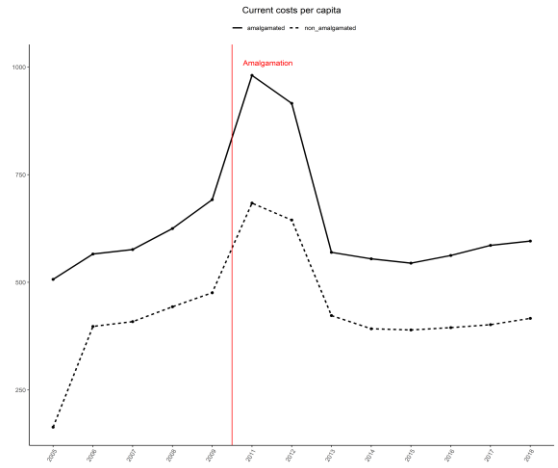
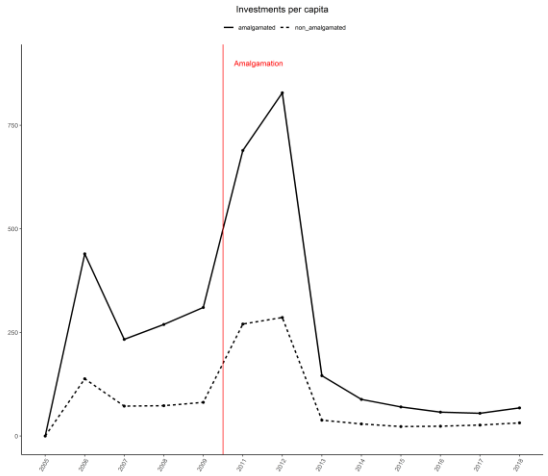
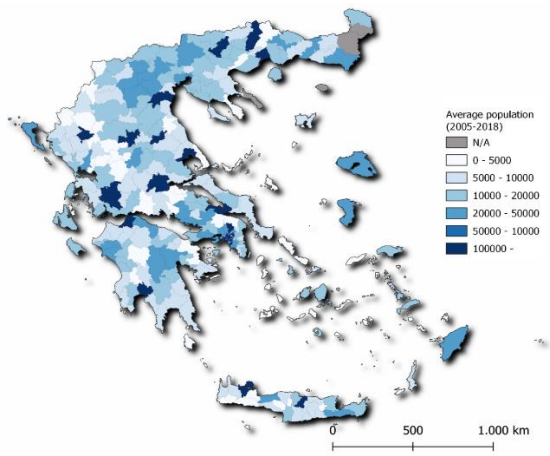


Figure 2. Investments per capita in amalgamated and non-amalgamated municipalities (2005-2018)

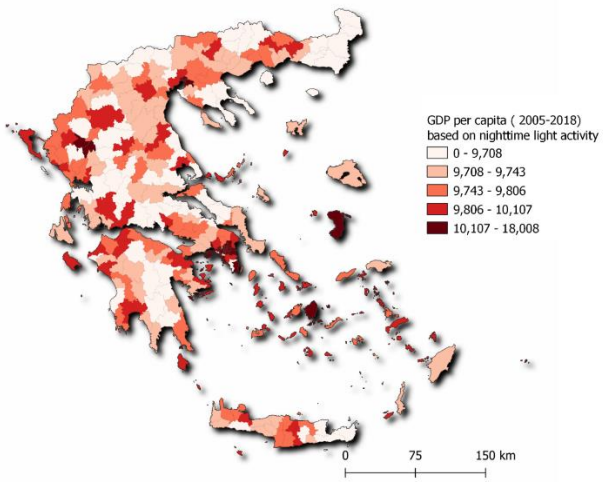


Furthermore, a number of municipal demographic and socioeconomic data are collected from different sources, including population (total and different age groups), number of births and deaths, number of road accidents (various indicators) and employment. The average population of municipalities for the period 2005-2018 is presented in Map1, below. The sources and details of the data are reported in Appendix A and summary statistics in Appendix B. In addition, we use remote sensing and satellite imagery to proxy economic activity at municipal level, as no official GDP data are available. By doing so, we generate GDP per capita at municipal level (see Map. 2 below). Several studies used satellite images of local nighttime light to proxy economic activity and development at municipal level (Henderson et al., 2012; Kulkarni et al., 2011; Mellander et al., 2015) . Details about the nighttime light activity indicator and its calculation are reported on Appendix C.

Map 1. Average municipal population (2005-2018)



Map 2. Average GDP (log) per capita (2005-2018) based on nighttime light activity



In order to compare the pre and the post-amalgamated municipalities, the dataset has been aggregated. It is important to note that in order to compare treated municipalities before and after the merger, the financial reports of the municipalities that will be eventually merged have been also merged before the implementation of the reform. This means that, for every x municipalities which were amalgamated, we generate one observation for every year prior the amalgamation, instead of x observations. Overall, we have data available for all 325 Greek municipalities over the reference time frame. We use fiscal data for each municipality, in per-capita terms, as an aggregate measure to compare the performance of amalgamated and non-amalgamated municipalities.

4. Empirical Strategy

Our first objective is to identify the average effect of the amalgamation reform on the expenditures of amalgamated municipalities. Ideally, we would like to compare decisions on expenditures for municipalities that were amalgamated (treated group), to the same decisions for municipalities in the counterfactual situation of not being amalgamated. This is impossible, and the best alternative would be to run a randomized control trial, which assigns participation and

non-participation to the treatment status, allowing us to compare the average expenditures of the two groups. Since in our analysis we cannot make use of a controlled randomized trial, we have to turn to quasi-experimental methods in order to define a suitable control group that can credibly estimates the counterfactual. The main concern regarding identification using this approach relates to unobservable characteristics that may vary between amalgamated and non-amalgamated municipalities, which might be correlated to municipality expenditures and treatment status. We address this in a number of ways. The first method we implement is a conventional DiD approach. In particular, we exploit the panel dimension of the dataset and evaluate whether the change in municipality expenditure after the reform has been different in the treated municipalities (i.e., those experiencing a merger) with respect to control municipalities (i.e., those that did not experience any amalgamation during the sample period).

In particular, we identify the effect of the amalgamation by estimating various versions of the following two-way fixed effects model:

$$Y_{it} = \mu_i + \tau_t + \gamma Amalgamation_{it} + \beta x_{it} + \epsilon_{it}, \qquad (1)$$

where Y_{it} is log of the per capita expenditure (i.e., either current or investment expenditures) in municipality *i* at time *t*; *Amalgamation* is a dummy variable that takes on the value of one if the municipality *i* at time t has been amalgamated and zero otherwise; x_{it} includes the control variables described in Section 3. To take account of unobserved time-invariant heterogeneity across municipalities, we include a set of municipal fixed effects, μ_i; while we control for shocks common to all municipalities in period *t* by adding year fixed effects, τ_t. Moreover, since Greek regions might have experienced differential growth paths over the considered period, one might argue that there could be other unobservable characteristics related to the specific region that might influence municipal choices over spending decisions and thus the decisions by policymakers to merge or not certain municipalities. For this reason, in additional specifications

we augment model (1) by including an interaction of region-by-year fixed effects. Finally, ϵ_{it}, is the error term, clustered at the municipal level. It is important to note at the outset that in this estimating framework, the coefficient γ represents our DiD estimate of the effect of municipal amalgamation on public spending.

While the decision of merging municipalities is ultimately a national governmental choice and hence it seems unlikely that one single municipality could influence this process, there is still one potential source of bias that might affect our estimation approach. Indeed, the amalgamation decision is not random; therefore, municipalities in the control and treatment group might be different along several dimensions. This might invalidate our identification strategy, for example by violating the parallel trend assumption. We address this concern in different ways. First, the inclusion of municipality fixed effects should control for any time-invariant unobservable characteristics that might be correlated with municipality expenditures as well as treatment status. Moreover, we also combine a DiD identification strategy together with a matching procedure. The main purpose of matching is to find a group of non-treated municipalities, which are similar to treated ones in all relevant pre-treatment characteristics, **x**, the only remaining difference being that one group is subject to amalgamation and the other group is not (selection on observables).

In the first stage, we therefore estimate the propensity score (PS) of being amalgamated using a discrete response model. In particular, we use data from the 2001 Census and run a logit regression, where the dependent variable is given by a dummy variable which takes on the value of 1 if the municipality is amalgamated and zero otherwise. The included control variables are population, per-capita surface (area per-capita), population disaggregated by age (aged), working age population, labor force participation rate, unemployment rate, youth unemployment rate and local GDP, in per-capita terms, at the NUTS III level. All these variables refer to the year 2001. The results of the estimation of the propensity score model are reported in Table D.1 of the

Appendix D. Once we have obtained the propensity score, following Sianesi (2004) and Smith and Todd (2005), we adopt a trimming procedure to define the common support as the region of values of the PS that have positive density within both the treatment and control groups distributions. We then re-estimate Equation (1) by using information only on the observations that lie on the common support.

5. Results

5.1. A test for the common trend assumption

The existence of a common trend is the key identifying assumption for the validity of a DiD identification strategy. In the framework of this analysis, the assumption implies that in the absence of the amalgamation process, merged municipalities would have experienced the same trends in their expenditure as the control ones. While this is not testable, an event-study analysis can shed some light on the validity of the research design. Specifically, following Autor (2003), the interactions of time dummies and the exposure indicator for pre-treatment periods are added to the baseline specification of Eq. (1). If the trends in expenditure are the same, then the interactions should not be statistically significant, i.e., the DiD coefficient is not significantly different from zero in the pre-treatment period. An attractive feature of this test is that the interaction of time dummies after the treatment (up to 7 years) with the treatment indicator is informative and can show whether the effect changes over time. In detail, the following specification is estimated as:

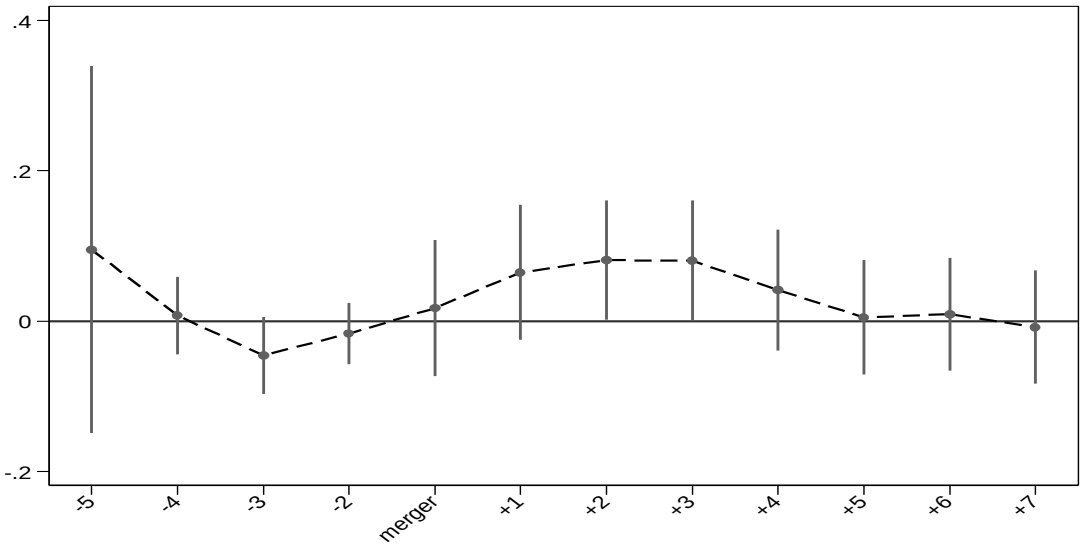
$$Y_{it} = \mu_i + \tau_t + \ + \sum_{\pi=2}^{5} \gamma_\pi \, Amalgamation_{i,\pi} + \sum_{\tau=0}^{7} \gamma_\tau \, Amalgamation_{i,\tau} + \beta x_{it} + \epsilon_{it}, \quad (3)$$

The omitted year is the year before the national law imposing mandatory mergers. This specification allows testing for the presence of parallel trends in the pre-treatment period, namely, whether the coefficients associated with the lead (γ_π, with π going from 5 years to 2

years before the adoption) are not statistically different from zero. As already anticipated, this approach is convenient to understand whether the treatment effect fades, increases, or stays constant over time, depending on the estimated coefficients of the lags (γ_τ, with τ going from the year of adoption to 7 years since the amalgamation).

As for current costs, the estimates and their 95% confidence intervals are plotted in Figure 3. As it is evident, there is no difference in expenditures over the pre-treatment period. In a similar manner, the coefficients associated to lags turn out to be not statistically significant at the conventional level. The only exception is given by the coefficient associated with "2 years" and "3 years" after the merger, which turns out to be positive and statistically significant. This implies that the current costs of amalgamated municipalities were higher 2 and 3 years after the merging process as compared to 1 year prior. This might simply reflect the presence of adjustment costs occurring immediately after the merger.

Figure 3: Autor test on (log) current costs per capita

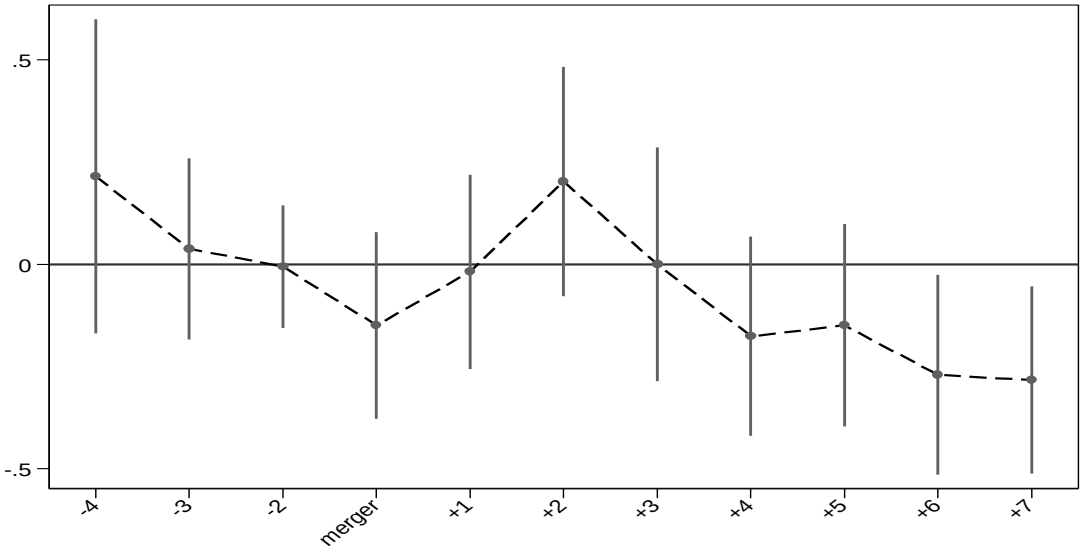


Investments' estimates and their 95% confidence intervals are depicted in Figure 4.[12] According

[12] Point estimates are reported in Table D.2 of the Appendix D.

to the estimates, there is no difference in investment expenditure over the pre-treatment period. Likewise, the coefficients associated to lags turn out to be not statistically significant up to 5 years after amalgamation. On the contrary, we observe a significant reduction in investment spending 6 and 7 years after the amalgamation.

Figure 4. Autor test on (log) investments costs per capita



Overall, these results seem to validate the research design, as there is no evidence against the presence of a common trend between treated and control units.

5.2 Baseline results

The results of the first set of three regressions estimated using as dependent variable the (log of) per capita current costs are provided in Table 1, while that using the (log of) per capita investment expenditure are shown in Table 2.

In particular, in column 1, we estimate Equation (1) in the full sample, including only municipal- and year-fixed effects. Model in column (2) includes the following additional covariates:

population, population density and inverse population. Column (3) takes into account region-by-year fixed effects. A potential source of bias that might affect our results is the omission of vertical transfers, hence, column (4) also controls for grants from upper-level governments.

To control for bias arising when municipalities in the treatment group differ from those included in the control group, we report estimates obtained by restricting the analysis on the subsample of matched municipalities in columns 5 through 8.

The results in Table 1 show a negative effect of amalgamation on current costs, but results are not very consistent across specifications. In particular, significant effects associated with the amalgamation reform only arise when we control for region-by-year fixed effects as well as for vertical transfers, thereby suggesting that it is important to account not only for transfers and other covariates, but also for region-specific trends. We find very similar results when estimates are run on the sample of matched municipalities.

Table 1. Current costs per capita in logarithmic scale

Dep. Variables	Current costs				Current costs matching			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Amalgamation	0.056	0.030	-0.024	**-0.101****	**0.116***	0.071	0.006	**-0.123****
	(0.048)	(0.042)	(0.052)	**(0.042)**	**(0.067)**	(0.057)	(0.057)	**(0.057)**
Observations	4,136	4,136	4,136	3,982	3,070	3,070	3,070	2,961
R-squared	0.797	0.805	0.818	0.853	0.780	0.790	0.805	0.844
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Transfers	No	No	No	Yes	No	No	No	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region * year FE	No	No	Yes	Yes	No	No	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%.

Turning to investment expenditure, Table 2 indicates that the amalgamation of municipalities has led to a significant decrease in the (log of) per capita investment. In particular, following cols. 1 through 4, we find a negative and robust effect of amalgamation on investment decisions', the size of the coefficients being also remarkably similar across models. In terms of magnitude, the

amalgamation process leads to a decrease in the (log of) per capita investment in the range of 11%- 20%. Findings are also consistent when we rely on the sample of matched municipalities. In this case, the coefficient associated with amalgamation is found to be negative and statistically significant in the most demanding models (col. 7 and 8), with the size of the coefficients being more pronounced as compared to that of cols. 3 and 4, ranging from -12% to -31%.

Table 2. Investments costs per capita in logarithmic scale

Dep. Variables	Investments				Investments matching			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Amalgamation	-0.128	**-0.168***	-0.112	**-0.206****	-0.125	-0.175	**-0.220***	**-0.307*****
	(0.095)	**(0.094)**	(0.102)	**(0.097)**	(0.122)	(0.121)	**(0.120)**	**(0.099)**
Observations	3,834	3,834	3,834	3,832	2,837	2,837	2,837	2,836
R-squared	0.779	0.782	0.797	0.836	0.772	0.774	0.790	0.840
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Transfers	No	No	No	Yes	No	No	No	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region * year FE	No	No	Yes	Yes	No	No	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%.

6. Robustness checks

In this section, the validity of previous results is confirmed by a battery of robustness checks that are intended to address possible issues related to the research design and could bias the baseline estimates. First, the classical placebo test is performed, then we move to a falsification exercise to prove that the estimated effects do not ensue from outliers.

6.1. Placebo Test

A common way to conduct a placebo test in the context of DiD analysis is to focus on the span prior to the shock, that is to simulate what would have happened to the expenditure of amalgamated municipalities if a fake year of the "Kallikratis" programme forcing mandatory merger was used. Specifically, we replicate the main analysis by assuming that the amalgamation occurred 1, 2 and 3 year(s) earlier than the true data. Were the coefficient associated to

amalgamation significant, it would suggest that even before the true year of the merging process, future treated municipalities had already a different path of expenditure, thus casting doubt on the validity of previous results.

The placebo exercise does not lead to any effect on expenditure as the γ coefficient turns out to be indistinguishable from zero in the specification that uses current costs as the dependent variable (Table 3, cols. 1, 2 and 3), and in the specification where investment decisions is used as the dependent variable (Table 3, col. 4, 5 and 6).

Table 3. Placebo

Dep. Variables	Current costs			Investments		
	(1)	(2)	(3)	(4)	(5)	(6)
Amalgamation fake 2007	-0.065			-0.203		
	(0.059)			(0.188)		
Amalgamation fake 2008		-0.021			-0.128	
		(0.041)			(0.105)	
Amalgamation fake 2009			-0.005			-0.083
			(0.035)			(0.095)
Observations	1,551	1,551	1,551	1,251	1,251	1,251
R-squared	0.761	0.760	0.760	0.733	0.733	0.732
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%.

6.2. Outliers

To check the robustness of our findings with regards to excluding extreme values, we replicate regressions in Tables 1 and 2 by dropping all observations in which the dependent variable is below the 1st or above the 99th percentile. In the same spirt, we exclude observations in which the dependent variable is below the 5th percentile or above the 95th percentile.

Results for current costs are shown in Table 4 – Panel A and it emerges that current costs are not affected by the amalgamation process, as the coefficient turns out to be not statistically different from zero in almost all specifications. These results also indicate that findings outlined

in the baseline setting are likely to be driven by some outliers, and hence we are very cautious in interpreting them.

As far as expenditure on investment is concerned, results in Table 4 – Panel B suggests that the main findings are not driven by outliers, as the amalgamation coefficient is negative and statistically significant at the 10% level, both in the case where the sample is trimmed at 1% (columns from 1-4) and at 5% (columns from 5-9). Overall, these results are reassuring of the robustness of negative effects of the amalgamation reform on the level of municipal investment.

Table 4. Current costs and investments (trimming 1% and 5%)

	Panel A: Current Costs							
	Trimming 1%				Trimming 5%			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Amalgamation	**0.081***	**0.059***	0.032	-0.032	0.041	0.040	0.026	-0.028
	(0.042)	**(0.035)**	(0.041)	(0.035)	(0.039)	(0.035)	(0.039)	(0.034)
Observations	4,054	4,054	4,054	3,906	3,722	3,722	3,722	3,595
R-squared	0.852	0.865	0.872	0.893	0.834	0.847	0.856	0.884
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Transfers	No	No	No	Yes	No	No	No	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region * year FE	No	No	Yes	Yes	No	No	Yes	Yes
	Panel B: Investments							
	Trimming 1%				Trimming 5%			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Amalgamation	**-0.157***	**-0.204****	**-0.152***	**-0.233*****	**-0.262*****	**-0.289*****	**-0.251*****	**-0.297*****
	(0.086)	**(0.085)**	**(0.092)**	**(0.082)**	**(0.076)**	**(0.076)**	**(0.086)**	**(0.074)**
Observations	3,758	3,758	3,758	3,756	3,451	3,451	3,451	3,449
R-squared	0.793	0.795	0.811	0.855	0.772	0.775	0.798	0.844
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Transfers	No	No	No	Yes	No	No	No	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region * year FE	No	No	Yes	Yes	No	No	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%.

To sum up, the analyses conducted in this section, along with the evidence supporting the presence of a common trend, have strengthened the evidence of a negative relationship between municipal amalgamation and investment expenditure of municipalities. In addition, the results indicate that it is very likely that such an effect is due to the shock caused by the "Kallikratis" programme, as no other plausible explanations that might hold against a causal interpretation of this relationship are found.

7. Heterogeneous effects

To investigate whether there is evidence of heterogeneous effects, we analyze how the effect of amalgamation varies along several dimensions.

Permanence

In order to investigate whether there has been a heterogeneous response according to the time since the amalgamation occurred, we build a continuous variable, named *permanence*. This is also because potential cost savings of amalgamation may need time to materialize. This variable measures the time since the amalgamation took place (1 to 8 years). In a similar vein, its quadratic term (*permanence*^{2}) is also included, allowing the effect to be a non-linear function of time. The two terms, *permanence* and *permanence*^{2}, are then interacted with Amalgamation, such that the estimated model is a generalized version of Eq. (1), taking the following form:

$$Y_{it} = \mu_i + \tau_t + Amalgamation_{it} \times (\gamma + \delta permanence_t + \lambda permanence_t^2) + \beta x_{it} + \epsilon_{it},$$

Results of estimation for this model are reported in Table D.3. of the Appendix D. The impact of the amalgamation is given by $\gamma + \delta permanence_t$ in the case of the linear specification, and by $\gamma + \delta permanence_t + \lambda permanence_t^2$ in the case of the quadratic one, and depends on the specific value of the variable *permanence*. In practice, it is possible to compute the impact for any year since the amalgamation took place.

For ease of interpretation, we plot the coefficients for reference values of the *permanence* (Panel A) and *permanence*^{2} (Panel B) in Figure 5 for current costs, while the same graph is depicted in Figure 6 for investment.

In relation to current costs, it emerges that although the visual depiction (Figure 5) suggests a negative relationship between the time since amalgamation and current spending decisions, this has no sufficient statistical power. On the other hand, we do observe a significant decline in investments after 5 years since the merger (Figure 6, Panel A), and after 6 years in the case of the quadratic specification (Figure 6, Panel B).

Figure 5. Time since the amalgamation- Current costs per capita in logarithmic scale

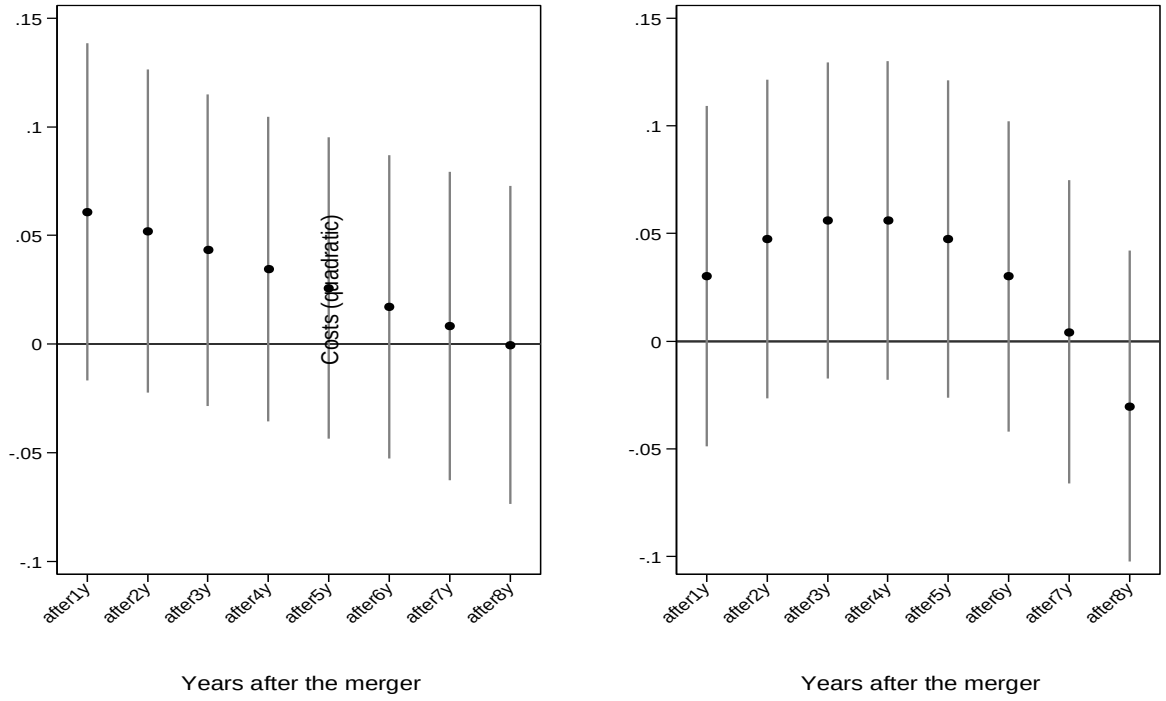
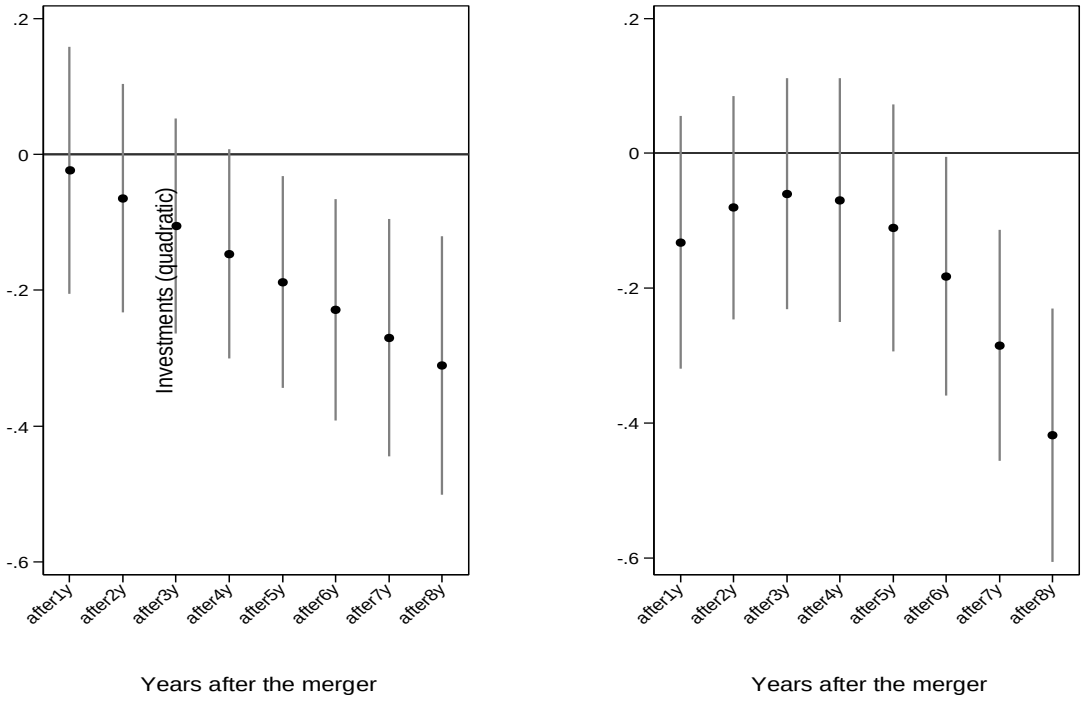


Figure 6. Time since the amalgamation- Investments per capita in logarithmic scale



Spending categories

So far, we have shown that the amalgamation reform is not associated with any robust effects on current expenditure. Nevertheless, while it is possible that in aggregated terms there is no evidence of any impact on current costs, a more in-depth analysis on specific items could shed some light on whether some components of current expenditure are, indeed, affected by the merger. Hence, we look at the following components: (i) personnel costs; (ii) financial costs; (iii) third parties' costs and (iv) other costs (including purchase of good and services).

In particular, as for personnel costs we have considered and summed up the staff fees and expenses as well as the remuneration of elected and third parties cost categories. In terms of financial costs, the following items have been aggregated: taxes-fees, payments for public credit service and other expenses. As for third parties' costs, we have sum up third party benefits and payments - transfers to third parties. Finally, for the other costs category, we put together other overheads and expenditure on the supply of consumables.

Results of this analysis are reported in Table 5, where in each specification we include control variables and municipal- and year-fixed effects. According to the findings, all categories with the exception of other costs yield effects not statistically different from zero at the 10% level. So, the only category for which a weak significant effect is found is that of "other costs", for which the amalgamation coefficient is negative (-0.127; see col. 4). It is also interesting to note that results do not change when we trim the sample at 1%: in this case, in fact, also the coefficient of other costs turns out to be not statistically significant (see Panel A of Table D.4. of the Appendix D). Conversely, when the sample is trimmed at the 5% level, it emerges that the amalgamation process is associated with an increase of financial expenses, with the coefficient of interest being positive (0.291) and statistically significant at 1% (see Panel B of Table D.4. of the Appendix D). In other words, these results reveal a (weak) increase in current expenditure observed in amalgamated municipalities which was possibly driven by an increase of financial expenses.

Table 5. Specific items: current costs

	Specific items: Current costs			
Dep. Variables	Personnel costs	Financial costs	Third parties' costs	Other costs
	(1)	(2)	(3)	(4)
Amalgamation	0.009	0.098	0.029	**-0.127***
	(0.031)	(0.149)	(0.074)	**(0.070)**
Observations	4,137	4,044	3,817	3,817
R-squared	0.839	0.651	0.700	0.825
Controls	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%.

For investment decisions we have found evidence that the amalgamation process led to a reduction of spending allocated for investments, but it is not clear, yet which component of investments drives our results. Therefore, we estimate Equation (1) using, as dependent variables, the per capita (log) of the four components of investments: (i) purchases of buildings, technical works and supplies of fixed assets (which accounts for 10% of total investment

expenditure); (ii) projects (corresponding to approximately 80%); (iii) studies, research, experimental work and specific costs (it amounts to 8% of the total budget devoted to investments); and (iv) Fixed investment titles (business holdings). Results of this analysis are reported in Table 6, where in each specification we include control variables and municipal and year-fixed effects. According to the estimates, purchases of buildings and technical works, which represent investment on physical capital, yield significant and negative effects at the conventional level. Moreover, it turns out that the building purchases and associated technical works decrease significantly once municipalities are forced to be merged, as the amalgamation coefficient turns out to be negative (-0.636) and statistically significant at 1%. It is also worth noting that results do not change if we trim the sample at 5% (see Panel A of Table D.5. in the Appendix D) and 1% of the observations (see Panel B of Table D.5. in the Appendix D).

Table 6. Specific items: investments

	Specific items: investments			
Dep. Variables	Purchases of buildings, technical works, and supplies of fixed assets	Projects	Studies, research, experimental work, and specific costs	Fixed investment titles (business holdings)
	(1)	(2)	(3)	(4)
Amalgamation	**-0.636*** **	-0.013	-0.062	0.573
	(0.140)	(0.125)	(0.131)	(0.354)
Observations	3,499	3,504	3,443	1,670
R-squared	0.606	0.710	0.639	0.529
Controls	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%.

8. Output

The empirical results suggest that there is robust evidence that, following the amalgamation reform, amalgamated municipalities significantly reduced per capita investment spending. In principle, there can be efficiency reasons underlying this decrease in per capita investment spending following a merger. These can range from unit cost reductions associated to investment projects of larger sizes, to the reduction in pork barrel expenditures, or higher efficiency of larger

municipalities due to the higher human capital of engineers and technicians in larger municipalities. If the reduction in investment spending is indeed the result of more efficient spending, sizeable negative economic effects should not characterize the treated municipalities after the merger. By way of contrast, if the decline in investment spending causes a net fall in the public capital stock that results from the fall in investments, then one would expect a fall in the economic performance of the merged municipalities.

To verify whether the reduction of expenditure after the amalgamation process led to a deterioration of local economic conditions, we need a measure of local GDP. Unfortunately, official estimates of GDP at the municipality level do not exist in Greece (as in many other countries). In order to circumvent this problem, we apply the approach pioneered by Henderson et al (2012) who used nighttime light from satellites to gauge per capital GDP differentials at local level. In particular, we have estimated a model with year and NUTS II fixed effects as well as clustered standard errors at NUTS II level and, applied a linear model to proxy local GDP using the nighttime light activity (logarithm of the sum of lights) data at the municipal level [13]. Estimates indicate that when employing nighttime light proxy local GDP as the dependent variable (Table 7) we do observe a statistically significant decrease in local GDP due to the amalgamation. Interestingly, the effect of the amalgamation is still negative and statistically significant when we implement the DiD identification strategy on the common support, although the magnitude drops considerably. If we take the more robust estimates at face value (i.e., column 6), we find that the amalgamation might have caused a reduction in local GDP by about 13%. Specifically, according to official Eurostat macro data, overall public investment was 5.7% in 2009, 3.7% of GDP in 2010 and reached 2.5% in 2011, it was reduced by more than 50%. (Eurostat, 2021b) These results suggest that the interpretation of the fall in per capita investment spending as the result of project rationalizations, synergies, scale economies and in

[13] For further details about the approach and the results, see Appendix C.

general higher efficiencies associated to the amalgamation may not be warranted. Most importantly, these findings are compatible with a Cobb-Douglas production function of local output where the elasticity with respect to local public capital is around one-third.

Table 7. Output

Dep. Variables	GDP based on luminosity			GDP based on luminosity matching sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Amalgamation	**-0.640*** (0.111)**	**-0.287*** (0.057)**	**-0.586*** (0.154)**	**-0.376*** (0.081)**	**-0.117*** (0.025)**	**-0.135*** (0.045)**
Observations	3,938	3,938	3,938	2,919	2,919	2,919
R-squared	0.782	0.929	0.934	0.611	0.978	0.979
Controls	No	Yes	Yes	No	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region * year FE	No	No	Yes	No	No	Yes

Note: Significance levels: ***1%, **5%, *10%.

9. Conclusions

Amalgamation reforms have been implemented extensively over time as policies meant to improve local government service provision and reduce costs due to economies of scale. However, as the bulk of the associated studies have found, their effectiveness is ambiguous. In this study we investigated whether this process has had an impact on the level of per-capita current costs and investments of Greek municipalities.

Specifically, we have analyzed the Greek experience of municipal amalgamations which took place in 2010, using administrative data on expenditures at the municipality level from 2005 to 2018. A unique dataset has been assembled for the very first time, by compiling the -not publicly available-annual municipal financial reports derived from different sources. We have employed a Difference-in- Differences approach combined with matching models and found very weak evidence that current costs are affected by the amalgamation reform.

Conversely, the amalgamation of municipalities seems to be associated with a significant decrease in per capita investment. In particular, we found a negative and robust effect of amalgamation on per capita investment expenditure, and, in terms of magnitude, the amalgamation process led to a decline in per capita investment in the range of 11 to 31%. Findings are also robust and consistent when we rely on the sample of matched municipalities. It is interesting that after the exploration of the specific spending items of current costs and investments we noticed that labour costs are not affected. On the contrary, we find consistent evidence of a sizeable fall in physical capital investments following the amalgamation reform. Moreover, we also find that in amalgamated municipalities there is a large and significant fall in economic performance, proxied by nighttime light. This indicates that local economic growth has declined as a result of lower public investment in the merged municipalities after amalgamation. We interpret this result by arguing that the fall in investment spending might not be due to higher efficiencies which allow the same investment projects to be realized at lower costs or avoid some duplications, but to a decrease in the accumulation of productive capital by local municipalities, which in turn implies a deterioration of their economic performance.

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Appendix A. Structure of the municipal fiscal data

The revenues and expenditures of the municipal budget are structured in two levels of disaggregation[14]; the first level consists of the main categories while the second one includes all specific items of each main one. Overall, there are nine main categories at level 1 (five for revenues and four for expenditures) and 45 specific items. The structure of all fiscal items as well as a brief description is presented in Table A.1 and Table A.2. In addition, in Table A.3 we report the sources of all fiscal data, socioeconomic indicators and outcome variables used in this study.

[14] After 2011 there are four levels of disaggregation. However, for consistency with previous years we only report the common levels.

Table A.1. Total revenues main categories and specific items

Main categories (level 1)	Specific item (level 2)	Description
Regular revenues (39.60% of total revenues)	Real estate income (3.07%)	Rents, Revenues from the exploitation of land, real estate, and common areas.
	Income from movable property (0.92%)	Capital interest, Income from other movable property.
	Revenue from remunerative fees and royalties (25.68%)	Cleaning and electric lighting services, Water supply service, Irrigation service, Sewerage service.
	Revenue from other fees, rights, and services (6.85%)	Revenues of cemeteries, Revenues from slaughterhouses, the exploitation of projects and the provision of services, from real estate tax, Fees to the gross income of traders, other fees and rights, Potential reciprocal fees.
	Taxes and levies (3.83%)	Taxes, Contributions
	Revenue from grants (59.65%)	Grants from institutionalized resources to cover operational expenses.
	Other regular income (1.64%)	Other regular income.
Extraordinary revenues (28.11% of total revenues)	Proceeds from the sale of movable and immovable property (1.07%)	Revenues from sale of immovable and movable property.
	Grants to cover operating costs (12.83%)	Grants to cover operating costs.
	Grants for investment expenditure (79.24%)	Grants from institutionalized resources for investment expenditures, other grants for investments and projects.
	Donations - Inheritances (0.53%)	Donations, Inheritances, and bequests.
	Increases - Fines – Parabolas (4.01%)	Increases, Fines, Fees.
	Other exceptional income (2.23%)	Business income, Income from expenses incurred on behalf of third parties, Other extraordinary income.
Income from past financial years (3.03% of total revenues)	Regular revenue from past financial years (91.85)	Regular income from previous financial years certified and collected for the first time.
	Extraordinary revenue from past financial years (8.15%)	Extraordinary income of previous financial years that is certified and collected for the first time.
Receivables from loans and previous financial years (5.19% of total revenues)	Receivables from loans (38.71%)	Loans to cover operating and investment expenses.
	Receivable balances of previous financial years (61.29%)	Balances receivable from past financial years - regular - extraordinary income.
Receipts for the State or third parties, and refunds (6.46% of total revenues)	Proceeds to the State and third parties (94.52%)	Pension contributions, Taxes and other charges, Insurance contributions, Other receipts in favor of third parties.
	Refunds (5.48%)	Refunds.
Cash balance (17.61% of total revenues)	Cash balance from regular income (48.49%)	Cash balance from regular income.
	Cash balance derived from extraordinary income (51.51%)	Cash balance derived from extraordinary income.

Notes: The percentages in the parentheses refer to the share within each main category.

Table A.2. Total expenditures main categories and specific items

Main categories (level 1)	Specific item (level 2)	Description
Current Costs (52.49% of total expenditures)	Staff fees and expenses (40.00%)	Remuneration of officials, regular employees with an indefinite contract, special posts, temporary staff (under contract of temporary staff, hourly wages, etc.), Employer contributions of social security municipalities, Ancillary benefits and staff costs, Expenditures on staff recruitment, education, and training.
	Remuneration of elected and third parties (8.44%)	Freelancers' fees and expenses, Expenses of elected officials, Remuneration of non-self-employed professionals, Remuneration of third parties in the capacity of legal entity, Certification and collection costs, Other Remuneration and Expenses of Third Parties.
	Third party benefits (18.71%)	Production process facilities, Communications, Rentals – Rents, Leasing rents, Premiums, Maintenance, and repair of durable goods by third parties, Water supply, lighting, cleaning (other third-party facilities).
	Taxes – fees (0.59%)	Taxes, Fees for the circulation of means of transport, Various taxes, and fees.
	Other overheads (3.65%)	Transport costs, Travel and subsistence expenses, public relations (promotion and advertising exhibition expenses), Conferences and celebrations, Subscriptions, Publication costs, Expenses for artistic, sports and social activities, Expenses for camps, countryside and meals, Miscellaneous expenses of a general nature
	Payments for public credit service (4.40%)	Loans to cover operating- investment expenses.
	Expenditure on the supply of consumables (5.99%)	Prints, books, stationery, publications, Bedding, camping supplies and foodstuffs, Hygiene and cleaning products, Fuels and lubricants, Material for printing, printing, bookbinding and other works, Maintenance materials of buildings and works, Spare parts for mechanical and other equipment, Pharmacy Supplies, Other supplies.
	Payments - transfers to third parties (17.83%)	Mandatory transfers to legal entities, Compulsory contributions, Optional contributions, benefits, and grants.
	Other expenses (0.39%)	Guarantees and other long-term receivables, extraordinary expenses.
Investments (28.85% of total expenditures)	Purchases of buildings, technical works, and supplies of fixed assets (10.31%)	Expropriations and purchases of land, technical buildings, Assets Supplies.
	Projects (79.34%)	Expenses for construction of buildings, municipal property projects, fixed (permanent) common facilities, Repairs, and maintenance of fixed utilities.
	Studies, research, experimental work, and specific costs (8.53%)	Studies - research and experimental work, Special Expenses.
	Fixed investment titles (business holdings) (1.81%)	Participations in municipal enterprises, other companies, and other legal entities.
Payments from previous financial years, returns and forecasts (18.23% of total expenditures)	Payments from previous financial years (48.55%)	Payments of operating expenses, Investment Expenditure Payments, Extraordinary expenses.
	Odds (49.05%)	Return of pension contributions, Reimbursement of taxes and other charges, insurance contributions, Other receipts in favor of third parties, Fixed advances, Other returns.
	Provisions for non-recovery (2.40%)	Provisions for non-collection of receivable balances certified during the past financial years.
Reserve (0.42% of total	Reserve	Reserve.

expenditures)

Notes: The percentages in the parentheses refer to the share within each main category.

Table A.3. Data sources

Variable name	Source
Fiscal indicators (as presented in table A.1 and A.2)	Hellenic Statistical Authority (2005-2009); Ministry of Interior (2011-2018)
Municipal area (in square kilometers)	Own calculations
GDP NUTS II- NUTS III level	Hellenic Statistical Authority
Population (and aged groups)	Eurostat
Total number of births	Eurostat (data for population and aged groups) and own calculations
Total number of deaths	Eurostat (data for population and aged groups) and own calculations
Population aged 15-74	Eurostat (data for population and aged groups) and own calculations
Working age population	Census 2001 (Hellenic Statistical Authority), Eurostat and own calculations
Persons in the labor force (% persons 15-74)	Census 2001 (Hellenic Statistical Authority) and own calculations
Persons not in labor force (% persons 15-74)	Census 2001 (Hellenic Statistical Authority) and own calculations
Employed persons (% persons in the labor force)	Census 2001 (Hellenic Statistical Authority) and own calculations
Unemployed persons (% persons in the labor force)	Census 2001 (Hellenic Statistical Authority) and own calculations
Young employed persons (% employment)	Census 2001 (Hellenic Statistical Authority) and own calculations
Young employed persons (% pop_15_24)	Census 2001 (Hellenic Statistical Authority) and own calculations
Nighttime lights activity	Defense Meteorological Satellite Program (DMSP)/Operational Linescan System (OLS) (1992–2013); Visible Infrared Imaging Radiometer Suite (VIIRS) (2012–2018)

Appendix B. Summary statistics

Table B1 reports summary statistics for all fiscal variables used in this study. Table B.2 presents summary statistics for the socioeconomic indicators as well as the outcome variable.

Table B.1. Summary statistics for fiscal data used in the analysis

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
Total revenues	4143	7.24	0.683	4.73	10.65	5.87	9.20	0.59	4.18
Total expenditures	4137	7.02	0.762	1.86	10.65	5.28	9.16	0.26	5.17
Current costs	4136	6.48	0.64	0.41	9.76	4.86	8.27	-0.01	7.73
Staff fees and expenses	4136	5.51	0.62	1.40	8.84	3.85	7.17	0.04	6.27
Remuneration of elected and third parties	3817	3.78	0.94	0.71	7.18	1.81	6.13	0.16	3.02
Third party benefits	3816	4.55	0.97	0.23	8.58	2.33	6.88	0.00	3.30
Taxes - Fees	3629	0.489	1.43	-4.33	6.75	-2.76	3.96	0.17	3.15
Other overheads	3816	2.64	1.16	-2.85	8.64	-.084	5.62	0.01	3.77
Payments for public credit service	3868	2.87	1.40	-6.37	6.52	-1.73	5.61	-1.19	5.91
Expenditure on the supply of consumables	3816	3.43	0.96	-2.76	7.87	1.16	5.69	-0.11	3.83
Payments - transfers to third parties	3799	4.60	0.90	-0.59	8.40	2.02	6.73	-0.40	4.70
Other expenses	2383	-0.22	2.20	-10.05	6.13	-5.89	4.14	-0.44	3.26

Investments	3834	5.17	1.44	-1.71	9.94	1.85	8.54	-0.09	3.21
Purchases of buildings, technical works, and supplies	3499	2.88	1.46	-4.79	7.71	-1.02	6.10	-0.43	4.15
Projects	3504	4.87	1.50	-3.23	9.49	0.92	8.39	-0.38	3.92
Studies, research, experimental work, and specific costs	3444	2.25	1.77	-5.68	8.43	-2.19	6.12	-0.31	3.44
Fixed investment titles (business holdings)	1692	0.79	2.01	-9.93	7.97	-4.29	5.04	-0.18	3.38

Table B.2. Summary statistics for socioeconomic and outcome variables

Variables	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**p1**	**p99**	**Skew.**	**Kurt.**
Municipal area (in square kilometers)	4153	299.74	324.39	1.02	1861.68	2.09	1476.54	1.60	5.89
GDP NUTS II	4225	17084.14	4659.01	11193.01	29215.07	11225.17	29215.07	0.89	2.92
GDP NUTS III	3895	15918.94	4255.20	9491.83	29921.42	9763.50	28185.20	0.72	2.88
Population	4153	24138.25	51773.28	98.00	745514.00	371.00	163446.00	9.64	124.53
Total number of births	3803	1246.72	3013.71	1.00	49637.00	3.00	13040.00	8.68	110.75
Total number of deaths	3614	1438.31	3191.96	0.00	59577.00	3.00	9643.00	11.91	199.09
Population aged 15-74	4153	19096.93	41878.38	81.00	604769.00	301.00	129774.00	9.76	126.55
Working age population	4030	22920.77	50960.37	269.00	730232.00	488.00	154235.00	9.77	126.14
Persons in the labor force (% persons 15-74)	4030	0.44	0.05	0.22	0.63	0.28	0.54	-0.64	4.23
Persons not in labor force (% persons 15-74)	4030	0.55	0.05	0.36	0.77	0.45	0.71	0.64	4.23
Employed persons (% persons in the labor force)	4030	0.88	0.04	0.68	0.97	0.73	0.95	-1.22	5.80

Unemployed persons (% persons in the labor force)	4030	0.11	0.04	0.02	0.31	0.04	0.26	1.22	5.80
Young employed persons (% employment)	4030	0.07	0.07	0.00	1.02	0.01	0.17	9.47	112.14
Young employed persons (% pop_15_24)	4080	0.17	0.20	0.00	2.67	0.02	0.45	9.50	104.91
Transfers (Revenues from grants)	4142	5.84	0.63	0.16	8.42	4.59	7.54	-0.27	7.82
Transfers (Grants to cover operating costs)	3987	3.22	1.43	-3.21	8.68	-0.69	6.56	-0.346	4.07
Transfers (Grants for investments)	4137	5.21	1.26	-2.35	9.72	2.42	8.35	-0.04	3.29
Nighttime light activity	4016	5060.35	4591.44	0.00	27981.00	41.00	19774.00	1.20	4.54

Appendix C. Nighttime light activity

Over the last decade, nighttime light activity has been used in several studies to proxy the economic activity and development at regional or municipal levels when data are not available (Henderson et al., 2012; Kulkarni et al., 2011; Mellander et al., 2015). Nighttime light (NTL) data from the Defense Meteorological Satellite Program (DMSP)/Operational Linescan System[15] (OLS) (1992–2013) and the Visible Infrared Imaging Radiometer Suite[16] (VIIRS) (2012–2018) on the Suomi National Polar-orbiting Partnership satellite has been extensively employed by the research community and hence, comprises one of the most reliable sources of nighttime satellite data.

In particular, many studies used nighttime light activity to proxy several socioeconomic variables. Ivan et al. (2020) calculated the Night Light Development Index (NLDI), based on night-time lights satellite images, as a proxy for measuring regional inequalities. The NLDI was calculated using a 0.15 km2 grid and census data from 1992 and 2011 over the 1992–2018 period, applying a Gini coefficient approach based on population and night light geographical distribution in Romania. Dingel et al. (2019) created metropolitan areas for Brazil, China, and India using contiguous areas of light in nighttime satellite photos to investigate the distribution of talents across and within cities of the aforementioned countries. Finally, Guerrero and Mendoza (2019) proposed a statistical approach to combine nighttime light data with official national income growth figure so as to estimate the economic growth at any administrative level.

For the purpose of this study we rely on the harmonized yearly dataset produced by Li, Zhou, Zhao, & Zhao (2020) using the DMSP/VIIRS nighttime satellite images. According to the

[15] Available at: https://www.ngdc.noaa.gov/eog/dmsp/downloadV4composites.html - Image and data processing by NOAA's National Geophysical Data Center, DMSP data collected by US Air Force Weather Agency.

[16] Available at: https://eogdata.mines.edu/products/vnl/ - Earth Observation Group, Payne Institute for Public Policy.

authors "[…] we generated an integrated and consistent NTL dataset at the global scale by harmonizing the inter-calibrated NTL observations from the DMSP data and the simulated DMSP-like NTL observations from the VIIRS data" (Li et al., 2020). For the design of the harmonized dataset the non-straylight-corrected VIIRS data were used, removing disturbances due to aurora and temporal lights. Afterwards, VIIRS data are matched to the calibrated DMSP data in terms of resolution and top coding. The generated global DMSP NTL time-series data (1992–2018) show consistent temporal trends (Miethe, 2020). The DMSP nighttime light data range in a scale from 0 to 63, the so-called digital number (DN), where 0 stands for no luminosity and 63 for full luminosity.

We downloaded the dataset and calculated the nighttime light luminosity at the municipal level, using the R package "nightlightstats"[17], based on the code of the paper "The Elusive Banker. Using Hurricanes to Uncover (Non-) Activity in Offshore Financial Centers" (Miethe, 2020).[18] Figure C.1 presents the nighttime light activity for Greek municipalities over the whole reference period (2005-2018).

[17] The R package "nighlightstats" is available at: https://github.com/JakobMie/nightlightstats.

[18] The software used for data extraction and computation of nighttime light luminosity is R version 4.0.5.

Figure C.1. Nighttime light activity for Greece over time (2005-2018); page 1 out of 4

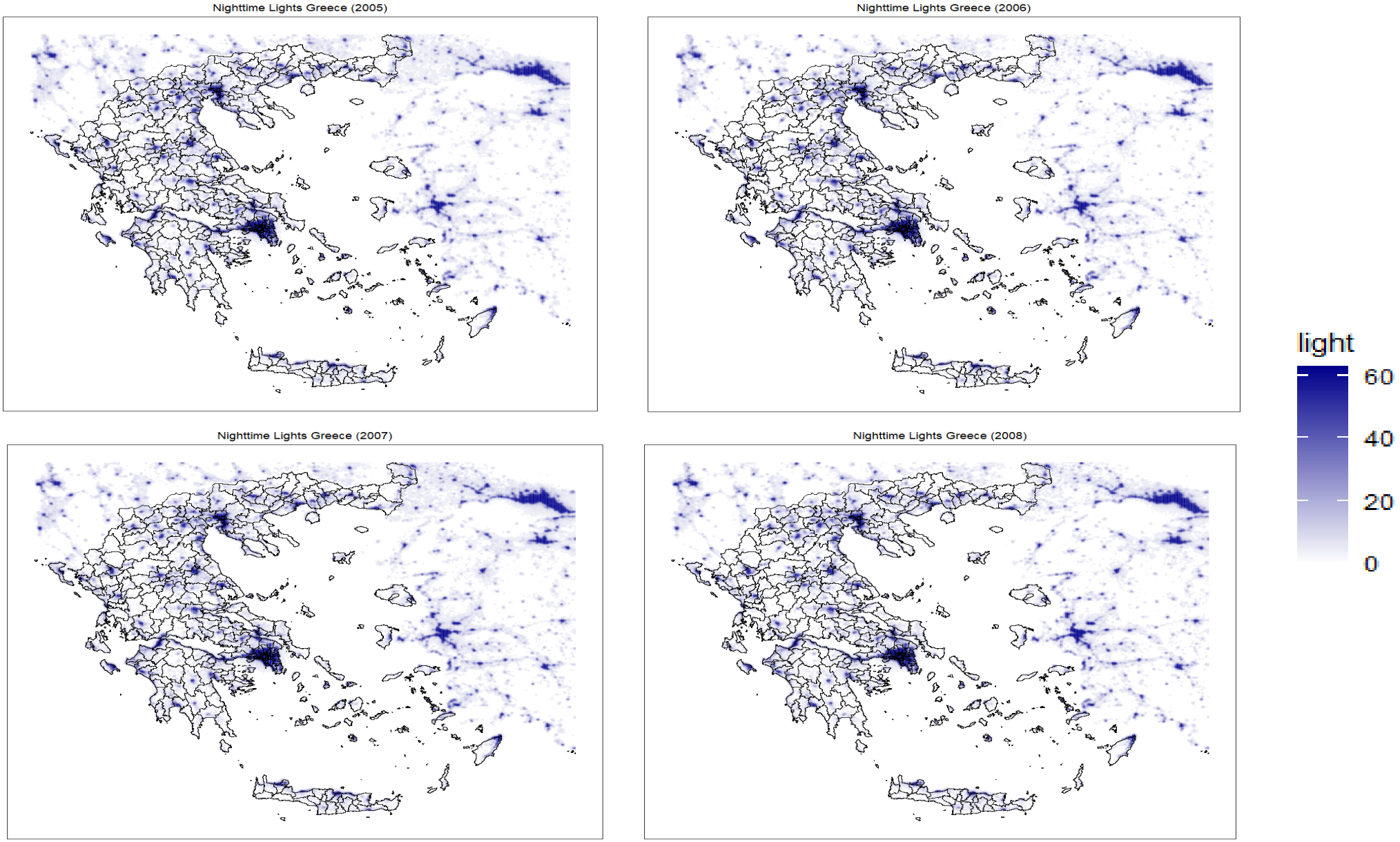


Figure C.1. Nighttime light activity for Greece over time (2005-2018); page 2 out of 4

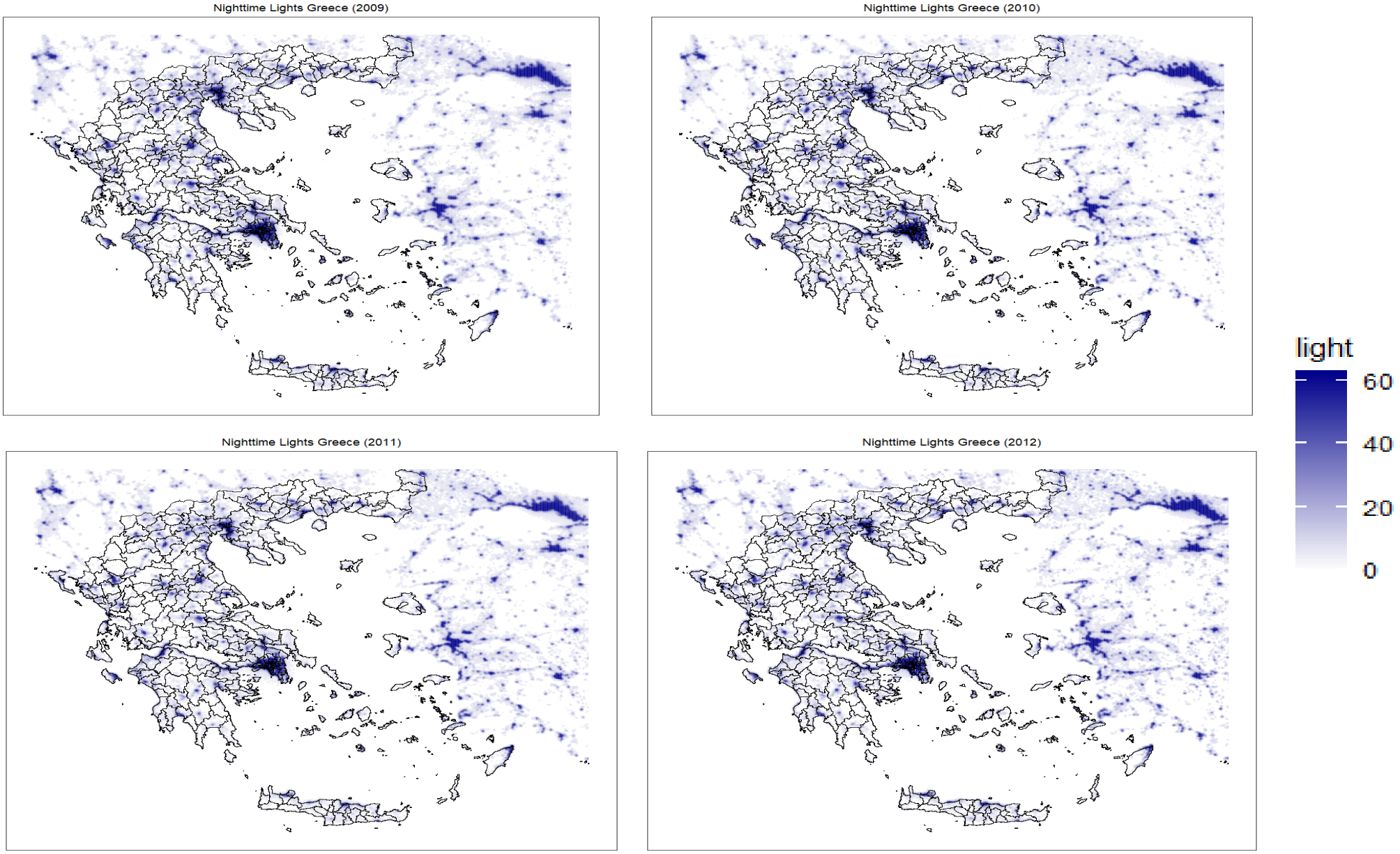
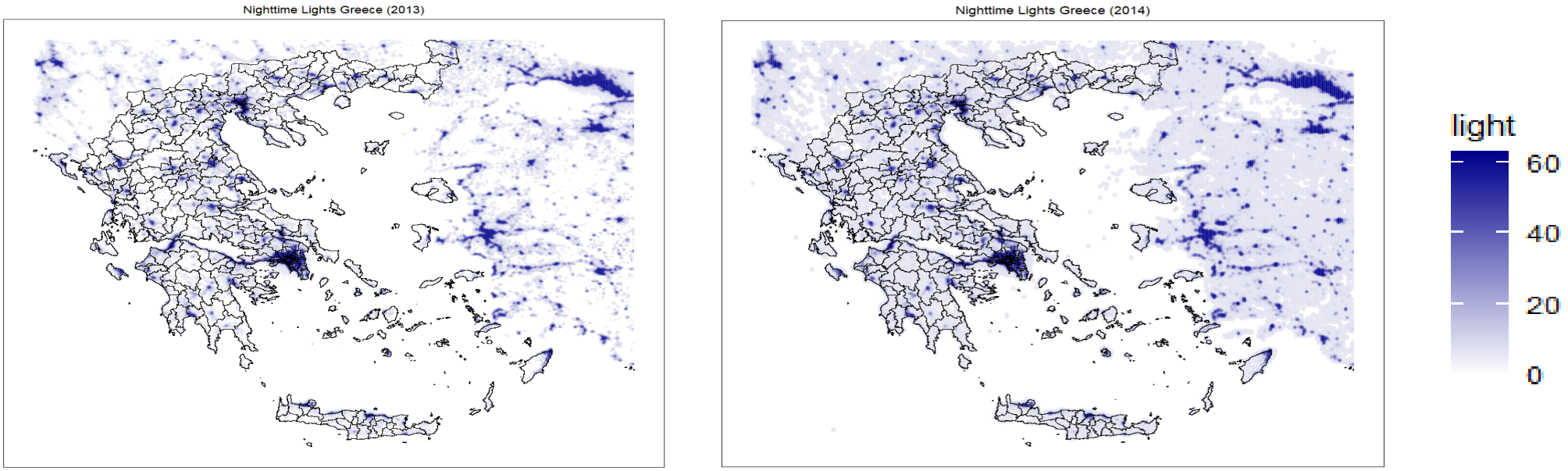
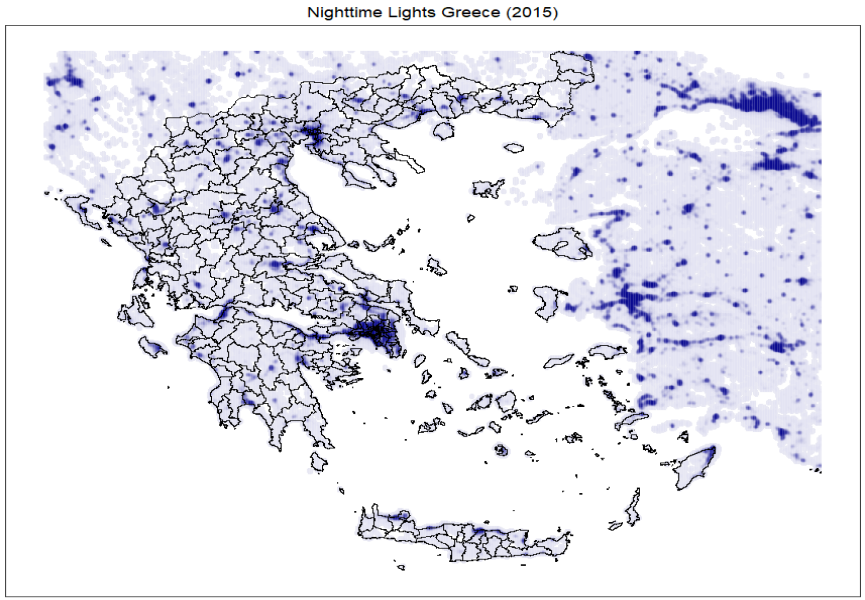


Figure C.1. Nighttime light activity for Greece over time (2005-2018); page 3 out of 4





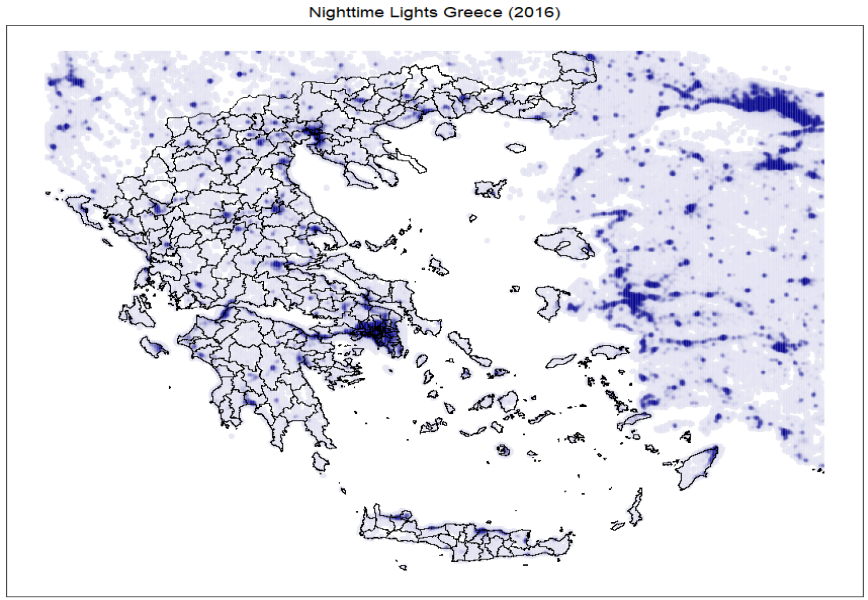
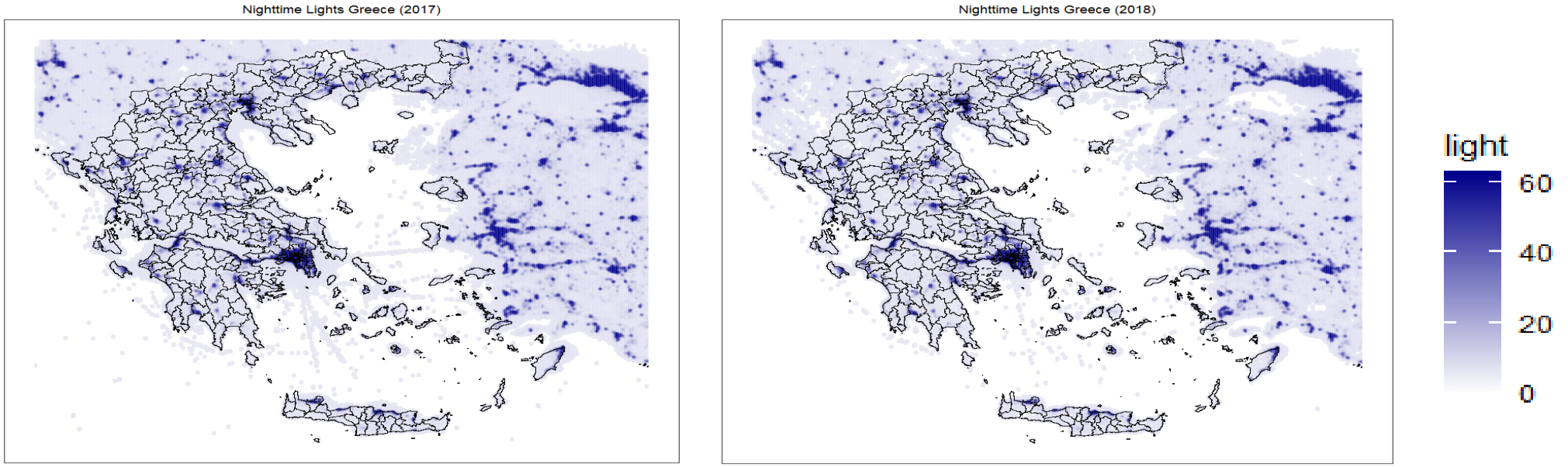


Figure C.1. Nighttime light activity for Greece over time (2005-2018); page 4 out of 4


Nighttime Lights Greece (2017)
Nighttime Lights Greece (2018)
light
60
40
20
0

Following Henderson et al. (2012), we implemented a fixed effect model with year and NUTS II fixed effects and clustered standard errors at NUTS II level. We report the results of this model in Table C.1.

Table C.1 Fixed effect model specifications

Variables	(1) **GDP NUTS II (log)**	(2) **GDP NUTS II (log)**	(3) **GDP NUTS II (log)**
Nighttime lights activity (sum of lights) log	**18.747**** **(6.579)**	9.608 (7.195)	2.779 (2.089)
Constant	**9.582***** **(0.050)**	**9.614***** **(0.054)**	**9.637***** **(0.007)**
Observations	169	169	169
R-squared	0.144	0.279	0.966
Regional FE	No	No	Yes
Year FE	No	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%.

Based on the model specifications of Table C1. we used these coefficients and applied a linear model to estimate the local GDP pc using the nighttime light activity (logarithm of the sum of lights) data at municipal level. As soon as we obtained the proxied GDP pc based on the luminosity, we continued the analysis to verify whether the reduction of expenditure after the amalgamation process led to a deterioration of local economic conditions.

Appendix D. Additional material

Table D.1. Estimation of the propensity score model

Estimated propensity score				
	Percentiles	**Smallest**		
1%	0.230	0.199		
5%	0.424	0.216		
10%	0.568	0.230	**Obs**	237
25%	0.812	0.247	**Sum of Wgt.**	237
50%	0.936		**Mean**	0.855
		Largest	**Std. Dev.**	0.182
75%	0.972	0.998		
90%	0.988	0.999	**Variance**	0.033
95%	0.994	1.000	**Skewness**	-1.919
99%	0.999	1.000	**Kurtosis**	6.064

Note: Significance levels: ***1%, **5%, *10%.

Table D.2. Current Costs and investments' estimates and their 95% confidence intervals (as presented in Figure 3 and Figure 4)

	Current costs			**Investments**		
Time points	**Estimate**	**LCI**	**UCI**	**Estimate**	**LCI**	**UCI**
5 years prior	0.095	-0.149	0.339			
4 years prior	0.007	-0.044	0.059	0.214	-0.169	0.598
3 years prior	-0.046	-0.097	0.005	0.038	-0.184	0.260
2 years prior	-0.017	-0.058	0.025	-0.005	-0.155	0.144
Amalgamation	0.017	-0.074	0.108	-0.149	-0.377	0.079
1 year after	0.065	-0.025	0.155	-0.019	-0.256	0.218
2 years after	0.081	0.002	0.161	0.202	-0.078	0.483
3 years after	0.080	0.000	0.160	0.000	-0.285	0.285
4 years after	0.041	-0.039	0.122	-0.176	-0.420	0.068
5 years after	0.005	-0.071	0.081	-0.150	-0.397	0.098
6 years after	0.009	-0.066	0.084	-0.270	-0.514	-0.026
7 years after	-0.008	-0.083	0.067	-0.283	-0.512	-0.055

Table D.3. Effect of the amalgamation on Current Costs and Investments per capita

	Current costs		**Investments**	
	(1)	(2)	(1)	(2)
Dep. Variables	Linear	Quadratic	Linear	Quadratic
Amalgamation	0.070	0.005	0.018	-0.214
	(0.050)	(0.056)	(0.121)	(0.155)
Permanence	**-0.009***	0.030	**-0.041****	0.098
	(0.005)	(0.019)	**(0.018)**	(0.073)

Permanence square		**-0.004****		**-0.015****
		(0.002)		**(0.008)**
Constant	**6.155*****	**6.155*****	**5.899*****	**5.900*****
	(0.123)	**(0.123)**	**(0.119)**	**(0.119)**
Observations	4,136	4,136	3,834	3,834
R-squared	0.366	0.366	0.653	0.654
Controls	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%.

Table D.3.1. Permanence of the amalgamation effect (as presented in Figure 5 and Figure 6)

	Current Costs		**Investments**	
	(1)	(2)	(3)	(4)
Dep. Variables	linear	quadratic	linear	quadratic
1 year after	0.061	0.030	-0.023	-0.132
	(0.047)	(0.048)	(0.110)	(0.114)
2 years after	0.052	0.047	-0.065	-0.080
	(0.045)	(0.045)	(0.102)	(0.101)
3 years after	0.043	0.056	-0.106	-0.060
	(0.044)	(0.045)	(0.096)	(0.104)
4 years after	0.035	0.056	-0.147	-0.070
	(0.043)	(0.045)	(0.094)	(0.110)
5 years after	0.026	0.047	**-0.188****	-0.111
	(0.042)	(0.045)	**(0.095)**	(0.111)
6 years after	0.017	0.030	**-0.229****	**-0.182***
	(0.042)	(0.044)	**(0.099)**	**(0.107)**
7 years after	0.008	0.004	**-0.270****	**-0.285*****
	(0.043)	(0.043)	**(0.106)**	**(0.104)**
8 years after	-0.000	-0.030	**-0.311*****	**-0.418*****
	(0.044)	(0.044)	**(0.116)**	**(0.114)**
Observations	4,136	4,136	3,834	3,834

Note: Significance levels: ***1%, **5%, *10%.

Table D.4. Specific items of current costs (trimming 5% and 1%)

	Panel A. Specific items: Current costs trimming 5%			
	Personnel costs	Financial costs	Third parties' costs	Other costs
	(1)	(2)	(3)	(4)
Amalgamation	0.024	**0.291*****	0.023	-0.008
	(0.024)	**(0.101)**	(0.064)	(0.052)

Observations	3,723	3,638	3,434	3,437
R-squared	0.881	0.662	0.695	0.806
Controls	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B. Specific items: Current costs trimming 1%

Dep. Variables	Personnel costs	Financial costs	Third parties' costs	Other costs
	(1)	(2)	(3)	(4)
Amalgamation	0.032	0.183	0.060	-0.096
	(0.027)	(0.119)	(0.073)	(0.061)
Observations	4,055	3,964	3,740	3,741
R-squared	0.886	0.668	0.712	0.827
Controls	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%.

Table D.5. Specific items of investments (trimming 5% and 1%)

Panel A. Specific items: Investments trimming 5%

Dep. Variables	Purchases of buildings, technical works, and supplies of fixed assets	Projects	Studies, research, experimental work, and specific costs	Fixed investment titles (business holdings)
	(1)	(2)	(3)	(4)
Amalgamation	**-0.600*** **	**-0.149***	-0.163	0.398
	(0.109)	**(0.090)**	(0.121)	(0.297)
Observations	3,151	3,153	3,099	1,496
R-squared	0.568	0.707	0.568	0.487
Controls	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B. Specific items: Investments trimming 1%

Dep. Variables	Purchases of buildings, technical works, and supplies of fixed assets	Projects	Studies, research, experimental work, and specific costs	Fixed investment titles (business holdings)
	(1)	(2)	(3)	(4)
Amalgamation	**-0.629*** **	-0.025	-0.166	0.489
	(0.120)	(0.112)	(0.129)	(0.335)
Observations	3,431	3,433	3,375	1,641
R-squared	0.594	0.721	0.623	0.534
Controls	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%.