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Public Investment and Regional Politics: The Case of Turkey

Mehmet Guney Celbis* Denis de Crombrugghe† Joan Muysken‡

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Abstract

The determinants of the regional allocation of transportation and communication investments are analyzed for the twenty-six statistical regions of Turkey for the years 1999 through 2011. A unique regional GVA series covering this period is constructed for this purpose. We specifically account for the possibility of dependence between allocation decisions for different infrastructure types. Estimation results strongly suggest that political bias has been present in the allocation decisions of regional transportation and communication public investments in Turkey.

Key words: Public Infrastructure, Regional Policy, Investment Allocation.
JEL Classifications: P16, R1, R42, R58, H54.

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1 Introduction

The contributions of public infrastructure to the growth of economies have been researched and advocated since the early 1900s. Especially transportation and communication infrastructure has drawn much attention. It is also commonly recognized as a stylized fact that transportation infrastructure forms and strengthens the links between economic areas, facilitates the mobility of goods, input factors, human capital, and creates positive externalities to firms and industries. Communications infrastructure on the other hand, is argued to play an important role in the "transportation" of information: it reduces the "information gap" between markets (Carey, 2008), and shape the economic geography by significantly impacting on financial services and capital flows (Dokmeci and Berkoz, 1996) while still being physically attached to specific locations (Castells et al., 2007). In this regard, transportation and communication infrastructures are especially relevant in a spatial context. A relevant topic is the allocation of these types of infrastructure across sub-national regions within a national economy. This allocation process involves decision makers who take into account regional and national needs together with region-specific characteristics. Therefore, this process can be subject to many factors such as geographical, locational, demographic, economic, and political attributes of the investment receiving regions. Additionally, the motives regarding welfare, equality, and efficiency can differ between economies and decision-makers, presenting heterogeneity in national goals regarding regional policy. Due to this heterogeneity, studying the determinants of the regional allocation of public investments is commonly done by focusing on spatial units within national economies, rather than samples consisting of countries.

While for many developed countries, research that focuses on the spatial allocation of government services and/or infrastructure are common, this is not always the case for developing economies. An example is Turkey, where the regional allocation of infrastructure has often been part of political debate, but not been subject to academic research. This may have been due to the previous unavailability of a sufficiently long time-series data which was a major data limitation that we tackled in this study: a meticulous data collection process from fragmented resources allowed us to attain a panel data set that has a time dimension of 13 years.[1] As a result, we have been able to conduct our analyses using a time-series cross-sectional data set from the twenty-six statistical regions of Turkey through the years 1999-2011, and contribute new evidence to the literature from a previously non-examined case.

Another novelty that this research presents is the consideration that investments in the separate infrastructure categories may not be decided independently from one another: we assume that the allocation decisions of all categories of public capital are made jointly (i.e. they are all subject to the same resource constraint). Thus, we do not treat the investments in transportation and communication infrastructure as being independent from the investments in other types of public capital. This assumption and its relevance to our research is discussed further in Section 5.

The rest of this study is structured as follows. Section 2 provides a review of the past literature and elaborates on the motivation of this paper. The concept of political bias in relation to public capital allocation is discussed in Section 3. An overview of the trends in regional infrastructure investments in Turkey and the regional governance structure of the country are reviewed in Section 4. The theoretical framework and how it leads to our empirical analysis is discussed in Section 5. The data collected is described in Section 6, and the empirical results are presented in Section 7. Finally, Section 8 presents the concluding discussion.

[1] Our models use a maximum of 12 years of observations due to the presence of lagged variables in the estimations.

2 Motivation and Previous Research

Our point of departure is the stylized fact that transportation and communication public infrastructure provides positive contribution to an economy through various channels. For instance, positive impact of public capital investments on economic growth has been observed in studies by Aschauer (1989a,b), Munnell and Cook (1990); Munnell (1990), Garcia-Mila and McGuire (1992), Aschauer (2000) for the United States, León-González and Montolio (2004) for Spanish provinces, Bom and Ligthart (2008) through meta-analysis, Hamalainen and Malinen (2011) for Finnish regions, among others.[2] Specifically transportation public capital has been a highly researched infrastructure category in relation to economic growth; research is done by Stephan (2001) for German and French regions, Cadot et al. (1999) for French regions, Berechman et al. (2006) for the United States, Montolio and Sole-Olle (2009) and Cantos et al. (2005) for Spanish provinces who have found a positive relationship between growth and this type of capital.[3] In addition, transportation infrastructure, together with communication infrastructure, has been found to influence trade performance positively as shown by Bougheas et al. (1999) for nine core EU and Scandinavian countries, Limao and Venables (2001) for 103 World Countries, Martínez-Zarzoso and Nowak-Lehmann (2003) for a sample of 20 EU and Mercosur countries and Chile, Longo and Sekkat (2004) for intra-African trade, Wu (2007) for Chinese regions, and Celbis et al. (2013) through meta-analysis. It has also been shown that public investments can benefit an economy through other channels as well; Altunc and Senturk find that infrastructural public investments have stimulated private investments in Turkey between 1980 and 2009, Holtz-Eakin and Lovely (1996) observe a positive impact of public capital on the expansion of the manufacturing sector in the United States, and Ding et al. (2008) find that telecommunications infrastructure has played an important role in regional per-capita income convergence in China from 1986 to 2002.

Population effects have been hypothesized to be present in the realization of public in-

[2]See Romp and De Haan (2007) for a comprehensive survey of the recent literature focusing on this relationship.
[3]Bhatta and Drennan (2003) provide an extensive survey of the literature focusing on the relationship between public investment in transportation and economic development.

vestments since the early 20$^{\text{th}}$ century. In a relatively early study, Hirsch (1959) observed, contrary to previous findings in the literature suggesting population size is an important factor, that for a wide range of urban service expenditures, the population size does not matter but geographical size does. On the other hand, Hansen (1965) reported that for a sample of Belgian communities, the concentration of population is associated with higher public investment, while in a country-level panel study, Randolph et al. (1999) find that factors such as the level of development, urbanization, population density, and labor force participation have strong implications on per capita spending on infrastructure in transportation and communication. Together with population-related factors, economic variables have naturally also drawn attention in the literature. This has led to the surging interest in the equity-efficiency preference in the allocation of public infrastructure as defined in Yamano and Ohkawara (2000) and Castells and Sole-Olle (2005). The equity-efficiency trade-off is the choice between investing in spatial sections of an economy with relatively higher productivity for attaining higher national efficiency, and investing into those that are lagging for achieving regional equity. In this regard, Nijkamp states that

> "In the light of economies of scale and scope, there may be a tendency to invest heavily in central areas, as here in general the expected benefits per unit of investment and per capita are the highest. Of course, this may be at odds with spatial equity targets, and therefore it may not be so easy to find a proper balance between the goals of efficiency and equity in a regional competition context." Nijkamp (2000, p.89).

In relation to regional equity goals, the inter-regional infrastructure investment can also be viewed as a redistributive policy as proposed by Sole-Olle (2011): money is re-allocated between regions through the regional investment of the funds which, in turn, are collected through taxes paid by regions.[4] Related empirical results vary depending on the economy and the time period in question. Mizutani and Tanaka (2008) for Japan in 1975-

[4] The author distinguishes infrastructure investment redistribution motives into two categories: Tactical and programmatic. In tactical redistribution few regions receive the benefits, and costs are shared by all regions. On the other hand, programmatic redistribution specifically aims to withdraw resources from certain regions and redistributes them to others (Sole-Olle, 2011).

1990, and Castells and Sole-Olle (2005) for Spain in 1987-1996 observe that relative to the national governments, sub-national units value efficiency more. On the other hand, Yamano and Ohkawara (2000) find that the Japanese central government has adopted a policy of equity regarding the allocation of public investments between 1970 and 1994 in their study on forty-seven prefectures.

Despite many such findings that support one another, a wide range of methodological diversity is still present in studies which focus on the determinants of local public investment. This heterogeneity is mainly due to differences based on the case-specific attributes of the economy in focus such as its regional governance structure, the type of public service in focus, such as transportation, communication, health, security, etc., and the scale of the investment receiving economy such as a city, region, country, trade union, and so on. We discuss further in this study how the specific case that we focus shapes our choices regarding the methodology used in our analyses.

3 Political bias and the allocation of public capital

Aside of the above discussed equity-efficiency trade-off in the distribution of public investments, political factors have also been attracting some interest. The presence of such factors may result in a politically biased regional allocation of public capital, which is the main focus of this paper. We discuss in detail the reasoning, measurement, and inclusion of a variable expressing political bias in our analyses in Section 5, and elaborate further on the results we find regarding this possible bias in Section 7. In regard to political factors, Crain and Oakley (1995, p.15) state that "...public capital decisions are not made in political vacuum" and in their study on US states, find that various political and institutional conditions influence public capital decisions. Similarly, in a study on the regions of France, which has a very similar regional governance structure to the country of focus in this study[5], Cadot et al. (1999) observe that "influence activities" represented by a political variable have important implications on the regional allocation of transportation infrastructure. Regard-

[5]Turkey has been taking the French regional governance system as a model (Gokyurt, 2010).

ing the same type of infrastructure, Painter and Bae (2001) point out to a significant influence of political factors along with demographic and economic determinants in their study on US states. Similar effects of politics on the spatial allocation of public investment for various specific cases are demonstrated by Kemmerling and Bodenstein (2006), Busemeyer (2007), and Kemmerling and Stephan (2008), and specifically in the context of political affiliation of the investment receiving units to the decision makers, by Costa-I-Font et al. (2003), Castells and Sole-Olle (2005), Joanis (2011), Sole-Olle (2011), and Zheng et al. (2013). Aside of the political affiliation of a region to the central government, public investments can also be seen by decision makers as a way to increase their election probabilities as pointed out by Nijkamp (2000). Moreover, the political structure of regional administration in an economy can have various implications on the investment decision process. For example, in a decentralized context where regions make their own investment decisions, Yu et al. (2011) find that public investments in neighboring regions play a significant role, pointing out that spatial dependence may exist if regions behave based on each others' investment choices.

4 Regional public infrastructure in Turkey

Since the establishment of the Republic of Turkey, regional policy goals have been shaped by five-year development plans made by the State Planning Organization (SPO) which was redefined as the "Ministry of Development" in 2011. For consistency, we use the label "SPO" for this governing body throughout this study.[6] Turkey has 26 statistical regions and an area of 783,562 km^2. These twenty-six regions are composed of varying number of provinces which add-up to a country total of eighty-one.[7] Along with the existence of local governing bodies and the gradual introduction of Regional Development Agencies (RDA's), the SPO is currently the principal body of decision concerning public investments.[8] Regarding local governance in Turkey, Lagendijk et al. state that

[6]For a summary of all five-year plans undertaken by the SPO see Keskin and Sungur (2010).

[7]Table A.1 lists the 26 statistical regions and their NUTS 2 level codes that cover all of Turkey's territory and Figure A.1 presents their locations.

[8]For a detailed up-to-date explanation of the role of the SPO in regional policy-making see Ertugal and Dobre (2011).

> "...it is important to remember that the current territorial governance structure, based on a division into 81 provinces, primarily serves to carry out basic administrative tasks under central authority." (Lagendijk et al., 2009, p.386)

This mechanism of centralized decision making attracts some criticism. For example, Gokyurt (2010) points out that the approach on the public investment process in Turkey suffers from an over-focus on central and sectoral points of view, and argues that the low contribution to public investment decisions by the local level causes inconsistencies between spatial needs and public investment plans. Moreover, the central authority (SPO), is fully under the authority of the government. This may suggest that existence of a political effect can also be expected to be valid for Turkey. Such a political effect can potentially play a role, leading to a political bias as discussed in Section 3 which, in turn, can result in a departure from the optimum allocation for maximizing country welfare.

Income and public investments have generally had an upward trend in Turkey during the last decade. Figure 1 shows the trends in the country gross domestic product (GDP) and transportation and communication public investments (abbreviated as "TPI" in the figure). An upwards trend for both variables is prominent especially for the period after 2002, which coincides to a post-crisis period and an election of a single-party government. Figures 2 and 3 plot the trends in the natural logarithms of GVA and public investments in transportation and communication for the five economically most developed regions (as of 2008) respectively. While for *ln GVA*, an increasing trend is observable for all five regions, the investment figures do not present clear trends except for Istanbul receiving the highest investments for the complete time range. The spatial distribution of transportation and communication infrastructure stock, GVA, and public investments in transportation and communication are presented in the maps in Figures A.2 to A.4 for the years 1999 and 2011 in the Appendix.[9,10] These figures underline the spatial patterns in the country and suggest that economic activity, and public investments in transportation and communication tend

[9] Maps have been drawn using the Stata command *spmap* written by Pisati (2007). Because the only available shapefile for the map of Turkey was in NUTS 3 scale, we have aggregated the NUTS 3 regions to NUTS 2 units by using the *mergepoly* command written by Picard and Stepner (2012).

[10] The calculation of the infrastructure index is detailed in Table A.3.

to concentrate to certain regions of the country, where obvious differences between 1999 and 2011 are present only for the latter: western and southern regions have received relatively less investments in 2011 than they did in 1999. This is the case also for several central and northern regions. However, it is important to note that these maps are snapshots in time and do not give information regarding any trend.

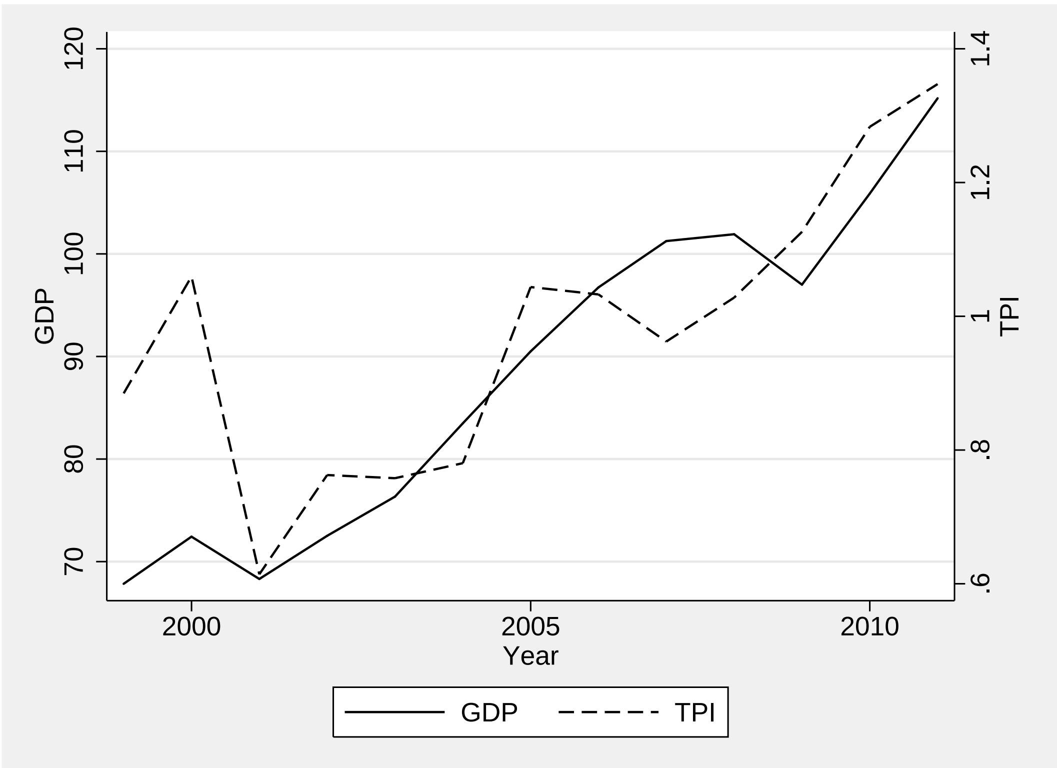


Figure 1. GVA and public investments in transportation and communication, constant 1998 national currency (billions), Turkey.

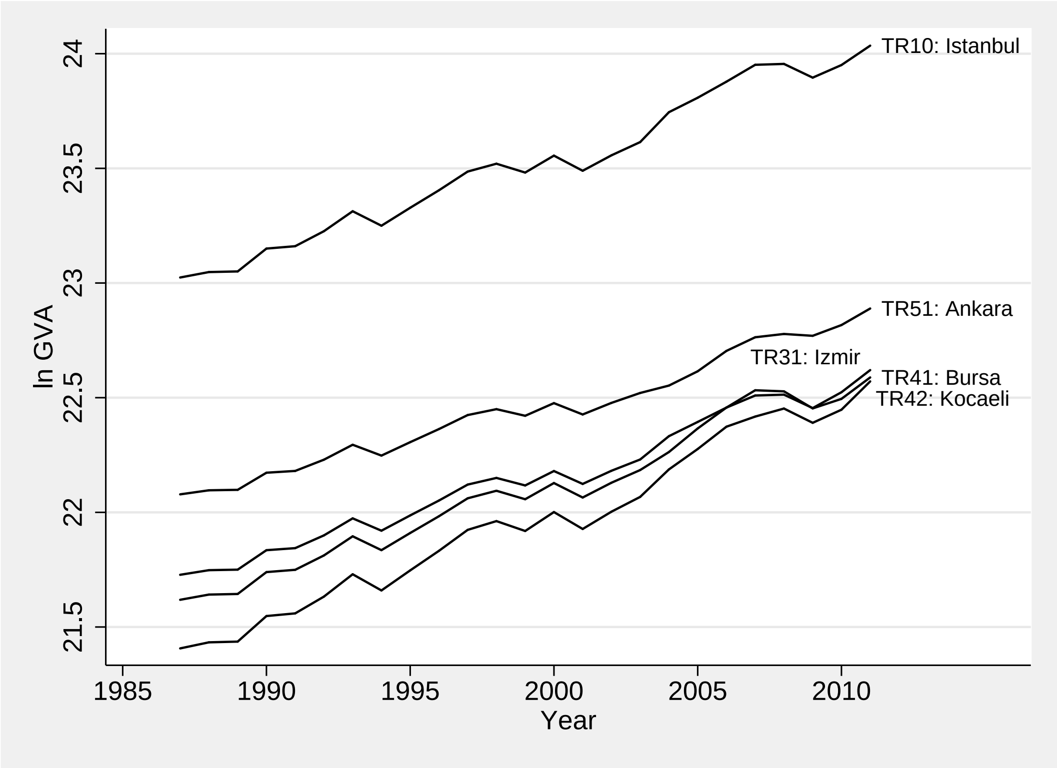


FIGURE 2. Regional *ln* GVA, constant 1998 national currency.

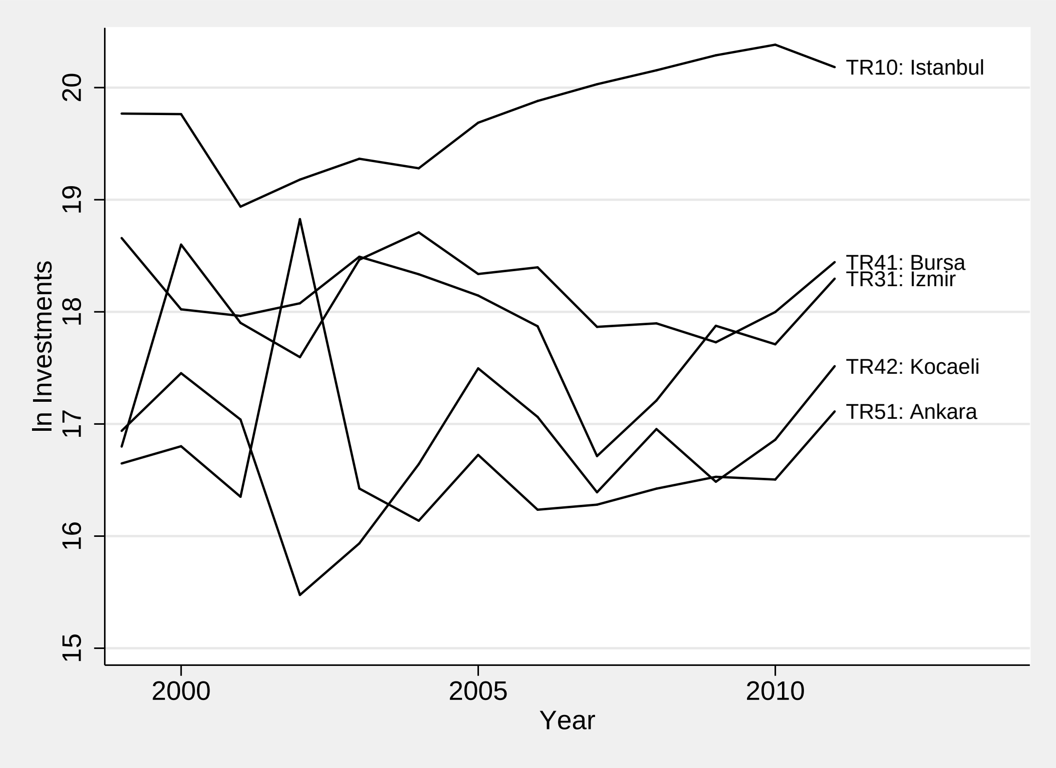


Figure 3. Regional public investments in transportation and communication per capita, constant 1998 national currency.

5 Theoretical framework and empirical approach

We follow the theoretical framework of Behrman and Craig (1987) as adapted by Castells and Sole-Olle (2005) and Zheng et al. (2013). According to this approach, a central government that faces budget and production constraints aims to maximize country welfare by allocating the public investments between regions subject to a trade-off between regional efficiency and regional equity which is embodied in the linear combination of two variables: output and population (Castells and Sole-Olle, 2005). This approach suggests that if a government is only concerned about regional equity, then regional population is the only characteristic that the government considers in the allocation of public investments. On the other hand, if the only concern of the government is regional efficiency, then the only determining factor in the allocation decisions is the regional per-capita output (Castells and Sole-Olle, 2005). These factors that represent equity and efficiency are included in our model as the population in region i at time t denoted by N_{it}, and the regional Gross Value Added (GVA) per capita denoted by $\frac{Y_{it}}{N_{it}}$ respectively where Y denotes the regional GVA.

On the other hand, the allocation process is also affected by the weights on each region that the government places (Castells and Sole-Olle, 2005; Zheng et al., 2013). These weights are determined by a set of regional characteristics. Non-uniform weights across regions can result in a biased allocation process. As discussed in section 3, political factors, especially in the form of political affiliation, are frequently considered by researchers as a determinant of public investment allocation. However, the measurement of such political effects are diverse. Some examples of the political affiliation variables used in the literature are presented in Table A.2 which demonstrates the large variety of ways that political affiliation is measured in the literature. The variation is possibly due to the diversity of the political structures and the regional governance schemes of countries focused. This leaves us some room to construct our own variable for political affiliation consistent with Turkey's centralized structure of territorial governance. In this regard, we introduce a variable to measure the regional political closeness to the central national government, P_{it}. The measurement and reasoning of this variable is as follows: we argue that the more political weight a region has in the decision-making processes of the government, the more these decisions can be biased in its favor, in line with the discussion in Section 3. An obvious influence of a regional economy on the government is through the individuals that take place in central decision-making. In Turkey, every region is allocated a fixed number of members of parliament (MP's) that are elected into the national assembly. It is also likely that some of these MP's elected into the national parliament from a given region are also members of the party or parties that form the national government. We argue that if the share of the MP's from a given region i in the government is relatively high within the total number of MP's in the parliament from the same region in a specific year, then a political bias towards this region can be expected in the allocation of transportation and communication infrastructure. Therefore, we measure P_{it} as the share of the MP's a region has in the central government party (or parties) out of all it's MP's in the parliament[11]: $P_{it} = \frac{No.\ of\ MP_{it}\ in\ the\ gov't}{no.\ of\ MP_{it}}$ where MP_{it} is the number of MP's from region i at time t.

In order to further focus on the tendencies in the literature focusing on public investment allocation, we present in Table A.4 a sample of factors considered by previous researchers. This table especially points out the diversity of the factors that are taken into account in previous studies. We assume this diversity to be the result of the case-specific attributes of each study. An important observation is that there is not a generally agreed core empirical specification of a model explaining infrastructure allocation. Table A.4 also shows that in the literature, the earlier discussed indicators representing the efficiency-equity choice and region-specific weights are usually taken into account by including variables such as the productivity of a region, its population, infrastructure stock, previously received public investments, and political variables, among others.

Regarding the estimation of the aforementioned effects on the allocation process of public infrastructure in transportation and communication, denoted as I_{it}, a potential source of endogeneity can be caused by the fact that transportation and communication public investments, may not be independent from the other types of public investments, as briefly discussed in Section 1. As these two categories of investment are together part of the total public investments that a region receives, their regional allocation decisions are expected to be made jointly. The relationship between these separate investment categories could exist in two ways: they can be complements or substitutes to a certain degree. Importantly, they are subject to the same government resource constraint, which suggests interdependence between these categories. Therefore, the public investments made in all other categories of infrastructure are included as an endogenous variable in our model ($O_{i,t}$).

Castells and Sole-Olle (2005) and Zheng et al. (2013) present a dynamic specification where a lagged dependent variable is among the explanatory variables.[12] This variable can be seen as the effect of previous policy choices in relation to concepts such as policy conti-

[11] The measurement of all variables including P_{it} are detailed in Table A.3.

[12] Unlike the empirical specification of Zheng et al. (2013), our model does not take into account the spatial interdependence of investments. Elhorst (2011) points out to the many econometric problems in the currently available dynamic spatial panel data estimators (ML, QML, IV/GMM, and Bayesian MCMC).

nuity and path dependence. In this regard, Zheng et al. (2013) point out that as investment projects may take multiple years, and investments made in a given year can bring further investments in the subsequent years. This argument leads to the motive of including the investments made in previous years as an endogenous variable. As in Castells and Sole-Olle (2005) and Zheng et al. (2013), we include into our model a lagged dependent variable, $I_{i,t-1}$ in order to take into account the expectation that investment flows may be correlated between consecutive time periods. In addition, it is likely that decision makers observe the information about regional political affiliation from the previous year (Castells and Sole-Olle, 2005) as opposed to having instant access to this information. Therefore, P_{it} is lagged one year in our estimations. On the other hand, information regarding the economic and demographic variables can be more readily available, as monthly or quarterly estimates usually exist. Therefore, these variables can be expected to have instant effects on allocation decisions of policy-makers.[13] Other than political factors, there still is a wide range of regional characteristics that need to be taken into account for controlling the earlier discussed regional weights placed by the government on regions. It is highly likely that decision makers take into account the regional needs by considering the already existing infrastructure within a region before allocating the infrastructure investments. Not surprisingly, that this is a commonly considered factor in the literature as shown in Table A.4 as this effect can work in different ways: relatively higher infrastructure stock that exists in a region can draw investment due to higher maintenance, upgrading, or extension possibilities while a government with equality concerns may be less willing to invest further on such a region, directing the investments to regions with lower levels of infrastructure. We control for the effect of the existing stock of transportation and communication infrastructure in a region by including the variable G_{it}, which is an infrastructure stock index constructed using the first principal components of the natural logarithms of the variables *Road density, Hway density, Railway density, Pub. Pier, Air capacity*, and *ADSL*.[14] Instead of including all the infrastructure categories in a

[13] Even though election polls are common, they are made by private companies and results can exhibit great variation between polling firms. Therefore political tendencies may require some time and consensus to be confirmed, while official information on the economy and the demography can be more readily available to the decision-makers.

[14] The definitions and measurements of these variables are presented in Table A.3.

disaggregated manner in the estimations, we use this combined index in order to keep the consistency with the dependent variable which is itself the combined public investment value of all these infrastructure categories. Thus, G_{it} measures how deprived or strong a region was in terms of general transportation and communication infrastructure in a given year.

Another regional attribute that is related to infrastructure is pointed out by Glomm and Ravikumar (1994, p.1174) who state that "the contribution of infrastructure to private factor productivity is subject to congestion." This view is supported by Castells and Sole-Olle (2005) who state that the utilization level of transport infrastructure stock has consequences on the services provided by infrastructure. For measuring congestion, Fernald (1999) uses the total miles driven by trucks and automobiles. We use the vehicle stock per capita in a region as an indicator of congestion and denote this variable as V_{it}/N_{it}. Based on the above discussion, our core empirical specification takes the following form:

$$\begin{aligned} lnI_{it} = c_0 + \beta_1 lnI_{i,t-1} + \beta_2 lnO_{it} + \beta_3 ln\left(\frac{Y_{it}}{N_{it}}\right) + \beta_4 lnN_{it} + \beta_5 lnP_{i,t-1} \\ + \beta_6 lnV_{it} + c_i + c_t + e_{it} \end{aligned} \tag{1}$$

where c_0 is a constant and e_{it} is the error term. As earlier discussed, the allocation of investments among regions are subject to weights determined by a set of regional characteristics. These characteristics are assumed to be partly within c_i which includes those that vary only cross-sectionally, and partly within c_t which includes those that vary only in time.

Geographical conditions of a region are also argued to affect public infrastructure projects: Ramcharan (2009) documents that the transport networks of countries with rougher surfaces are less developed than those with less rough terrain surface. In support of this conclusion, Martincus et al. (2012, p.11), state that "Roughness imposes severe challenges to development and maintenance of transport networks." Within these lines, we hypothesize that regional hilliness (or roughness) can either discourage investment, or require more costly investment projects and increase regional needs. In order to control for this potential geographical effect, we define a variable that attempts to measure the regional urban hilliness.

We denote this time-invariant variable as R_i and measure it as defined in Table A.3.

Investment decisions may be affected by the electoral cycle as suggested by Castells and Sole-Olle (2005): when an election is close, the public investment flows may may be subject to a different decision-making process. We include the variable E_t which is the number of years until the next national election year in order to take into account the effects of the electoral cycle. In order to further capture the country-wide political structure, we introduce a single party dummy, S_t, that takes the value of one if the national government has a non-coalition single party structure in a given year. This variable is in national scale and does not present cross-sectional variation. That is to say for all regions, S_t takes the value of one for the years in which the national government was consisted of a single party (2003 onwards) and zero for the coalition years 1999 through 2002.

Another potentially relevant regional characteristic is the size of a region; since transportation and communication infrastructure are distributed through space, larger regions simply have more room for investment in these infrastructures. We control for the effect of the size of a region by including the regional area as an explanatory variable in our specification and denote it as A_i. The regional characteristics enter equation (1) through the terms c_i and c_t as follows:

$$c_i = \rho_1 A_i + \rho_2 R_i + \tilde{c}_i$$

$$c_t = \delta_1 S_t + \delta_2 E_t + \tilde{c}_t$$

where the ρ and δ are the parameters associated to the corresponding variables and $\tilde{c}_i$ and $\tilde{c}_t$ are remaining unobserved region and time effects respectively. Substituting the terms determining c_i and c_t to equation (1) leads to the augmented empirical specification that we estimate:

$$\begin{aligned} lnI_{it} = {} & c_0 + \beta_1 lnI_{i,t-1} + \beta_2 lnO_{it} + \beta_3 ln\left(\frac{Y_{it}}{N_{it}}\right) + \beta_4 lnN_{it} + \beta_5 lnP_{i,t-1} \\ & + \beta_6 lnV_{it} + \rho_1 A_i + \rho_2 R_i + \delta_1 S_t + \delta_2 E_t + \tilde{c}_i + \tilde{c}_t + e_{it} \end{aligned} \qquad (2)$$

It is important to note that in equation (2) only one out of the three political variables vary by region ($lnP_{i,t-1}$). The years remaining to election and the single-party dummy are in national scale and vary over time but are constant across regions. As the variable $lnP_{i,t-1}$ is the only one that takes into account regional political differences, we expect that this variable should be more significant regarding the allocation decisions than the other two political factors.

As discussed in Section 5, the investment allocation decisions of I_{it} are assumed to be made jointly with that of lnO_{it}. As this joint decision creates endogeneity concerns, we instrument lnO_{it} with its lagged value, lnO_{it-1}, and estimate the model with two-stage least squares with region specific fixed effects (IV-FE).[15,16] The instrument is chosen to be the lagged value of the endogenous variable in order to preserve comparability with the results of the other two models, where lagged levels and/or differences are used as instruments as another source of endogeneity is the presence of the lagged dependent variable. In order to account for this endogeneity, we estimate equation (2) also with the Arellano and Bond (1991a) estimator and the Arellano and Bond (1991b)/Blundell and Bond (1998) estimator, also called Difference GMM (Diff-GMM) and System GMM (Sys-GMM) respectively.[17] The variable $lnO_{i,t-1}$ is again treated as an endogenous variable in the GMM estimations, but this time instrumented in GMM fashion as discussed in Arellano and Bond (1991a,b); Blundell and Bond (1998); Roodman (2009). Finally, in the GMM estimations, we include lagged industrial electricity consumption per capita, $K_{i,t-1}$, as an IV style instrument. The results are reported in Table 2. Year dummies are included in all estimations.

6 Data and Descriptive Statistics

By the time this study was finalized, a province level (NUTS 3) GDP series existed for Turkey between 1987 and 2001. Separately, a regional level (NUTS 2) GVA series existed for the years between 2004 and 2011. There was no sub-national output data for 2002 and

[15] See Greene (2012) for the details of instrumental variable (IV) estimation.
[16] The IV-FE estimation is made using the *xtivreg2* command in stata developed by Schaffer (2005).
[17] The GMM estimations have been done in STATA 13 by using the *xtabond2* command developed by Roodman (2009).

2003. However, these two series were presented as part of one single regional GVA series for the period 1995-2006 by *EUROSTAT* until the second half of 2011, and by *OECD* Stat until March 2013.[18] We constructed a unique regional GVA series for Turkey to be used in this study. After aggregating all the data to NUTS 2 level and deflating the figures such that all are in 1998 prices, we imputed the missing years and expressed the entire series in terms of GVA. As a result we obtained a regional GVA series for each 26 NUTS 2 regions of Turkey for the period between 1987 through 2011.[19]

The descriptive statistics of the variables used for the estimations and and in the construction of the infrastructure index are shown in table 1. All variables that enter the estimations, except A_i and R_i are time variant. Most of our sample covers a period of a national single-party government.[20] In order control for the possibility of a different general investment policy compared to the coalition party years, we include a dummy variable for the single party period. As mentioned in Section 5, this corresponds to 2003 onwards.[21]

Tables A.5 to A.9 compare for each of the five economically largest regions the public investment flows in transportation and communication to the percentage changes in the infrastructure index G, road, highway, railroad lengths, and the air passenger capacities for the years 1999 through 2011.[22] For land transportation infrastructure indicators, negative percentage changes are present. This is can be due to the high importance that the government has placed on this type of infrastructure in the last decade resulting in road distances to shorten in some cases. Such cases are often pointed out in the reports by relevant government sources. Some examples of roads that decreased in length during the last decade and their amounts of decrease as documented by governmental sources are Adyaman - Ankara

[18]The figures for the years 2002 and 2003 were accurately blank. Both institutes removed this data upon our notification that the two series could not be treated as one. We would like to thank the officials at *TURKSTAT* for confirming this situation, and to officials from *EUROSTAT* and *OECD* Stat for removing the previously published data.

[19]Appendix A.1 presents the modifications done to generate a complete regional GVA series for the range 1987-2011. We are aware of at least one study published in a peer reviewed journal, using regional output data for Turkey for the period 1992-2006, with no mention to this issue.

[20]November 2002 onwards. The single party at this period was not a member of the preceding coalition government.

[21]Because the elections which started the single-party period were late in 2002 (November 3), we do not consider this year to be within the single-party period.

[22]There are some figures that stand out in Tables A.7 and A.8 which are associated to the following reasons: in Bursa, a construction investment for a 190 km "High standard railroad" between Bandirma, Bursa, and Bilecik was done in 2009 (Devlet Planlama Teskilati, a), while in Ankara, investment for a high-speed train between Ankara and Konya was made in 2009 (Devlet Planlama Teskilati, a), and investments were made for multiple railroad constructions from Ankara to many other destinations in 2010 (Devlet Planlama Teskilati, b).

(50 km)[23], Artvin - Erzurum (24 Km)[24], Black Sea Coastal Road (17 km)[25], and a 1.5 km decrease in distance due to opening of new tunnels on the Antalya-Kemer-Tekirova road.[26] These tables also show that there are years where the stock measurements included in our data are non-responsive to monetary investment. This could be due to the fact that stock variables measure infrastructural attributes such as length and capacity while the monetary investment figures measure additional attributes that are not reflected on the measurement of stock. These are expenditures such as maintenance and repairs, IT updates, re-ordering, modernization, and reinforcement of previously built infrastructure as specified in the relevant governmental database.[27] Nevertheless, the amount of infrastructure measured in stock still needs to be included in our estimations as investment flows can be expected to depend, to a certain degree, on the existing size of infrastructure in a region as discussed in Section 5.

[23] Governorship of Adyaman, retrieved on 3-10-2012 from http://www.adiyaman.gov.tr/ortak_icerik/adiyaman.icisleri/dosyalar/devam_e

[24] Governorship of Artvin, retrieved on 3-10-2012 from http://www.artvin.gov.tr/index.php?page=haber&file=detay&id=9700.

[25] Republic of Turkey, Ministry of Transport, Maritime Affairs and Communications (2012). Retrieved on 3-10-2012 from http://www2.tbmm.gov.tr/d24/7/7-4158sgc.pdf.

[26] Republic of Turkey, Ministry of Transport, Maritime Affairs and Communications. Retrieved on 3-10-2012 fromhttp://www.kgm.gov.tr/Sayfalar/KGM/SiteEng/Root/MainPageEnglish.aspx.

[27] The database of the Republic of Turkey, Ministry of Development (2012). Retrieved on 3-10-2012 from under http://www2.dpt.gov.tr/kamuyat/il.html.

Table 1. Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
I_{it}	37522816	87231458.91	225310.2	711365696
O_{it}	87802644.13	66317566.11	1508900	406984544
GVA	3025344114.84	4076647565.64	442062336	27436367872
N_{it}	2707646.58	1981422.14	732790	13255685
P_{it}	0.64	0.15	0.24	0.93
V_{it}	349.56	410.37	25	2737
A_i	29.6	12.06	5.2	59.66
R_i	54.72	39.6	1.17	118.26
S_t	0.69	0.46	0	1
E_t	1.46	1.28	0	4
K_{it}	0.92	0.88	0.03	3.93
G_{it}	7.04	2.44	4	12.22
Infrastructure index variables				
Road density	84.08	14.94	53.49	119.67
Hway density	5.26	11.6	0	59.85
Railway density	13.16	8.15	0	40.41
Air transport capacity	3470355.03	5912765.84	0	28500000
Pub. Pier	1459.38	1955.74	0	5951
ADSL	111.81	67.18	35	353
N		338		

The public investment data of SPO that we use in this study was modified as follows: a currency change in Turkey which "erased six zeros" from the Turkish Lira in the mid 2000's was accounted for. Moreover, in the original source, this data is in provincial level. We aggregated this data to NUTS 2 level. Public investments that are directed to more than one province were not recorded in the original data provided by the SPO. However, these "missing" figures were reported under a "Multifarious Provinces" classification for each year where individual projects and the specific locations where investments are directed were provided. As an exploratory exercise, for attaining more precise figures, we have transformed the data by distributing these investments to "multifarious provinces" into the corresponding provinces following a tedious data cleaning process for the three most populous provinces of Turkey. We observed that the transformed data compared to the original version caused roughly an upward shift of the trend lines of public investments in transportation and communication. Based on this observation, for each year in the sample, we distributed these "multifarious investments" to all regions by inflating the province specific investments by the ratio of the amounts that were not reported as region-specific.[28]

7 Empirical results

Beginning by looking at the coefficient of our main variable of interest, P_{it}, we observe that all three estimation methods find a significant impact of the political affinity of the regions to the central government on the amount of public in investments in transportation and communication they receive. This result is the main finding of our study: regions that have a higher share total MP's in the government party have received higher transportation and communication investments, while those with less political affinity to the government party received less investments in this category of infrastructure through 1999 and 2011. We conclude that political effects cause bias in the allocation of this type of regional infrastructure in Turkey.

The results of all three estimation results suggest that dynamic effects are present in the regional public investment flows: previous investments have a "spillover" effect to the current period. This result is robust throughout our models and is supported by the AR1 test results from the difference and system GMM results in the second and third columns respectively. As discussed in Section 5, continuity of regional investment policies and the interrelatedness of investment flows in consecutive periods may give rise to this result. On the other hand, the other types of public investments a region receives does not have a significant coefficient. But the consistent negative sign that it has in the results from all our models may hint at a substitution effect rather than a complementary one.

All our models provide evidence that the higher the efficiency (per capita output) of a region is, the higher are investments in transportation and communication, especially based on

[28]The details of this process are presented in Appendix A.2.

the IV-FE results. However, this effect diminishes both in magnitude and significance as the endogeneity posed by the lagged dependent variable is taken into account in the GMM models at columns 2 and 3. Similarly, population has a strong and significant impact according to the IV results, but the difference and system GMM estimations yield smaller coefficients (and in the case of the difference-GMM results, an insignificant coefficient). According to the system-GMM estimation, a 1% increase in population increases investments by around 0.7% while the predicted approximate increase in investment as a response to a 1% increase in per capita output is about 1.1% (significant only in 10% level). However, the coefficients of $ln(GVA_{it}/N_{it})$ are higher in the first two columns than those of lnN_{it}, and in the case of the difference-GMM results, they have higher significance. Therefore, our results imply a lack of clear emphasis on either equality or equity of regions by the Turkish government; even though both output efficiency and regional population seem to affect investments positively, we do not observe conclusive robust evidence regarding their *relative* importance in allocation decisions.

Out of the other two political variables, only S_t yields a significant coefficient: the System-GMM results suggest that there have been more country-wide public investments in transportation and communication made during the singly party period.

We do not observe strong evidence that the existing infrastructure in a region is a determinant of transportation and communication investment allocation decisions in Turkey. The IV-FE model gives some evidence that the effect is negative. This would mean that regions with less infrastructure receive higher infrastructure investment. However, this result is not supported by the GMM estimations in terms of significance but is reinforced only in terms of direction. Similarly, congestion does not seem to play a role in the allocation decisions.

Finally, geography is not a determinant of the allocation decisions according to our results: neither the size or the hilliness of a region have significant coefficients.

Table 2: Estimation Results for Equation (10)

	(1)	(2)	(3)
	IV-FE	Diff-GMM	Sys-GMM
$lnI_{i,t\text{-}1}$	0.369***	0.324***	0.465***
	(0.0632)	(0.115)	(0.134)
lnO_{it}	-0.0780	-0.0718	-0.102
	(0.140)	(0.191)	(0.163)
$ln(GVA_{it}/N_{it})$	3.164***	2.247*	1.116*
	(0.741)	(1.180)	(0.632)
lnN_{it}	2.548***	1.904	0.714**
	(0.900)	(2.309)	(0.289)
$lnP_{i,t\text{-}1}$	0.686***	1.136**	0.720**
	(0.180)	(0.448)	(0.324)
G_{it}	-0.418*	0.256	0.0153
	(0.244)	(0.427)	(0.0488)
$ln(V_{it}/N_{it})$	0.318	0.130	-0.609
	(0.457)	(0.616)	(0.430)
S_t	-0.173	0.320	1.268***
	(0.551)	(0.705)	(0.230)
E_t	0.00899	-0.0669	-0.244
	(0.156)	(0.137)	(0.150)
A_i			0.00810

			(0.00850)
R_i			-0.000181
			(0.00216)
Constant			-13.74
			(8.868)
Observations	312	286	312
Number of regions	26	26	26
observations per region	12	11	12
Number of instruments	1	21	26
GMM lag limits		(1,2)	(1,2)
Endogenous variable(s)	$ln(Other\ PI)_{it}$	$ln(I)_{i,t\text{-}1}$, $ln(Other\ PI)_{it}$	$ln(I)_{i,t\text{-}1}$, $ln(Other\ PI)_{it}$
AR1 test (p-value)		0.000461	0.000287
AR2 test (p-value)		0.713	0.877
Hansen test (p-value)		0.499	0.214
Sargan test (p-value)		0.596	0.130
Year Dummies	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

8 Concluding Discussion

The main outcome of this study is the observed strong evidence that political bias has been present in the allocation decisions of regional transportation and communication investments in Turkey through 1999 and 2011. Strikingly, no other explanatory variable in our empirical model demonstrates such a clear and persistent effect on the regional allocation of transportation and communication infrastructure. Elaborating on this result by considering the various economic benefits presented by this types of infrastructure, which are documented in the literature and reviewed in this study, we argue that the regional allocation of transportation and communication infrastructure in Turkey is not optimally conducted. Therefore, a diversion of regional policies from their goals and a lower level of welfare, not only for regions, but also for the national economy as a whole can be expected to result from such a biased allocation process. The main policy recommendation resulting from this study is to remove the political effects from this decision-making process in the favor of concentrating only to national economic goals such as the efficiency or equity of regions, or focusing on regions lagging in terms of transportation and communication infrastructure. In the context of a possible dependence between infrastructure types, investments in transportation and communication was assumed to share the same government resource constraint with other types of investments in our analyses. However, no evidence for the complementability or substitutabilty between these infrastructure categories was observed.

Regarding the distinction between efficiency and equity concerns of the government, the results are inconclusive; there is not a clear emphasis placed by the government on regional population or regional per capita output. Finally, we also observe evidence that significantly higher investments in transportation and communication has been made nationwide during the single-party period.

A Appendix

Table A.1. Region Codes and Names

TR10: Istanbul
TR21: Tekirdag, Edirne, Kirklareli
TR22: Balikesir, Canakkale
TR31: Izmir
TR32: Aydin, Denizli, Mugla
TR33: Manisa, Afyon, Kutahya, Usak
TR41: Bursa, Eskisehir, Bilecik
TR42: Kocaeli, Sakarya, Duzce, Bilecik
TR51: Ankara
TR52: Konya, Karaman
TR61: Antalya, Isparta, Burdur
TR62: Adana, Mersin
TR63: Hatay, Kahramanmaras, Osmaniye
TR71: Kirikkale, Aksaray, Nigde,
TR72: Kayseri, Sivas, Yozgat
TR81: Zonguldak, Karabuk, Bartin
TR82: Kastamonu, Cankiri, Sinop
TR83: Samsun, Tokat, Corum, Amasya
TR90: Trabzon, Ordu, Giresun, Rize
TRA1: Erzurum, Erzincan, Bayburt
TRA2: Agri, Kars, Igdir, Ardahan
TRB1: Malatya, Elazig, Bingol, Tunceli
TRB2: Van, Mus, Bitlis, Hakkari
TRC1: Gaziantep, Adiyaman, Kilis
TRC2: Sanliurfa, Diyarbakir
TRC3: Mardin, Batman, Sirnak, Siirt

Table A.2. Measurement of political affiliation in other studies

Author	Title	Measurement
Cadot et al. (1999)	A Political Economy Model of Infrastructure Allocation: An Empirical Assessment	Dummy equal to 1 when the majority in a regional council and that of the national parliament are either both right-wing or both left-wing.
Costa-I-Font et al. (2003)	Political competition and pork-barrel politics in the allocation of public investment in Mexico	The share of votes in the municipalities received by the governing party in each state, A dummy variable for states governed by a political party different from the governing party.
Castells and Sole-Olle (2005)	The regional allocation of infrastructure investment: The role of equity, efficiency and political factors	Numerous variables constructed from data on election results, election system, and other political characteristics.
Moré and Ollé (2005)	Does decentralization improve the efficiency in the allocation of public investment? Evidence from Spain	The incumbent party's vote share in the last election.
Kemmerling and Bodenstein (2006)	Partisan Politics in Regional Redistribution Do Parties Affect the Distribution of EU Structural Funds across Regions?	Size of the left and eurosceptic parties.

Table A.2. Variable Measurement of political affiliation in other studies (cont'd)

Author	Title	Measurement
Sole-Olle and Sorribas-Navarro (2008)	The effects of partisan alignment on the allocation of intergovernmental transfers. Differences-in-differences estimates for Spain	The relative policital position of the grant receiving government (partner, leader, etc. of the upper and lower level governments) or the difference between the vote share of the party in government and the vote share of the second party.
Mizutani and Tanaka (2008)	Productivity effects and determinants of public infrastructure investment	Ratio of majority vote to minority vote in the House of Representatives, or percentage of votes for the gov't party in the prefectureal congress (depending on the investment source).
Zheng et al. (2013)	Central government's infrastructure investment across Chinese regions: A dynamic spatial panel data approach	Number of committee members (or candidates) each province has in the Central Committee of the Communist Party of China.

Table A.3: Variable Definitions

Name	Year Coverage	Description
I_{it}	1999-2011	Public investments in transportation and communication deflated to 1998 prices (national currency). Inflated to account for the missing amounts due to the "Various Provinces" classification. Source: Republic of Turkey, Ministry of Development.
O_{it}	1999-2011	Public investments in areas other than transportation and communication deflated to 1998 prices (national currency). Inflated to account for the missing amounts due to the "Various Provinces" classification. Source: Republic of Turkey, Ministry of Development.
P_{it}	1999-2011	Number of members of parliament (MP) in the government from the region divided by the lagged total number of MP's allocated to the region. Source for the base variables: Turkish Statistical Institute (Turkstat).
S_t	1999-2011	Dummy variable that equals one if a single party government was in power, and equals zero if a coalition government was in power.

Table A.3: Variable Definitions (cont'd)

Name	Year Coverage	Description
Y_{it}	1987-2011	Regional Gross value added in 1998 prices (national currency). Source: Turkstat. Modified as specified in Appendix A.
N_{it}	1990-2011	Population. Source: OECD Stat.
R_i	Constant	Elevation of the highest provincial center of the region minus that of the lowest, divided by regional area. The elevations of the provincial centers in each region has been obtained using the Google Earth software search box. Source: Google Earth 7.0.3.8542.
A_i	Constant	Area in 1000 square meters, excluding lakes. Source: Turkstat.
V_{it}	1990-2011	Total number of vehicles except trailers or tractors. Source: Eurostat.
E_t	1999-2011	The number of years remaining to a year in which elections took place. Takes the value of zero if a given year is an election year.

Table A.3: Variable Definitions (cont'd)

Name	Year Coverage	Description
K_{it}	1995-2011	Electricity consumption by industrial establishments (MWh). Source: Turkish Statistical Institute. Divided by population. Only used as an instrument in the estimations.
G_{it}	1995-2011	Index of transportation and communication infrastructure stock constructed using the first principal components of the variables *ln Road density, ln Hway density, ln Railway density, ln total length of public piers, ln Air transport capacity*.
$Road\ density_{it}$	1995-2011	Provincial road length (km). Source: Turkstat. Divided by *Area*.
$Hway\ density_{it}$	1995-2011	Highway length (km). Source: Turkstat. Divided by *Area*.
$Railroad\ density_{it}$	1995-2011	Railroad length (km). Source: Turkstat. Divided by *Area*.

Table A.3: Variable Definitions (cont'd)

Name	Year Coverage	Description
$Air\ capacity_{it}$	1987-2011	Total passenger capacity in the regional airports. Compiled from the information on area and establishment dates available at the airport interactive map at the website of the Republic of Turkey: Ministry of Transport, Maritime Affairs and Communication.
$Pub.\ pier_i$	as of 2005 (constant)	Total public pier length (m). Source Republic of Turkey - Ministry of Transport, Maritime Affairs and Communication "1995 - 2005 Ulatrma ve Haberleme", Ankara 2005.
$ADSL_i$	as of 2006 (constant)	Table Number of ADSL lines in the PTT offices. Source: Republic of Turkey - General Directorate of PTT.

TABLE A.4. Some Examples of Factors Considered in Previous Studies for the Determinants of the Allocation of Public Investment

Author	Title	Sample	Dependent variable	Considered factors
Cadot et al. (1999)	A Political Economy Model of Infrastructure Allocation: An Empirical Assessment	21 French regions	Investment in transportation infrastructure	Labor productivity, stock of transportation infrastructure, number of large establishements, taxes, political affiliation, location dummies.
Costa-I-Font et al. (2003)	Political competition and pork-barrel politics in the allocation of public investment in Mexico	32 Mexican federal units	Public investment per capita	Political Affiliation, relative income, population share, education, urbanization, political affinity, resource abundance.
Castells and Sole-Olle (2005)	The regional allocation of infrastructure investment: The role of equity, efficiency and political factors	50 Spanish regions	Transportation investment by the central government divided by the previous year's capital stock	Lagged dependent variable, output growth, population growth, trucks, land vehicles, rail transport, maritime transport, air transport, income, debt, political affinity.
Moré and Ollé (2005)	Does decentralization improve the efficiency in the allocation of public investment? Evidence from Spain	44 Spanish regions	Investment in roads	Lagged dependent variable, decentralization, growth of output, no. of vehicles, vehicle usage, political affinity.

Table A.4. Some Examples of Factors Considered in Previous Studies for the Determinants of the Allocation of Public Investment (cont'd)

Author	Title	Sample	Dependent variable	Considered factors
Kemmerling and Bodenstein (2006)	Partisan Politics in Regional Redistribution Do Parties Affect the Distribution of EU Structural Funds across Regions?	116 EU regions	EU structural funds per capita	Per capita GDP, unemployment, agricultural shares, effective number of parties, presence of federalist systems, political affinity.
Sole-Olle and Sorribas-Navarro (2008)	The effects of partisan alignment on the allocation of intergovernmental transfers. Differences-in-differences estimates for Spain	869 local Spanish governments	Grants received per capita	Political affinity, debt burden, population, property value per capita, property tax rate.
Mizutani and Tanaka (2008)	Productivity effects and determinants of public infrastructure investment	46 Japanese prefectures	Public capital investment	Private sector output, previous stock of public capital, employment indicators, political influence, population density, fiscal balance, gov't grants.
Zheng et al. (2013)	Central government's infrastructure investment across Chinese regions: A dynamic spatial panel data approach	31 Chinese provinces	Infrastructure investment made by the central government	Lagged dependent variable, spatially lagged dependent variable, GDP (quadratic), political affinity, road infrastructure, railroad infrastructure.

Table A.5: Correspondence of infrastructure investment and changes infrastructure stock

TR10: Istanbul						
Year	*TPI*	% Δ *G*	% Δ *Road length*	% Δ *Highway length*	% Δ *Railway length*	% Δ *Airport capacity*
1999	384797376.0	0	-0.1658375	0	0	0
2000	382969824.0	0	0	0	0	0
2001	167828656.0	-0.0574539	-0.4983389	0	0	14
2002	213587648.0	-0.4102019	-10.35058	0	0	0
2003	257194000.0	0.2213662	-2.793296	7.612457	0	0
2004	236313232.0	-0.0238267	2.490422	-2.572347	0	0
2005	354826336.0	-0.4317256	-10.84112	0	0	0
2006	430711040.0	-0.6652262	-16.14256	0	0	0
2007	500065440.0	0	0	0	0	0
2008	566248384.0	-0.1564413	-0.25	0	-5.238095	0
2009	647192448.0	0	0	0	0	0
2010	711365696.0	0.9425969	28.07018	0	0	0

Table A.6: Correspondence of infrastructure investment and changes infrastructure stock

TR31: Izmir						
Year	*TPI*	% Δ *G*	% Δ *Road length*	% Δ *Highway length*	% Δ *Railway length*	% Δ *Airport capacity*
1999	126816936.0	0	-0.962963	2.923977	0	0
2000	67156928.0	0.0137332	-1.570681	1.704545	0	0
2001	63317432.0	0	0	0	0	0
2002	70885456.0	0.0891208	-0.987842	2.793296	0	0
2003	107371784.0	0.3773066	-0.5372218	3.26087	8.695652	0
2004	91823424.0	0.0483963	1.774691	-0.5263158	0	0
2005	75945392.0	-0.0221887	-0.5307051	0	0	0
2006	57746812.0	0.2745712	0.152439	5.820106	0	0
2007	18143602.0	0	0	0	0	0
2008	29777156.0	0.169755	-1.674277	4	1.846154	0
2009	57994792.0	0.0162951	-0.1547988	.4807692	0	0
2010	49172868.0	-0.0128944	-0.3100775	0	0	0

Table A.7: Correspondence of infrastructure investment and changes infrastructure stock

TR41: Bursa						
Year	*TPI*	% Δ *G*	% Δ *Road length*	% Δ *Highway length*	% Δ *Railway length*	% Δ *Airport capacity*
1999	19747866.0	0	-1.325052	0	9.118541	0
2000	119625496.0	-0.9927337	0	0	0	750
2001	59517364.0	-0.0074947	-0.1258917	0	0	0
2002	43827840.0	0	0	0	0	0
2003	104561104.0	-0.0125159	-0.210084	0	0	0
2004	133385976.0	3.810494	-0.0421053	0	0	0
2005	92055936.0	-0.0048307	-0.084246	0	0	0
2006	97656920.0	4.53861	0	225	0	0
2007	57448380.0	0	0	0	0	0
2008	59269704.0	-0.1369844	0.2107926	0	-3.899721	0
2009	50056440.0	1.910984	.4627682	0	64.34782	0
2010	65583524.0	0.7201613	1.675042	13.84615	.8818342	0

Table A.8: Correspondence of infrastructure investment and changes infrastructure stock

TR51: Ankara						
Year	*TPI*	% Δ *G*	% Δ *Road length*	% Δ *Highway length*	% Δ *Railway length*	% Δ *Airport capacity*
1999	16989698.0	0	2.672467	0	1.973684	0
2000	19805366.0	-0.0787801	-0.968523	0	0	0
2001	12619823.0	-0.5572711	-0.3667482	-5.882353	0	0
2002	150107392.0	0.0448568	0.5521472	0	0	0
2003	13581354.0	0.3077955	-0.0610128	3.645833	0	0
2004	10192342.0	-0.0637925	-0.2442002	-0.5025126	0	0
2005	18341684.0	0.0099385	0.122399	0	0	0
2006	11244385.0	0	0	0	0	0
2007	11763313.0	-0.0498027	-0.6112469	0	0	0
2008	13571400.0	-0.0150068	-0.1845018	0	0	0
2009	15077028.0	2.412661	0.6161429	0	52.25806	0
2010	14717430.0	1.941078	1.592162	0	38.34746	0

Table A.9: Correspondence of infrastructure investment and changes infrastructure stock

TR42: Kocaeli						
Year	*TPI*	% Δ *G*	% Δ *Road length*	% Δ *Highway length*	% Δ *Railway length*	% Δ *Airport capacity*
1999	22721532.0	0	-0.7407407	0	8.264462	0
2000	37998184.0	-0.1056419	0.39801	0	-4.198473	0
2001	25127580.0	-0.006224	-0.148662	0	0	0
2002	5258311.5	-0.07326	-1.736973	0	0	0
2003	8329263.0	-0.1528016	-3.585859	0	0	0
2004	16884820.0	0.0177367	-0.3143007	.6535948	0	0
2005	39677976.0	0	0	0	0	0
2006	25727916.0	0.3315606	-0.262743	7.467533	0	0
2007	13138195.0	-0.0021968	-0.052687	0	0	0
2008	23087934.0	0.0361985	-0.2108593	0	1.593626	0
2009	14432585.0	-0.0132495	-0.3169572	0	0	0
2010	20988992.0	0.0154567	0.3709592	0	0	0

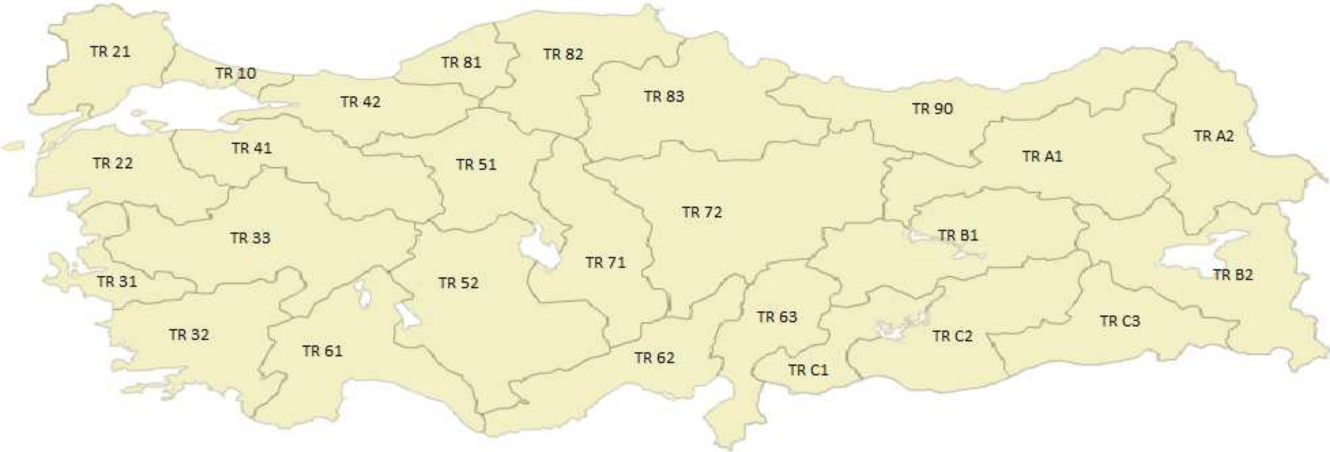
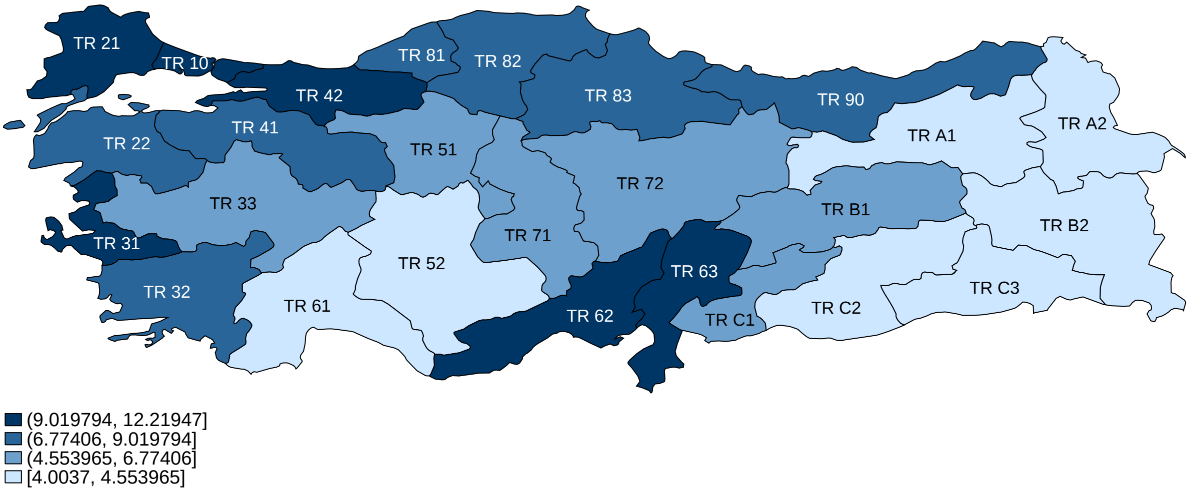


FIGURE A.1. The NUTS-2 level regions of Turkey.

Figure A.2. Spatial distribution of infrastructure stock

(a) 1999



(b) 2011

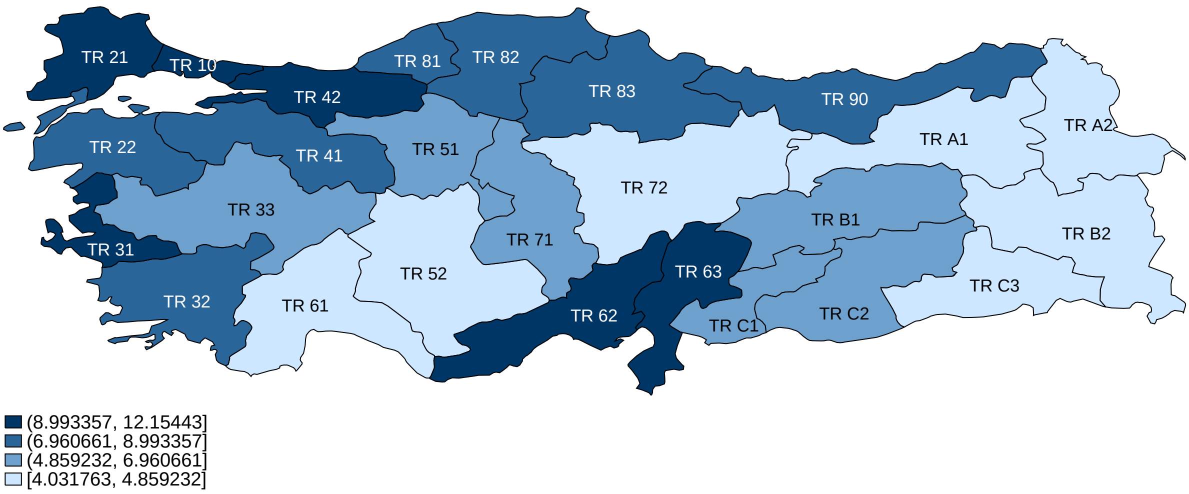
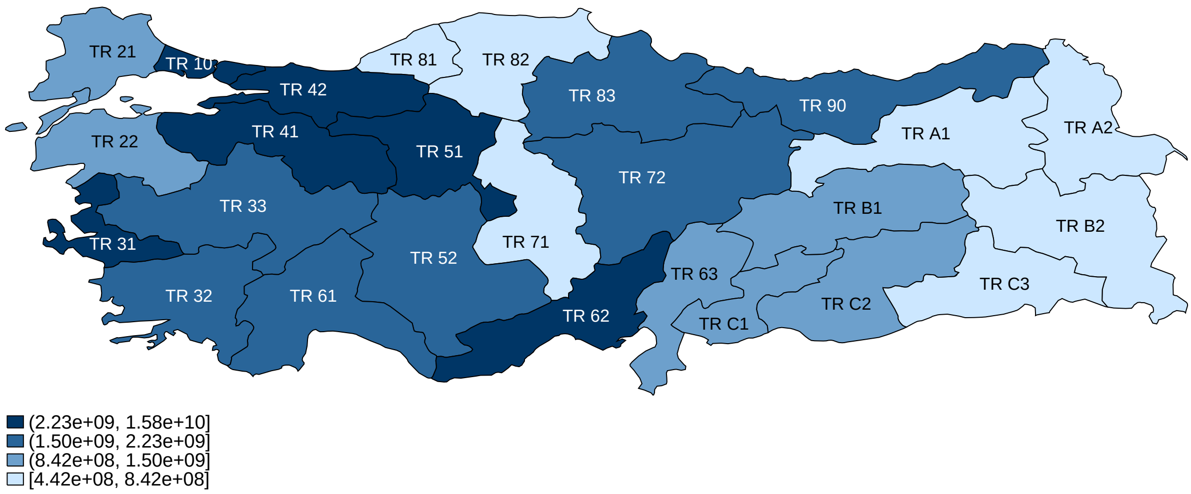


Figure A.3. Spatial distribution of gross value added

(a) 1999



(b) 2011

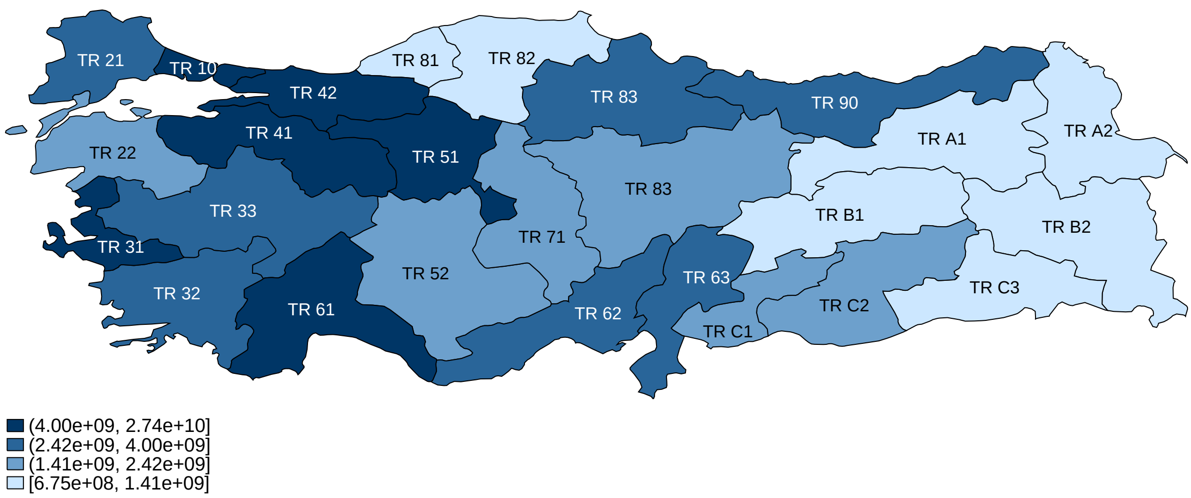
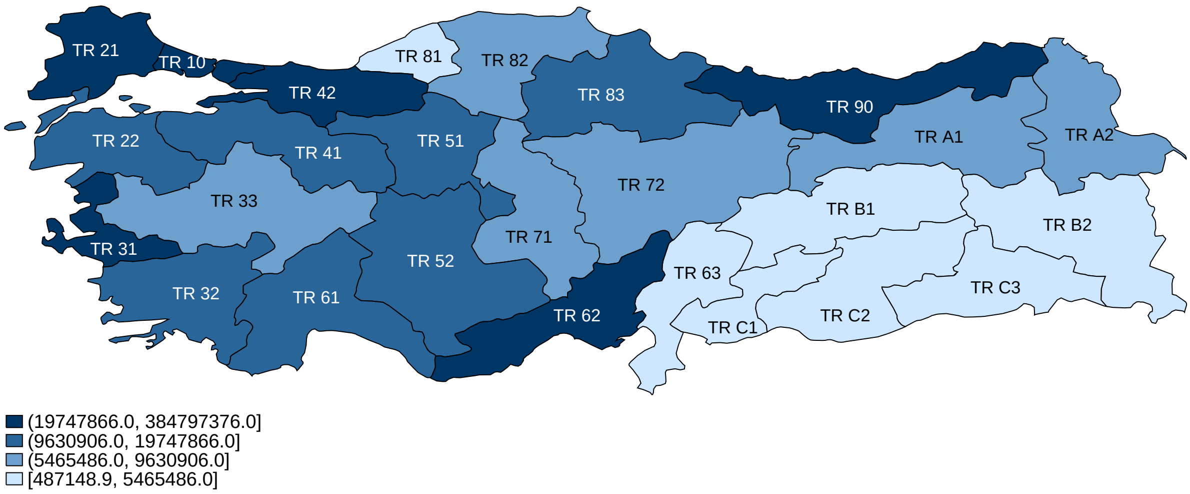
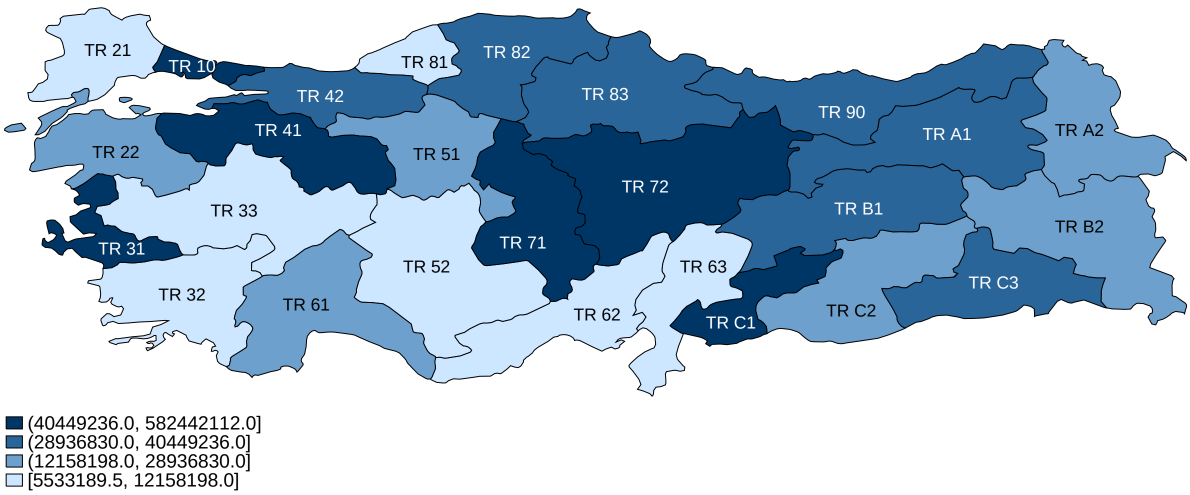


Figure A.4. Spatial distribution of public investments in transportation and communication

(a) 1999



(b) 2011



A.1 Gross value added data adjustments

As earlier mentioned, the output indicators for Turkish regions do not follow a comparable structure for the data range used in this study. Therefore, we modified the available data as such: first, the province level data was aggregated so that the spatial units would correspond to NUTS2 regions. Next, the series was deflated to 1998 constant national currency. The output series which is in terms of GDP for 1987-2001 and in terms of GVA for 2004-2011 (thus, with a two-year gap) is labeled as *R_Output*, the national GDP series for Turkey as a whole for the whole range is labeled as *N_Output*, a dummy variable that takes the value of one if the year is between 2004-2011 (ie. if the measured regional output is in terms of GVA), is labeled as *GVAdum*,

In order to express all the series in terms of GVA, for each region, the below pooled OLS regression was estimated for the years in the sample before 2004:

$$ln(R\_Output)_t = \beta_0 + \beta_1 ln(N\_Output)_t + \beta_2 GVAdum_t + \epsilon_t \quad (3)$$

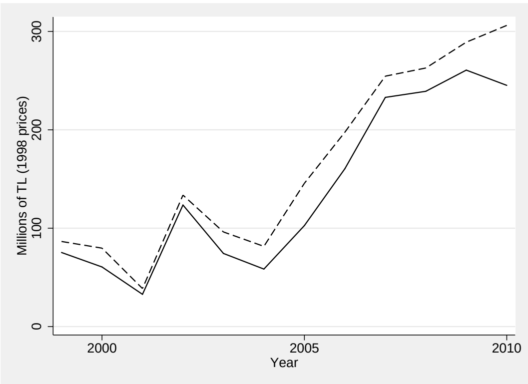
Using the parameter estimates from equation (3), ln regional GVA ($lnRGVA_t$) in constant 1998 currency was predicted. Finally, the already existing regional GVA figures for 2004-2011 were merged into this predicted series. As a result, a reconciled and interpolated regional NUTS2 GVA series for 1987-2011 has been available for the analyses conducted in this study.

A.2 Public investments data adjustments

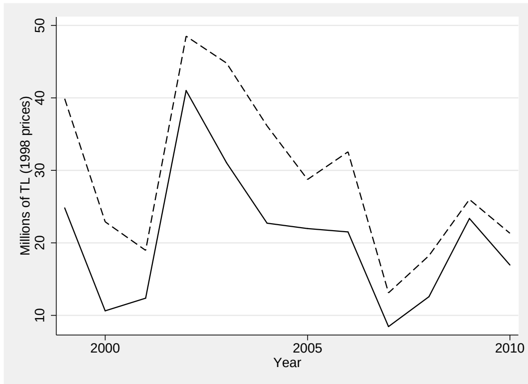
Data on public investments were available in provincial level (NUTS3) for 1999-2011. As for the GVA adjustments, the provincial data has been first aggregated to regional (NUTS2) scale. The original source reports provincial data only if all investment has been directed within the province; if investment was directed to more than one province (for example a road connecting two or more provinces, this investment did not appear within the category of the provinces. However, such investments are reported under a "Multifarious Provinces" category, where the investment and the directed provinces is explained in detail. For three large provinces, Istanbul, Izmir, and Ankara, we have distributed such investments by hand from the "Multifarious Provinces" category to the three provinces. When investments were specified as directed to more than one province, we weighted all those provinces equally when distributing the investment figures, as it is impossible to know how the investment was shared between them. As a result, we were able to compare the original data to our modified data for three major provinces. Transportation and communication investment trend lines for each province were shifted upwards, mostly following very similar trends, as can be seen in the below graph.

Figure A.5: Comparison of original and modified data

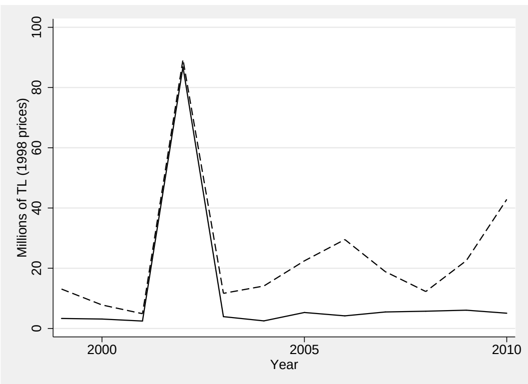
(a) Istanbul



(b) Izmir



(c) Ankara



Therefore, upon deflating all investment figures to 1998 prices in national currency using the GDP deflator for 1998, we have made an assumption that is possible to inflate each provinces investment figures by the recorded figures times the ratio of the missing investment ratio for each year. The details of this modification are as follows:

If we call the

– transportation and communication investments that are summed from available provincial data *Recorded TPI*,

– reported aggregate country investments in transportation and communication, where no investment figure is missing, *Aggregate TPI*, and

– the originally available provincial investment data OTPI,

and if for each year,

– *Aggregate TPI Recorded TPI = Missing TPI* , ie. those that are not showing up under provincial categories but are "hidden" under "Multifarious Provinces," and

– *Missing Ratio = Missing TPI / Recorded TPI*,

then for each region, the investment figures used in this study, *TPI*, equals:

$OTPI + OTPI \times MissingRatio$

The resulting regional figures add up to the officially reported total country aggregate investment in transportation and communication for each year.

References

Altunc, Ö. F. and Senturk, B. The role of public and private investment to ensure sustainable macroeconomic stability in Turkey. 2nd international symposium on sustainable development, June 8-9 2010, Sarajevo.

Arellano, M. and Bond, S. (1991a). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2):277–297.

Arellano, M. and Bond, S. (1991b). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2):277–297.

Aschauer, D. A. (1989a). Does public capital crowd out private capital? *Journal of Monetary Economics*, 24(2):171–188.

Aschauer, D. A. (1989b). Is public-expenditure productive. *Journal of Monetary Economics*, 23(2):177–200. ISI Document Delivery No.: U9363 Times Cited: 842 Cited Reference Count: 50 Aschauer, da Elsevier science bv Amsterdam.

Aschauer, D. A. (2000). Do states optimize? public capital and economic growth. *The Annals of Regional Science*, 34(3):343–363.

Behrman, J. R. and Craig, S. G. (1987). The distribution of public services: An exploration of local governmental preferences. *The American Economic Review*, pages 37–49.

Berechman, J., Ozmen, D., and Ozbay, K. (2006). Empirical analysis of transportation investment and economic development at state, county and municipality levels. *Transportation*, 33(6):537–551.

Bhatta, S. D. and Drennan, M. P. (2003). The economic benefits of public investment in transportation: A review of recent literature. *Journal of Planning Education and Research*, 22(3):288–296.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, 87(1):115–143.

Bom, P. and Ligthart, J. E. (2008). How productive is public capital? a meta-analysis.

Bougheas, S., Demetriades, P. O., and Morgenroth, E. L. (1999). Infrastructure, transport costs and trade. *Journal of International Economics*, 47(1):169–189.

Busemeyer, M. R. (2007). Determinants of public education spending in 21 OECD democracies, 19802001. *Journal of European Public Policy*, 14(4):582–610.

Cadot, O., Rller, L., and Stephan, A. (1999). *A Political Economy Model of Infrastructure Allocation: An Empirical Assessment*. Centre for Economic Policy Research.

Cantos, P., Gumbau-Albert, M., and Maudos, J. (2005). Transport infrastructures, spillover effects and regional growth: evidence of the spanish case. *Transport Reviews*, 25(1):25–50.

Carey, J. W. (2008). *Communication as culture, revised edition: Essays on media and society*. Routledge.

Castells, A. and Sole-Olle, A. (2005). The regional allocation of infrastructure investment: The role of equity, efficiency and political factors. *European Economic Review*, 49(5):1165–1205.

Castells, M., Fernandez-Ardevol, M., Qiu, J. L., and Sey, A. (2007). *Mobile Communication and Society: a global perspective*. The MIT Press.

Celbis, M. G., Nijkamp, P., and Poot, J. (2013). How big is the impact of infrastructure on trade? evidence from meta-analysis. Technical report, United Nations University, Maastricht Economic and social Research and training centre on Innovation and Technology.

Costa-I-Font, J., Rodriguez-Oreggia, E., and Lunapla, D. (2003). Political competition and pork-barrel politics in the allocation of public investment in mexico. *Public Choice*, 116(1/2):185–204.

Crain, W. M. and Oakley, L. K. (1995). The politics of infrastructure. *Journal of Law and Economics*, 38(1):1–17.

Devlet Planlama Teskilati. Dokuzuncu kalkinma plani 2007-2013, 2009 yili yatirim programi. http://www.kalkinma.gov.tr/Pages/KamuYatirimProgramlari.aspx.

Devlet Planlama Teskilati. Dokuzuncu kalkinma plani 2007-2013, 2010 yili yatirim programi. http://www.kalkinma.gov.tr/Pages/KamuYatirimProgramlari.aspx.

Ding, L., Haynes, K., and Liu, Y. (2008). Telecommunications infrastructure and regional income convergence in China: panel data approaches. *The Annals of Regional Science*, 42(4):843–861.

Dokmeci, V. and Berkoz, L. (1996). International telecommunications in Turkey. *Telecommunications Policy*, 20(2):125 – 130.

Elhorst, J. P. (2011). Dynamic spatial panels: models, methods, and inferences. *Journal of Geographical Systems*, 14(1):5–28.

Ertugal, E. and Dobre, A. M. (2011). Dynamics of regionalisation and the impact of the eu: Comparing regional reforms in romania and Turkey. *Europe-Asia Studies*, 63(7):1195–1222.

Fernald, J. G. (1999). Roads to prosperity? assessing the link between public capital and productivity. *The American Economic Review*, 89(3):pp. 619–638.

Garcia-Mila, T. and McGuire, T. J. (1992). The contribution of publicly provided inputs to states' economies. *Regional Science and Urban Economics*, 22(2):229–241.

Glomm, G. and Ravikumar, B. (1994). Public investment in infrastructure in a simple growth model. *Journal of Economic Dynamics and Control*, 18(6):1173 – 1187.

Gokyurt, F. (2010). *Kamu yatirimlarinin programlama izleme srecine yerelin katilimi*. Basbakanlik Devlet Planlama Teskilati.

Greene, W. (2012). *Econometric Analysis*. Pearson International Edition. Pearson Education, Limited.

Hamalainen, P. and Malinen, T. (2011). The relationship between regional value-added and public capital in finland: what do the new panel econometric techniques tell us? *Empirical Economics*, 40(1):237–252.

Hansen, N. M. (1965). The structure and determinants of local public investment expenditures. *The Review of Economics and Statistics*, 47(2):150–162.

Hirsch, W. Z. (1959). Expenditure implications of metropolitan growth and consolidation. *The Review of Economics and Statistics*, 41(3):232–241.

Holtz-Eakin, D. and Lovely, M. E. (1996). Scale economies, returns to variety, and the productivity of public infrastructure. *Regional Science and Urban Economics*, 26(2):105–123.

Joanis, M. (2011). The road to power: partisan loyalty and the centralized provision of local infrastructure. *Public Choice*, 146(1-2):117–143.

Kemmerling, A. and Bodenstein, T. (2006). Partisan politics in regional redistribution do parties affect the distribution of eu structural funds across regions? *European Union Politics*, 7(3):373–392.

Kemmerling, A. and Stephan, A. (2008). The politico-economic determinants and productivity effects of regional transport investment in europe. *EIB Papers*, 13(2):36–60.

Keskin, H. and Sungur, O. (2010). Bolgesel politika ekseninde yasanan donusum: Turkiyede kalkinma planlarnda bolgesel politikalarin degisimi. *Sosyal Bilimler Dergisi*, (21):271–293.

Lagendijk, A., Kayasu, S., and Yasar, S. (2009). The role of regional development agencies in Turkey: From implementing EU directives to supporting regional business communities? *European Urban and Regional Studies*, 16(4):383–396.

León-González, R. and Montolio, D. (2004). Growth, convergence and public investment. a bayesian model averaging approach. *Applied Economics*, 36(17):1925–1936.

Limao, N. and Venables, A. J. (2001). Infrastructure, geographical disadvantage, transport costs, and trade. *The World Bank Economic Review*, 15(3):451–479.

Longo, R. and Sekkat, K. (2004). Economic obstacles to expanding intra-african trade. *World Development*, 32(8):1309–1321.

Martincus, C. V., de Carballo, J., and Cusolito, A. (2012). Routes, exports, and employment in developing countries: following the trace of the inca roads. Preliminary paper.

Martínez-Zarzoso, I. and Nowak-Lehmann, F. (2003). Augmented gravity model: An empirical application to Mercosur-European union trade flows. *Journal of applied economics*, 6(2):291–316.

Mizutani, F. and Tanaka, T. (2008). Productivity effects and determinants of public infrastructure investment. *The Annals of Regional Science*, 44(3):493–521.

Montolio, D. and Sole-Olle, A. (2009). Road investment and regional productivity growth: the effects of vehicle intensity and congestion. *Papers in Regional Science*, 88(1):99–118.

Moré, A. E. and Ollé, A. S. (2005). Does decentralization improve the efficiency in the allocation of public investment? evidence from spain. *Documents de treball IEB*, (5):1.

Munnell, A. H. (1990). Why has productivity growth declined? productivity and public investment. *New England Economic Review*, 30:3–22.

Munnell, A. H. and Cook, L. M. (1990). How does public infrastructure affect regional economic performance? In *Is There a Shortfall in Public Capital Investment? Proceedings of a Conference*.

Nijkamp, P. (2000). *Infrastructure and suprastructure in regional competition: A deus ex machina?* Springer.

Painter, G. and Bae, K.-H. (2001). The changing determinants of state expenditure in the United States: 1965-1992. *Public Finance and Management*, 9(4):370–392.

Picard, R. and Stepner, M. (2012). MERGEPOLY: Stata module to merge adjacent polygons from a shapefile. Statistical Software Components, Boston College Department of Economics.

Pisati, M. (2007). SPMAP: Stata module to visualize spatial data. Statistical Software Components, Boston College Department of Economics.

Ramcharan, R. (2009). Why an economic core: domestic transport costs. *Journal of Economic Geography*, 9(4):559–581.

Randolph, S., Bogetic, Z., and Hefley, D. (1999). Determinants of public expenditure on infrastructure: Transportation and communication. Availability Note: Information provided in collaboration with the RePEc Project: http://repec.org Accession Number: 0747859; Keywords: Infrastructure; Publication Type: Working Paper; Update Code: 200410.

Romp, W. and De Haan, J. (2007). Public capital and economic growth: A critical survey. *Perspektiven der Wirtschaftspolitik*, 8(S1):6–52.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system gmm in stata. *Stata Journal*, 9(1):86–136.

Schaffer, M. E. (2005). XTIVREG2: Stata module to perform extended iv/2sls, gmm and ac/hac, liml and k-class regression for panel data models. Statistical Software Components, Boston College Department of Economics.

Sole-Olle, A. (2011). Inter-regional redistribution through infrastructure investment: tactical or programmatic? *Public Choice*.

Sole-Olle, A. and Sorribas-Navarro, P. (2008). The effects of partisan alignment on the allocation of intergovernmental transfers. differences-in-differences estimates for Spain. *Journal of Public Economics*, 92(12):2302–2319.

Stephan, A. (2001). Regional infrastructure policy and its impact on productivity: A comparison of Germany and France. Technical report, Discussion papers//WZB, Wissenschaftszentrum Berlin für Sozialforschung, Forschungsschwerpunkt Markt und Politische Ökonomie.

Wu, Y. (2007). Export performance in China's regional economies. *Applied Economics*, 39(10):1283–1293.

Yamano, N. and Ohkawara, T. (2000). The regional allocation of public investment: Efficiency or equity? *Journal of Regional Science*, 40(2):205–229.

Yu, Y., Zhang, L., Li, F., and Zheng, X. (2011). On the determinants of public infrastructure spending in Chinese cities: A spatial econometric perspective. *The Social Science Journal*, 48(3):458–467.

Zheng, X., Li, F., Song, S., and Yu, Y. (2013). Central government's infrastructure investment across Chinese regions: A dynamic spatial panel data approach. *China Economic Review*.

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