COMPETITION FOR INFRASTRUCTURE AMONG REGIONS IN TURKEY*

*Türkiye'de Bölgelerarası Altyapı Rekabeti***

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Abstract

There has been a surge in infrastructure enhancements in Turkey during the 2000s, particularly in the area of transportation and communication. This has provided valuable testing grounds of economic theories from a regional economics perspective. Empirically, the positive effect of infrastructure enhancements on trade and economic growth alongside numerous development-related outcomes is highly established in the literature. Our research aims to shed light, through econometric methods, on how the socioeconomic attributes of regional economies play a role in the allocation of the investments in transportation and communication. We observe that regional competition is an important effect among other factors.

Keywords*: Regional Policy, Regional Competition, Public investments, Spatial Dependence, Political Effects, Turkey.*

Öz

Ulaştırma ve haberleşme alanı başta olmak üzere, 2000'li yıllarda Türkiye'de altyapı geliştirilmesinde büyük bir artış yaşanmıştır. Bu durum bölgesel iktisadi bir perspektiften bakıldığında ekonomik teorilerin test edilebilmesi için çok değerli bir zemin yaratmıştır. Kalkınma ile ilgili birçok başka faktörün yanısıra, altyapı gelişiminin ticaret ve ekonomik büyümeye olan pozitif etkisi ampirik olarak literatürde kuvvetli şekilde temellendirilmiştir. Bu çalışmamızın amacı, ekonometrik yöntemler aracılığıyla bölgesel ekonomilerin sosyoekonomik özelliklerinin ulaştırma ve haberleşme kamu yatırımlarının tahsisindeki yeri konusunda aydınlatıcı bulgular edinmektir. Çalışmamızda başka faktörler ile birlikte bölgesel rekabetin önemli bir etki unsuru olduğunu gözlemlemekteyiz.

Anahtar kelimeler*: Bölgesel Politika, Bölgesel Rekabet, Kamu Yatırımları, Mekansal Bağımlılık, Siyasi Etkiler, Türkiye.*

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Introduction

The contribution of public infrastructure to economic growth has been discussed and empirically demonstrated in the past decades. Transportation and communication infrastructure has particularly drawn much attention. Transportation infrastructure strengthens the links between economic areas, facilitates the mobility of goods, input factors, human capital, and creates positive externalities to firms and industries.[1,2] Communication infrastructure on the other hand, plays an important role in the "transportation of information" by reducing the "information gap" between markets,[3] and shapes the economic geography by impacting on financial services and capital flows[4] while still being physically attached to specific locations.[5] These arguments imply that transportation and communication infrastructures are particularly of interest in a spatial context.

Within a regional framework, the allocation of these types of infrastructure across sub-national regions within a national economy has been a matter of debate for economists and politicians across the world. This allocation process requires decision makers to take into account regional and national needs together with region-specific characteristics. As a result, this process can be subject to many factors such as geographical, locational, demographic, economic, and political attributes of the investment receiving regions. Moreover, the motives regarding welfare, equality, and efficiency may differ between economies and decision-makers, presenting heterogeneity in national goals regarding regional policy. Due to this heterogeneity, studying the

1 Tiruvarur Lakshmanan et al., "Benefits and Costs of Transport", *Papers in Regional Science*, 80(2), 2001, p. 139-164.

2 Piyushimita Thakuriah et al., "Costs and Benefits of Employment Transportation for Low-Wage Workers: An Assessment of Job Access Public Transportation Services", *Evaluation and Program Planning*, 37, 2013, p. 31-42.

3 James W. Carey, *Communication as Culture, Revised Edition: Essays on Media and Society*. Routledge, 2008, p. 20.

4 Vedia Dökmeci-Lale Berköz, "International Telecommunications in Turkey", *Telecommunications Policy*, 20(2), 1996, p. 125-130.

5 Manuel Castells-Mireia et al., *Mobile Communication and Society: A Global Perspective*, The MIT Press, 2007, p. 79.

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.

The aim of this study is to assess the regional infrastructural policies form the viewpoint of a regional policy-maker. Instead of focusing on the economic outcomes of infrastructure related regional policies, this study aims to understand how decisions regarding the regional allocation of transportation and communication infrastructure in Turkey are made. In this regard, Armstrong and Taylor state that "regional policy exists because of the persistence of regional disparities in a wide range of variables, which have a profound effect on the economic welfare of a nation's regions," identifying regional policy as "an important component of a broader and more comprehensive economic policy embracing the whole economy."[6] In this regard, to maximize country welfare, policies are implemented with the purpose of influencing the distribution of economic activity among regions, and changes in this distribution imply important consequences for the inhabitants of the country as a whole.[7]

While for many developed countries, the spatial allocation of government services or infrastructure is widely researched, this is not always the case for developing economies. An example of an under-researched case is that of Turkey, where the regional allocation of infrastructure has often been part of political debate, but not a subject of academic research. In their study on Turkey, Luca and Rodriguez-Pose and Uslu[8,9] have provided valuable evidence that politics has played a role in the distribution of total public investments during the period 2005-2012. On the other hand, the distribution of specific types of public capital for

6 Armstrong, H.-Taylor, J. *Regional Economics and Policy*, Blackwell Publishing, 2000, p. 203.
7 Hoover, E. M.-Giarratani, F., *An Introduction to Regional Economics*, Alfred A. Knopf, Inc., New York 1971.
8 Davide Luca-Andres Rodriguez Pose, "Distributive Politics and Regional Development: Assessing the Territorial Distribution of Turkey's Public Investment", *The Journal of Development Studies*, 51(11), 2015, p. 1518-1540.
9 Çağrı Levent Uslu, "Seat-Vote Elasticity and the Provincial Distribution of Government Spending in Turkey." *Eurasian Economic Review* 7(1), 2017, p. 49-67.

a longer year span that covers more than one government period has not been researched — probably due to the unavailability of a sufficiently long time-series data for Turkey. This was a major limitation that we tackled in this study: a meticulous data collection process from fragmented resources allowed us to attain a panel dataset that has a time dimension of 13 years. More specifically, we have been able to conduct our analyses using a time-series cross-sectional dataset from the twenty-six statistical regions of Turkey through the years 1999-2011 (the period covered is discussed in detail in Section 4). Our results on Turkey, particularly regarding regional competition, contribute novel findings to the literature.

This study also contributes to the literature by treating the separate infrastructure investment categories as dependent on each other, and by considering the possible role of spatial dependence in investment decisions. The former consideration assumes that the allocation decisions of all categories of public capital are made jointly (i.e. they are all subject to the same resource constraint). The latter approach requires the augmentation of our models with the spatial lags of the dependent and explanatory variables, which in turn allow us to reach further valuable findings on how investment decisions are made.

The rest of this study is structured as follows. Section 2 provides a review of the past literature and elaborates on the motivation and contribution of this paper, followed by an overview of the trends in regional infrastructure investments in Turkey and the regional governance structure of the country. Section 3 discusses the theoretical framework and how it leads to our empirical analysis. The data is described in Section 4. Section 5 presents the empirical results and elaborates on their implications, followed by the concluding discussion in Section 6.

Research Motivation and Contribution

Public capital and regional goals

In growth studies, transportation public capital has been a frequently highlighted infrastructure category. A positive relationship between growth and this type of capital is found by Stephan[10] for German and French regions, Cadot et al.[11] for French regions, Berechman et al.[12] for the United States, Montolio and Sole-Olle[13] and Cantos et al.[14] for Spanish provinces. Furthermore, Bhatta and Drennan (2003) provide an extensive survey of the literature on the relationship between economic development and public investment in transportation.[15][16] There is strong evidence that transportation infrastructure, together with communication infrastructure, positively influences trade as well. Studies such as by Bougheas et al.[17] for nine core EU and Scandinavian countries, Limao and Venables[18] for 103 World Countries, Martinez-Zarzoso and Nowak-Lehmann[19] for a sample of twenty EU and Mercosur countries and Chile, Longo and Sekkat[20] for intra-African trade,

10 Andreas Stephan, "Regional Infrastructure Policy and its Impact on Productivity: A Comparison of Germany and France", *Discussion papers Wissenschaftszentrum Berlin für Sozialforschung*, 2, 2001, p. 3-41.

11 Olivier Cadot et al., "A Political Economy Model of Infrastructure Allocation: An Empirical Assessment", *Centre for Economic Policy Research Working Paper*, 15, 1999, p. 4-33.

12 Joseph Berechman et al., "Empirical Analysis of Transportation Investment and Economic Development at State, County and Municipality Levels", *Transportation*, 33(6), 2006, p. 537-551.

13 Daniel Montolio-Albert Sole-Olle, "Road Investment and Regional Productivity Growth: the Effects of Vehicle Intensity and Congestion", *Papers in Regional Science*, 88(1), 2009, p. 99-118.

14 Pedro Cantos et al., "Transport Infrastructures, Spillover Effects and Regional Growth: Evidence of the Spanish Case", *Transport Reviews*, 25(1), 2005, p. 25-50.

15 Saurav Dev Bhatta-Matthew P. Drennan, "The Economic Benefits of Public Investment in Transportation: A Review of Recent Literature", *Journal of Planning Education and Research*, 22(3), 2003, p. 288-296.

16 It is important to highlight that the concepts of "economic growth" and "Economic development" differ significantly. While the former is a one-dimensional concept and simply refers to increases in output/income, the latter is multi-dimensional and incorporates many social advancements such as reduction in poverty and ameliorations in educations and health, among others. We would like to thank the anonymous referee for underlining this important distinction.

17 Spiros Bougheas et al., "Infrastructure, Transport Costs and Trade," *Journal of International Economics*, 47(1), 1999, p. 169-189.

18 Nuno Limao-Anthony J. Venables, "Infrastructure, Geographical Disadvantage, Transport Costs, and Trade", *The World Bank Economic Review*, 15(3), 2001, p. 451-479.

19 Inmaculada Martinez Zarzoso- Felicitas Nowak Lehmann, "Augmented Gravity Model: An Empirical Application to Mercosur-European Union Trade Flows", *Journal of Applied Economics*, 6(2), 2003, p. 291-316.

20 Roberto Longo and Khalid Sekkat, "Economic Obstacles to Expanding Intra-African Trade", *World Development*, 32(8), 2004, p. 1309-1321.

Wu[21] for Chinese regions, and Celbiş et al.[22] through meta-analysis show the existence of relationship between trade and infrastructure. It has been shown that public investments can benefit an economy through other channels as well; Altunç and Şentürk[23] find that public investments in infrastructure have stimulated private investments in Turkey between 1980 and 2009, Holtz-Eakin and Lovely[24] observe a positive impact of public capital on the expansion of the manufacturing sector in the United States, and Ding et al.[25] find that telecommunications infrastructure has played an important role in regional per-capita income convergence in China during the period 1986-2002.

Recognizing the importance of public investment as a key policy tool, another strand of literature aims to explain the factors that drive its allocation. In this regard, population size is seen as an important determinant. For instance, Hansen[26] observed for a sample of Belgian communities that the concentration of population is associated with higher public investment. Similarly, Randolph et al.[27] found that factors such as the level of development, urbanization, population density, and labor force participation have strong implications on per capita spending on public infrastructure in transportation and communication. On the contrary however, Hirsch[28] observed that for a wide range of

21 Yanrui Wu, "Export Performance in China's Regional Economies", *Applied Economics*, 39(10), 2007, 1283-1293.

22 Mehmet Güney Celbiş et al., "Infrastructure and Trade: A Meta-Analysis", *Region*, 1(1), 2015, p. 25-64.

23 Ömer Faruk Altunç-Bilge Sentürk, "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.

24 Douglas Holtz Eakin-Mary E. Lovely, "Scale Economies, Returns to Variety, and the Productivity of Public Infrastructure", *Regional Science and Urban Economics*, 26(2), 1996, p. 105-123.

25 Lei Ding et al., "Telecommunications Infrastructure and Regional Income Convergence in China: Panel Data Approaches", *the Annals of Regional Science*, 42(4), 2008, p. 843-861.

26 Niles M. Hansen, "The Structure and Determinants of Local Public Investment Expenditures", *The Review of Economics and Statistics*, 47(2), 1965, p. 150-162.

27 Randolph, Susan et al., *Determinants of Public Expenditure on Infrastructure: Transportation and Communication*. The World Bank, 1999, p. 41.

28 Werner Z. Hirsch, "Expenditure Implications of Metropolitan Growth and Consolidation", *The Review of Economics and Statistics*, 41(3), 1959, p. 232-241.

urban service expenditures, population size does not matter, but geographical size does.

In more recent research, there has been a surging interest in the equity-efficiency trade-off — as defined by Yamano and Ohkawara[29] and Castells and Sole-Olle[30] — in the allocation of public infrastructure. This trade-off is defined as choosing between investing in the geographical parts of an economy with relatively higher productivity, or investing into those that are socioeconomically lagging. In the former case, the purpose is to attain a higher level of national efficiency, while in the latter it is attaining a higher level of regional equity. But within a regional competition context, achieving a fine balance between equity and efficiency is a challenge.[31]

As we shall see in our empirical results, regional competition turns out to be quite relevant for the case of Turkey. We observe — among other results — that regions compete for attracting public investment and that specific regional attributes cause investments to be directed into a region at the expense of other regions. For instance, we find that regions with the strong political affiliation to the government draw more investments.

The spatial allocation of infrastructure investment is also viewed as a redistributive policy. Sole-Olle[32] points out that money is re-allocated between regions through the investment of funds, which in turn are collected through the taxes paid in those regions. This redistribution can be either tactical or programmatic: in tactical redistribution few regions receive the benefits, and costs are shared by all regions; while in programmatic redistribution resources are withdrawn from certain regions and redistributed to

29 Norihiko Yamano-Toru Ohkawara, "The Regional Allocation of Public Investment: Efficiency or Equity?", *Journal of Regional Science*, 40(2), 2000, p. 205-229.
30 Antoni Castells-Albert Sole Olle, "The Regional Allocation of Infrastructure Investment: The Role of Equity, Efficiency and Political Factors", *European Economic Review*, 49(5), 2005, p. 1165-1205.
31 Peter Nijkamp, *Infrastructure and Suprastructure in Regional Competition: A Deus Ex Machina*? *Springer* 2000, p. 89.
32 Sole-Olle, Albert, "Inter-Regional Redistribution through Infrastructure Investment: Tactical or Programmatic?" *Public Choice* 156(1-2), 2013, p. 229-252.

others.[33] Empirical findings depend on the economy and the time period in question. Mizutani and Tanaka[34] for Japan in 1975-1990, and Castells and Sole-Olle[35] for Spain in 1987-1996 observe that relative to the national governments, efficiency is valued more by sub-national units. Nevertheless, Yamano and Ohkawara[36] find in their study on forty-seven prefectures that the Japanese central government has adopted a policy of equity in the allocation of public investments between 1970 and 1994.

Spatial dependencies and investment allocation

Investment allocation may be influenced by geographical priorities more than the equity-efficiency trade-off.[37] Naturally, infrastructure within a region may be necessarily extended or connected to the regions in proximity, leading to a spillover impact of infrastructure[38] for which we find evidence in our results. Furthermore, infrastructure improvements connect and complement each other over space. For instance, roads in one region may lead to a port in another, completing a trade route. From an investment perspective, regions may regulate their own public spending as a response to those in neighboring regions, given the economy is decentralized Yu et al.[39] Finally, It is also possible that regions may be in competition for attracting public infrastructure investment from a general budget, and this competition may have a spatial character.

In region-level research, economic circumstances are often duly considered to be continuous over space.[40] As a result, regional

33 *Ibid.*
34 Fumitoshi Mizutani-Tomoyasu Tanaka, "Productivity Effects and Determinants of Public Infrastructure Investment", *The Annals of Regional Science*, 44(3), 2008, p. 493-521.
35 Castells-Sole-Olle, *loc. cit.*
36 Yamano-Ohkawara, *loc. cit.*
37 Vassilis Monastiriotis-Yannis Psycharis, "Between Equity, Efficiency and Redistribution: An Analysis of Revealed Allocation Criteria of Regional Public Investment in Greece", *European Urban and Regional Studies*, 21(4), 2014, p. 445-462.
38 Rosina Moreno-Enrique Lopez-Bazo, "Returns to Local and Transport Infrastructure Under Regional Spillovers", *International Regional Science Review*, 30(1), 2007, p. 47-71.
39 Yihua Yu et al., "On the Determinants of Public Infrastructure Spending in Chinese Cities: A Spatial Econometric Perspective", *The Social Science Journal*, 48(3), 2011, p. 458-467.
40 Giuseppe Arbia, *Spatial econometrics: Statistical Foundations and Applications to Regional Convergence*, Springer, 2006, p. 5.

attributes such as gross domestic product (GDP) or employment are often treated by taking potential spatial effects into account.[41,42,43] This approach leads to the formulation of spatial dependence in econometric estimations through various methods.[44] Due to our focus on investments in hard infrastructure, which inevitably is of spatial character, we specifically take into account the possibility of spatial dependence. Further discussion on the spatial effects and their formalization is presented in Section 5.

Political influences and investment allocation

Regional political ties may influence the public capital distribution policies. Crain and Oakley (1995) find that various political and institutional conditions influence public capital decisions in the US states. In another study on the US, Painter and Bae[45] point out a significant influence of political factors, along with demographic and economic determinants. For the case of France - a country with similar regional governance structure to Turkey[46] - Cadot et al.[47] observe that "influence activities" play a role in the allocation of transportation infrastructure.

The importance of politics is also demonstrated in many other studies such as Kemmerling and Bodenstein,[48] Busemeyer,[49]

41 Luc Anselin-Sergio Rey, "Properties of Tests for Spatial Dependence in Linear Regression Models", *Geographical Analysis*, 23(2), 1991, p. 112-131.
42 Sergio Rey, "Spatial Empirics for Economic Growth and Convergence", *Geographical Analysis*, 33(3), 2001, p. 195-214.
43 Raymond J. Florax-Arno van der Vlist, "Spatial Econometric Data Analysis: Moving Beyond Traditional Models", *International Regional Science Review*, 26(3), 2003, p. 223-243.
44 Luc Anselin, *Spatial Econometrics: Methods and Models*, (4). Springer 1988, p. 17.
45 Gary Painter-Kwi-Hee Bae, "The Changing Determinants of State Expenditure in the United States: 1965-1992", *Public Finance and Management*, 9(4), 2001, p. 370-392.
46 Fatih Gökyurt, *Kamu Yatırımlarının Programlama ve İzleme Sürecine Yerelin Katılımı*, (Devlet Planlama Teşkilatı Müsteşarlığı, Uzmanlık Tezi), Ankara 2010, p. 26
47 Cadot-Roller-Stephan, *loc. cit*.
48 Achim Kemmerling-Thilo Bodenstein, "Partisan Politics in Regional Redistribution: Do Parties Affect the Distribution of EU Structural Funds Across Regions?", *European Union Politics*, 7(3), 2006, p. 373-392.
49 Marius R. Busemeyer. "Determinants of Public Education Spending in 21 OECD Democracies, 1980-2001", *Journal of European Public Policy*, 14(4), 2007, p. 582-610.

Kemmerling and Stephan[50], Costa-I-Font et al.,[51] Castells and Sole-Olle,[52] Joanis,[53] Sole-Olle,[54] Zheng et al.,[55] and Luca and Rodrguez-Pose.[56] Consistent with the literature, our study addresses potential political effects through alternative measurements presented in Section 3.

There is no general consensus in the literature on how political effects should be measured. Table 1 lists the various approaches that are found in earlier studies. This clear diversity in the measurement of political factors is due to the worldwide heterogeneity in political structures and regional governance systems. This heterogeneity motivates us to construct our own variables for political affiliation based on Turkey's centralized structure of territorial governance, which we discuss in Section 2.4.

Political influences and investment allocation

Regarding local governance in Turkey, Lagendijk et al. state that

> *"...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."*[57]

Indeed, "central authority" is the key defining term in Turkish

50 Achim Kemmerling-Andreas Stephan, "The Politico-Economic Determinants and Productivity Effects of Regional Transport Investment in Europe", *EIB Papers*, 13(2), 2008, p. 36-60.
51 Joan Costa-I-Font et al., "Political Competition and Pork-Barrel Politics in the Allocation of Public Investment in Mexico", *Public Choice*, 116(1-2), 2003, p. 185-204.
52 Castells-Sole-Olle, *loc. cit.*
53 Marcelin Joanis. "The Road to Power: Partisan Loyalty and the Centralized Provision of Local Infrastructure", *Public Choice*, 146(1-2), 2011, p. 117-143.
54 Sole-Olle, *loc. cit.*
55 Xinye Zheng et al. "Central Government's Infrastructure Investment Across Chinese Regions: A Dynamic Spatial Panel Data Approach", *China Economic Review* 27, 2013, p. 264-276.
56 Luca-Rodriguez-Pose, *loc. cit.*
57 Arnoud Lagendijk et al., "The Role of Regional Development Agencies in Turkey: From Implementing EU Directives to Supporting Regional Business Communities?", *European Urban and Regional Studies*, 16(4), 2009, p. 386.

regional policy-making. Since the establishment of the Republic of Turkey, regional policy goals have been shaped centrally through five-year development plans. These plans are made by the State Planning Organization (SPO) which was redefined as the "Ministry of Development" in 2011 (the final year in our dataset). For consistency, we refer to this governing body as "SPO" throughout this study. Along with the existence of local governing bodies and the gradual introduction of Regional Development Agencies, the SPO has been the principal body of decision-making concerning public investments. This centralized structure of decision-making has been attracting some criticism. According to Gökyurt (2010), the public investment policies in Turkey suffer from an over-focus on central and sectoral approaches, leading to inconsistencies between spatial needs and public investment plans.

Nationwide politics is generally expected to influence regional policies. At the beginning of the period covered in this study (1999-2011), there were five political parties in the Turkish parliament. The leading party had a victory margin of 2.13 percentage points.[58] The order of parties - or the political groups - had changed in late 1999 and remained so until 2002 with relatively similar vote shares. In 2002 however, only two political parties managed to enter the parliament by crossing the 10 percent vote threshold. The leading party remained as the single governing party since then, with large vote margins.

In the period 1999-2011, income and public investments generally showed a rising trend. Figure 1 compares the trends in GDP and public investments in transportation and communication (abbreviated as "TPI" in the figure). A general upward trend in both indicators is visible for the period after 2002. The economic crisis that took place during the early 2000s, and the subsequent recovery is also clearly observable in Figure 1.

58 All data on the past composition of the Turkish parliament is retrieved from the Inter-Parliamentary Union on 6 June, 2016.

FIGURE 1.
GDP AND PUBLIC INVESTMENTS IN TRANSPORTATION AND COMMUNICATION, CONSTANT 1998 NATIONAL CURRENCY (BILLIONS), TURKEY.

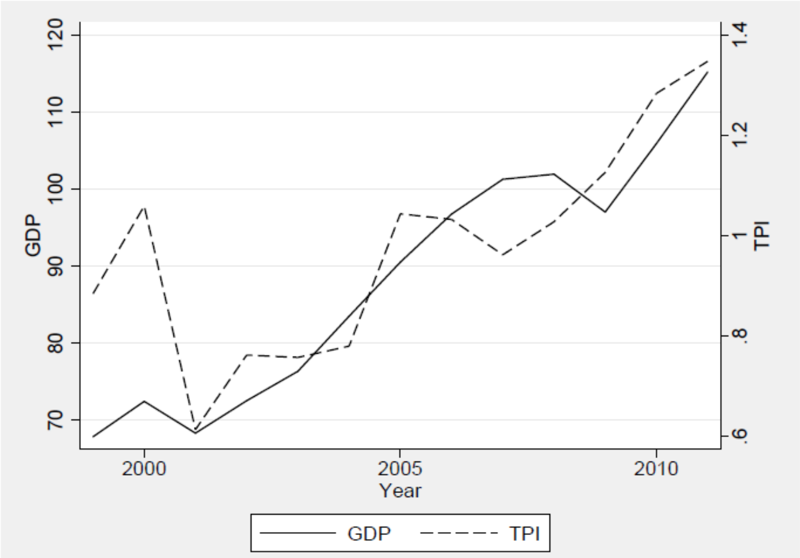


TABLE 1.

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.

Esteller and Sole (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.
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 political 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 prefectural congress (depending on the investment source).

Zheng at al. (2003)	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.
Luca and Rodriguez-Pose (2015)	Distributive politics and regional development: Assessing the territorial distribution of Turkey's public investment	Party vote shares, vote margin, number of seat allocation, political similarity dummy.
Rodriguez-Pose at al. (2016a)	Liberals, socialists, and pork-barrel politics in Greece	Political periods, re-election dummy, vote shares.
Rodriguez-Pose at al. (2016b)	Politics and investment: Examining the territorial allocation of public investment in Greece	Political periods, re-election dummy, vote shares.

Theoretical Framework and Empirical Approach

We follow the theoretical framework of Behrman and Craig[59] as adapted by Castells and Sole-Olle,[60] and empirically expanded by Zheng et al.[61] through the addition of spatial effects. Within this framework, a central government facing budget and production constraints aims to maximize country welfare by allocating public investments across regions. This process is subject to a trade-off between national efficiency and regional equity, represented as a linear combination of two variables: output per capita and population.[62] If the government is only concerned about regional equity, then regional population is the only characteristic that the government considers when allocating public investments. Therefore, the government divides infrastructure investments equally among all citizens in the country. As a result, regions which have more people receive higher shares of investment. On the other hand, if the only concern of the government is national efficiency, then regional per capita output is the only determining factor.[63] In accordance with this theoretical setting, the equity-efficiency trade-off in our model is embodied in the log-linear combination of population (N) and Gross Value Added per capita (y).

Zheng et al.[64] point out that investment projects may take multiple years and can give rise to further investments in subsequent periods. We include in our specifications the lagged dependent variable as investment flows may be determined, to some extent, by their earlier realizations. The investment value in transportation and communication in region i at time t is denoted as I_{it}.

59 Jere R. Behrman-Steven G. Craig, "The Distribution of Public Services: An Exploration of Local Governmental Preferences", *The American Economic Review*, 77(1), 1987, p. 37-49.
60 Castells-Sole-Olle, *loc. cit.*
61 Zheng, Song-Yu, *loc. cit.*
62 Castells-Sole-Olle, *loc. cit.*
63 *Ibid.*
64 Zheng, Song, and Yu, *loc. cit.*

We anticipate that the allocation process is also affected by the emphasis put by the government on each individual region.[65,66] The emphasis on a region is determined by a set of regional characteristics including political factors. The prominence of political effects may result in an allocation that is not driven purely by economic motives. In other words, a political dimension would also be present in the process, aside of the equity-efficiency trade-off. As discussed in Section 2, political factors are frequently considered by researchers as determinants of these weights, and therefore of investment preferences.

One way the government's attention on specific regions can be influenced is through the individuals that take place in central decision-making. In Turkey, every region sends a fixed number of elected members of parliament (MP) to the national assembly. If for a given region, the share of the MPs in the government out of the regional total is relatively high, then a positive political bias towards this region can be expected.[67] This expectation forms the rationale behind one of our measures of political affiliation, *P*, which is the share of the MPs a region has in the government party (or parties).[68] Another political variable that we use for measuring the political connection between a region and the national government is the regional vote margin of the nationally leading party, denoted as *M*. To illustrate; if the nationally leading party comes as the second party in a region as a result of national or regional elections, then the value of *M* for that region would be negative.

Public investments in transportation and communication are components within total public investments. Therefore, they form one of the sub-categories along with other regional public investment classifications such as health, education,

65 Castells-Sole-Olle, *loc. cit.*
66 Zheng-Song-Yu, *loc. cit*.
67 Turkey changed its government system from a parliamentarian structure to a presidential one in 2017. However, the way individual MPs are elected into the parliament has essentially remained the same.
68 The number of MPs a region sends to the parliament is decided based on its population size. Therefore, volume effects are already considered.

manufacturing, and tourism.[69] In order to capture the relationship between investment types, the sum of all other public investments O_{it} is included as an explanatory variable aside of lagged I_{it}. Because I_{it} and O_{it} are both part of total public investments, they are likely to be subject to the same government budget constraint. This would imply that the allocation decisions regarding I_{it} and O_{it} are made jointly. Furthermore, investments in separate categories can be either complements or substitutes. As a result, we specifically account for a possible dependency between I_{it} and the investments in other sectors, O_{it}.

It is likely that decision makers consider the regional needs by taking into account the already existing infrastructure within a region when allocating public capital. We therefore control for the effect of the existing stock of transportation and communication infrastructure in region *i* and denote it as $G_{i,t-1}$. This variable is an infrastructure stock index constructed using the first principal components of the natural logarithms of the variables Road Density, Highway Density, Railway Density, Public Pier Length, Air Capacity, and ADSL. Instead of including all the infrastructure categories separately in the estimations, we use this index in order to preserve consistency with the dependent variable (I) which is the total investment value of all these infrastructure types. We assume that a policy-maker with aversion to regional infrastructure disparities would direct investments to regions with less infrastructure stock. In our models, this assumption would be supported if a negative coefficient estimate on $G_{i,t-1}$ is observed. However, if the motivation is to further enhance the infrastructure in regions with already high levels of infrastructure stock, $G_{i,t-1}$ would yield a positive estimate.

Another regional attribute that is related to infrastructure is congestion.[70,71] Infrastructure congestion may necessitate additional investments into a region. An example of quantifying

69 We are unable to separate transportation investments from communication investments, as in the available data the two components are reported as pooled together.
70 Gerhard Glomm-Balasubrahmanian Ravikumar, "Public Investment in Infrastructure in A Simple Growth Model", *Journal of Economic Dynamics and Control*, 18(6), p. 1994.
71 Castells-Sole Olle, *loc. cit.*

congestion is offered by Fernald[72] who uses aggregate road utilization as a measure. For the purpose of adopting a similar measure for Turkey, we use the vehicle stock per capita (v_{it}) as an indicator of congestion.

The below presented model is constructed according to the earlier discussed variables and constitutes our base specification, but does not account for spatial dependence:

$$ln\, I_{it} = \theta + \beta_1 lnI_{i,t-1} + \beta_2 lnP_{i,t-1} + \beta_3 M_{i,t-1} + \beta_4 lnO_{it} + \beta_5 lny_{i,t-1} + \beta_6 lnN_{i,t-1} + \beta_7 lnG_{i,t-1} + \beta_8 lnv_{i,t-1} + e_{it} \quad (1)$$

In the above equation, the term θ is a constant and e_{it} is the error term. All our estimations include year dummies in order to account for the time fixed effects. As earlier discussed, the joint allocation decision of I_{it} and O_{it} poses endogeneity concerns. Moreover, the equity-efficiency trade-off itself is subject to simultaneity: while a region may receive investments thanks to its efficiency (a high y), its high efficiency may in turn be driven by investments. Therefore, additional endogeneity is implied given the inclusion of the variable $y_{i,t-1}$. Another source of endogeneity is due to the presence of the lagged dependent variable which leads to an underestimation of the persistence of regional transportation and communication public investments, in other words, a downward bias in β_1 since its estimate is greater than zero (Nickell Bias).[73] Common ways to deal with the Nickell bias are the Arellano and Bond[74] and the Arellano and Bover/Blundell and Bond estimators[75,76] - also referred as Difference GMM (Diff-GMM) and System GMM (Sys-GMM) respectively.[77]

72 John Fernald, "Roads to Prosperity? Assessing the Link Between Public Capital and Productivity", *The American Economic Review*, 89(3), 1999, p. 619-638.

73 Stephen Nickell, "Biases In Dynamic Models with Fixed Effects", *Econometrica*, 49(6), 1981, p. 1417-1426.

74 Manuel Arellano- Stephen Bond, "Some Tests of Specification for Panel Data: Monte-Carlo Evidence and an Application to Employment Equations" *The Review of Economic Studies*, 58(2), 1991, p. 277-297.

75 Manuel Arellano-Olympia Bover, "Another Look at the Instrumental Variable Estimation of Error Components Models", *Journal of Econometrics*, 68(1), 1995, p. 29-51.

76 Richard Blundell-Stephen Bond, "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics*, 87(1), 1998, p. 115-143.

77 David Roodman, "How to Do XTABOND2: An Introduction To Difference And System GMM In Stata", *Stata Journal*, 9(1), 2009, p. 86-136.

We address the rest of the potential endogeneity issues through three alternative approaches: by instrumenting lnO_{it} and $lny_{i,t-1}$ with their lagged values in a two-stage least squares estimation with fixed effects (IV-FE), by instrumenting them with their lagged levels or differences and levels in the GMM models as discussed in Arellano and Bond,[78] Arellano and Bover,[79] Blundell and Bond,[80] Roodman,[81] and finally by including residuals from first-stage estimations where the endogenous covariates are the dependent variables.[82,83]

As noted earlier, spatial effects can be highly influential in the allocation of public investments in transportation and communication. We estimate two types of spatial models. The General Spatial Model[84] (GSM) presented in Equation 2 is a spatially augmented version of Equation 1. The GSM can be reduced to the Spatial Autoregressive Model[85] (SAR) if $\rho = 0$ or to the Spatial Error Model[86] (SEM) if $\lambda = 0$. If both spatial terms are not significantly different than zero ($\rho = \lambda = 0$) then the GSM reduces to the base specification presented in Equation 1. A final extension is the Spatial Durbin Model[87] (SDM) where not only the dependent variable, but also the explanatory variables are spatially lagged.

78 Arellano-Bond, *loc. cit*.
79 *Ibid.*
80 Blundell-Bond, *loc. cit*.
81 Roodman, *loc. cit*.
82 The IV-FE estimation is made using the xtivreg2 command in Stata developed by Schaffer (cited in the below footnote), and the GMM estimations have been done in Stata by using the xtabond2 command developed by Roodman (Ibid).
83 Mark Schaffer. "XTIVREG2: Stata Module to Perform Extended IV/2SLS, GMM and AC/2HAC, LIML and K-Class Regression for Panel Data Models", *Statistical Software Components*, Boston College Department of Economics, 2005.
84 Harry H. Kelejian-Ingmar R. Prucha, "A Generalized Spatial Two-Stage Least Squares Procedure for Estimating A Spatial Autoregressive Model with Autoregressive Disturbances", *The Journal of Real Estate Finance and Economics*, 17(1), 1998, p. 99-121.
85 Anselin, *loc. cit*.
86 James LeSage-Kelley Pace, *Introduction to Spatial Econometrics*, Boca Raton, FL: Chapman&Hall/CRC, 2009, p. 203.
87 Anselin, *loc. cit*.

1. *General Spatial Model (GSM)*

$$ln\, I_{it} = \theta + \rho \sum_{j=1}^{N} w_{ij}\, lnI_{jt} + \beta_1 lnI_{i,t-1} + \beta_2 lnP_{i,t-1} + \beta_3 M_{i,t-1} + \beta_4 lnO_{it} + \beta_5 lny_{i,t-1} + \beta_6 lnG_{i,t-1} + \beta_7 lnN_{i,t-1} + \beta_8 lnv_{i,t-1} + \xi_{it}$$

$$\xi_{it} = \lambda \sum_{j=1}^{N} w_{ij} \xi_{jt} + \vartheta_{it} \qquad (2)$$

2. *Spatial Durbin Model (SDM)*

$$ln\, I_{it} = \theta + \rho \sum_{j=1}^{N} w_{ij}\, lnI_{jt} + \beta_1 lnI_{i,t-1} + \beta_2 lnP_{i,t-1} + \beta_3 M_{i,t-1} + \beta_4 lnO_{it} + \beta_5 lny_{i,t-1} + \beta_6 lnG_{i,t-1} + \beta_7 lnN_{i,t-1} + \beta_8 lnv_{i,t-1} + \alpha_1 \sum_{j=1}^{N} w_{ij}\, lnI_{j,t-1} + \alpha_2 \sum_{j=1}^{N} w_{ij}\, lnP_{j,t-1} + \alpha_3 \sum_{j=1}^{N} w_{ij}\, lnM_{j,t-1} + \alpha_4 \sum_{j=1}^{N} w_{ij}\, lnO_{jt} + \alpha_5 \sum_{j=1}^{N} w_{ij}\, lny_{j,t-1} + \alpha_6 \sum_{j=1}^{N} w_{ij}\, lnG_{j,t-1} + \alpha_7 \sum_{j=1}^{N} w_{ij}\, lnN_{j,t-1} + \alpha_8 \sum_{j=1}^{N} w_{ij}\, lnv_{j,t-1} + \epsilon_{it} \qquad (3)$$

In the above presented equations, *N* is the number of regions, ξ_{it} and ϵ_{it} are error terms and $\vartheta_{it} \sim N(0, \sigma^2_{\vartheta})$, and $\epsilon_{it} \sim N(0, \sigma^2_{\epsilon})$. The spatial lag terms with coefficients ρ and λ are introduced for the purpose of exploring the possible spatial dependence in lnI_{it} and across the unobserved factors respectively. The conductivity of spatial effects is represented by the *NN* weight matrix *W*. Each element w_{ij} of *W* is the inverse Euclidean distance between the most populous cities of regions i and j, and each element of the main diagonal of *W* is equal to zero (i.e. $w_{ij} = 0$ where $i = j$). The

SDM spatially lags the explanatory variables in the model for the purpose of investigating the nature of the spatial interactions.

Maximum Likelihood Estimation (MLE) is a common approach in coping with inconsistency and bias concerns that exist in models with spatial terms.[88] Furthermore, Spatial panel models are estimated using MLE in numerous studies, such as Pfaffermayr,[89] Ertur and Musolesi,[90] Baltagi and Bresson,[91] Lee and Yu,[92,93] Debarsy and Ertur,[94] Elhorst and Freret.[95] Since we estimate the GSM and SDM specifications using MLE, our results are subject - to some extent - to the earlier discussed Nickell dynamic panel bias. On the other hand, Lee and Yu[96] point out that in a panel setting, the variance parameter estimated with MLE will be inconsistent when the time dimension is finite. Consequently, in all fixed effects estimations we use the Lee and Yu procedure for bias correction for fixed effects as in Ertur and Musolesi,[97] Elhorst et al.,[98] Atems,[99]

88 J. Paul Elhorst, "Specification and Estimation of Spatial Panel Data Models", *International Regional Science Review*, 26(3), 2003, p. 244-268.
89 Michael Pfaffermayr, "Spatial Convergence of Regions Revisited: A Spatial Maximum Likelihood Panel Approach", *Journal of Regional Science*, 52(5), 2012, p. 857-873.
90 Cem Ertur-Antonio Musolesi, "Spatial Autoregressive Spillovers vs Unobserved Common Factors Models: A Panel Data Analysis of International Technology Diffusion", *Centre d'Economie et Sociologie Appliquees a l'Agriculture et aux Espaces Ruraux Working Paper*, 2012/09, 2012, p. 1-38.
91 Badi H. Baltagi-Georges Bresson, "Maximum Likelihood Estimation and Lagrange Multiplier Tests for Panel Seemingly Unrelated Regressions with Spatial Lag and Spatial Errors: An Application to Hedonic Housing Prices in Paris", *Journal of Urban Economics*, 69(1), 2011, p. 24-42.
92 Lung Fei Lee-Jihai Yu, "Estimation of Spatial Autoregressive Panel Data Models with Fixed Effects", *Journal of Econometrics*, 154(2), 2010a, p. 165-185.
93 Lung Fei Lee-Jihai Yu, "Some Recent Developments in Spatial Panel Data Models", *Regional Science and Urban Economics*, 40(5), 2010b, p. 255-271.
94 Nicolas Debarsy-Cem Ertur, "Testing for Spatial Autocorrelation in a Fixed Effects Panel Data Model", *Regional Science and Urban Economics*, 40(6), 2010, p. 453-470.
95 J. Paul Elhorst-Sandy Freret, "Evidence of Political Yardstick Competition in France Using A Two-Regime Spatial Durbin Model with Fixed Effects", *Journal of Regional Science*, 49(5), 2009, p. 931-951.
96 Lee-Yu, *loc. cit.*
97 Ertur-Musolesi, *loc. cit.*
98 Paul J. Elhorst et al., "The Impact of Interaction Effects among Neighbouring Countries on Financial Liberalization and Reform: A Dynamic Spatial Panel Data Approach", *Spatial Economic Analysis*, 8(3), 2013, p. 293-313.
99 Bebonchu Atems, "The Spatial Dynamics of Growth and Inequality: Evidence Using US County-Level Data", *Economics Letters*, 118(1), 2013, p. 19-22.

and Kalenkoski and Lacombe[100] among others by using the option "leeyu" in the Stata command xsmle by Belotti et al.[101] However, comparing the estimated coefficients of ln $I_{i,t-1}$ in the Sys-GMM models to those in the GSM model presented and discussed in Section 5 - which takes into account both spatial lag and spatial error dependence - imply that this bias is tolerable given the results with significant estimates.

For the purpose of coping with biases that may arise due to serial correlation, we also estimate models after a Forward Orthogonal Deviations transformation[102] (FOD) of the model covariates. The FOD transformation uses only the future observations to demean each variable and eliminate individual effects as in the first-differencing step of the Di -GMM estimation. While doing this however, the FOD transformation does not induce serial correlation in the transformed errors and residuals, unlike the FD approach. We report the FOD counterpart of each estimation model in our output tables.

Furthermore, in order to address the endogeneity that may be caused by $lnI_{i,t-1}$, $ln\ O_{it}$, and $ln\ y_{i,t-1}$ in the spatial models, we first regress each of these variables on their own first lags and all other model covariates in order to obtain the residuals from a reduced-form specification (using the same estimation procedure with the corresponding model). Following the prediction of the residuals, we estimate the main models augmented with the three predicted residuals ,, and) that correspond to the three regressors assumed to be endogenous. Subsequently, we combine this approach with a FOD transformed estimation procedure, as reported in Section 5.

Data and Descriptive Statistics

The available Turkish regional output data has been going through many revisions in terms of their measurement methods,

100 Charlene Kalenkoski-Donald Lacombe, "Minimum Wages and Teen Employment: A Spatial Panel Approach", *Papers in Regional Science*, 92(2), 2013, p. 407-417.
101 Federico Belotti et al., "Spatial Panel-Data Models Using Stata", *The Stata Journal*, 17(1), 2017, p. 139-180.
102 Arellano-Bover, *loc. cit.*

spatial scales, and time periods covered. The discontinuities and inconsistencies over time in the measurement methods present challenges that researchers must acknowledge. In December 2016, TurkStat retrospectively published a NUTS 3 level GDP series for the period 2004-2014 resulting from the adaptation of its data to the European System of National and Regional Accounts (ESA 2010). The new series however, revised the existing GDP figures for Turkey upwards by about 20 percent as a result of substantial methodological revisions, and covers only the single party years (The World Bank, 2017; IMF, 2018). Our strategy on the other hand allows us to go further back in time and include the years when the country was being run by other administrations (the 56th and 57th governments) by reconciling the available regional Gross Value Added (GVA) data with regional GDP figures from the 1990s. This procedure also allows us to better match the regional accounts with our maritime infrastructure data, which are only available for the year 2010 and does not cover any improvements in this type of infrastructure that may have happened since that year. Appendix Table: 1 provides a detailed explanation of the methods we applied in order to obtain a regional output series in NUTS 2 level for the period 1999-2011. In this way, our data set includes data from the late 1990s and early 2000s which add valuable information thanks to more variation in administrative and governmental viewpoints, in the expense of three more recent years of data which coincide with the same governing party that has been in office since late 2002.

The data are from the databases of various ministries and organizations. The sources, year coverages, and descriptions of all variables used in this study are presented in Table 2. The descriptive statistics of all variables used in the estimations and their notations are given in Table 3.

TABLE 2.

VARIABLE DEFINITIONS

Name	Year Coverage	Description
I	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	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	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. Based on general elections. Source: Turkish Statistical Institute (Turkstat).
M	1999-2011	Regional vote margin of the nationally leading party. Based on both local and general elections. Source: Turkstat.
Y	1987-2011	1987-2011 & Regional gross value added per capita in 1998 prices (national currency). Source: Turkstat for GVA and GVP, OECD Stat for population. Modified as specified in the Appendix.
N	1990-2011	1990-2011 & Population. Source: OECD Stat.
V	1990-2011	Total number of vehicles per capita (except trailers or tractors). Source: Eurostat, OECD Stat for population.

G	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	1995-2011	1995-2011 & Provincial road length (km). Source: Turkstat. Divided by regional surface.
Hway density	1995-2011	1995-2011 & Highway length (km). Source: Turkstat. Divided by regional surface.
Railroad density	1995-2011	1995-2011 & Railroad length (km). Source: Turkstat. Divided by regional surface.
Air capacity	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	as of 2005 (constant)	Total public pier length (m). Source Republic of Turkey - Ministry of Transport, Maritime Affairs and Communication "1995 - 2005 Ulaştırma ve Haberleşme", Ankara 2005.
ADSL	as of 2006 (constant)	Number of ADSL lines in the PTT offices. Source: Republic of Turkey - General Directorate of PTT.

TABLE 3.

DESCRIPTIVE STATISTICS

Variable	Mean	Std. Dev.	Min	Max
Public investments in transportation and communication, millions of TL *(I)*	37.52	87.23	0.23	711.37
Other public investments, millions of TL *(O)*	87.8	66.32	1.51	406.98
Gross value added per capita, TL *(y)*	952.64	421.84	349.04	2069.78
Population, millions *(N)*	2.71	1.98	0.73	13.26
Share of region's MP's in the government in total MP's of the region *(P)*	0.64	0.15	0.24	0.93
Vote margin *(M)*	11.53	19.59	-26.55	54.64
Infrastructure index *(G)*	7.04	2.44	4	12.22
Vehicles per 1000 capita *(v)*	115.27	60.17	18.48	279.35
N	338			

Empirical Results

The instrumental variable (IV) estimation results are reported in Table 4. As discussed in Section 3, we initially present an instrumental variable fixed effects model (IV-FE), and its FOD transformed counterpart to address possible endogeneity issues. Aside of the expected persistence in investments, we observe positive and significant coefficient estimates on $lnP_{i,t-1}$. The other measure for political influence, $M_{i,t-1}$ does not yield significant results. Our initial results also suggest that richer regions attract more investment based on the results for $lny_{i,t-1}$ from both the FE and FOD models. Slight evidence for a positive role of population is also present among the FE results.

Moving on to the GMM results, presented in Table 5, we observe some evidence in the FOD transformed Diff-GMM model (columns 3 and 4) and the Sys-GMM estimation suggesting that political affiliation ($P_{i,t-1}$) influences the allocation of investments across regions. Furthermore, the Diff-GMM model and its FOD counterpart imply that regions with less infrastructure stock (Gi,t-1) are likely to receive more public investments in transportation and communication. The GMM results do not provide any information on the aforementioned spatial spill-overs and possible competition effects. Nonetheless, the political influences prominent in the IV-FE model results are still present to some degree in the findings from the GMM models.

As discussed in Section 2.2, economic activity is continuous over space. The omission of spatial effects in region-level analysis often leads to unrealistic models where regions are assumed to be independent units of observation. The results of the FE and FOD transformed GSM and SDM estimations (Equations 2 and 3) are presented in Table 6. The SDM specification is our most comprehensive model as it includes spatially lagged explanatory variables along the spatially lagged dependent variable. The two SDM estimations (FE and FOD) yield a negative and significant estimate of ρ, suggesting that investments received by surrounding regions negatively impact the investment flows into a region. In other words, the more regions in the proximity receive transportation and communication investments, the less a region will receive investments in the same category. This result, which is our principal finding, strongly indicates the existence of competition for public infrastructure investments in transportation and communication across regions. The GSM on the other hand, which omits spatially lagged terms, does not yield any significant result regarding the spatially lagged dependent variable and the spatially lagged unobserved terms. All spatial panel models presented in this paper, and the direct and indirect effects are estimated using the Stata command xsmle developed by Belotti et al.[103] The spatial weight matrix is generated from coordinates using the Stata command spmat developed by Drukker et al.[104]

The spatially lagged explanatory variables provide additional valuable information which can shed light on the nature of regional competition. However, simply considering the point estimates reported in Table 6 may not be sufficient. Based on the contribution of LeSage and Pace,[105] Elhorst[106] shows that it is important to distinguish among the direct and indirect effects in spatial models. In the SDM, both the direct and indirect effects of explanatory variables depend on the coefficient estimates of their spatially lagged values.[107] We single out the variables $lnI_{i,t-1}$, $lny_{i,t-1}$, and $P_{i,t-1}$, and present their indirect and direct effects (based on the SDM) in Table 7. The direct and indirect effect estimates are similar to the estimation results reported in Table 6. Turning back to the earlier discussed results on regional competition, aside of the expected positive estimate for lagged investments, we observe a negative and significant indirect effect of this variable for both SDM estimations (Table 7). This result reinforces the implication conveyed by the estimated ρ, and suggests that the competition for investments persists through time, at least for one lag period. Therefore, if a region attracts investment, it can be expected that this will negatively affect the investment flows into its surrounding regions at least for the following year.

Continuing with the results pertaining to infrastructure, the FE SDM results hint that infrastructure presence in nearby regions may positively impact on how much investment a region receives (the coefficient estimate of $\sum_{j=1}^{N} w_{ij} G_{j,t-1}$). This result may be attributable to the continuity of infrastructure over space, implying that infrastructure in nearby areas are complementary to

103 Belotti-Hughes-Mortari, *loc. cit.*
104 Drukker, David M., et al., "SPPACK: Stata Module for Cross-Section Spatial-Autoregressive Models (Version S457245)", *Boston College Department of Economics*, 2011.
105 LeSage-Pace, *loc. cit.*
106 Paul J. Elhorst, "Applied Spatial Econometrics: Raising the Bar", *Spatial Economic Analysis*, 5(1), 2010, p. 9-28.
107 Paul J. Elhorst, *Spatial Panel Data Models*, Springer Berlin Heidelberg, Berlin-Heidelberg, 2014, p. 37-93.

a region's own infrastructure. This finding is related to the earlier discussed spillover impact of infrastructure[108] and emphasizes again the important function of investments in transportation and communication as a regional connectivity policy instrument.

The coefficient estimates for $P_{i,t-1}$ are positive and significant for all spatial models, suggesting that regions which are affiliated more closely to the government receive higher investments. Further underlining the existence of political influences, the spatially lagged counterpart of this variable ($\sum_{j=1}^{N} w_{ij} P_{j,t-1}$) has a negative effect according to both the FE and FOD SDM estimations. The effects of $P_{i,t-1}$ and its spatial lag are confirmed by the direct and indirect effects reported in Table 7. This result elucidates a mechanism that reinforces the earlier observed regional competition effect; while $P_{i,t-1}$ increases investment inflows, a region receives less investments if the affiliation of nearby regions to the central government is strong. In other words, regions that are closer to the government steer investments towards themselves at the expense of surrounding regions. For the vote margin variable on the other hand, we only observe significant estimates for its spatially lagged counterpart ($\sum_{j=1}^{N} w_{ij} M_{j,t-1}$), but no significant indirect effects are observed to validate this finding.

The small evidence regarding spatially lagged other investments in the FE SDM model ($\sum_{j=1}^{N} w_{ij} O_{jt}$) suggest that investments in other sectors attract transportation and communication public investments to their vicinity. If this effect exists, then transportation and communication investments are spatially complementary to other investments such as in education, health, manufacturing, or tourism, as these sectors need transportation and communication infrastructure to be built or improved in surrounding areas. Weak evidence is also observed for population in the FE GSM results, suggesting that regions with larger population receive more investments.

Finally, the FOD transformed spatial models suggest that $lnI_{i,t-1}$ is endogenous (as suggested by the significant estimate on).

108 Moren-Lopez-Bazo, *loc. cit.*

TABLE 4.

IV ESTIMATION RESULTS

	FE	FOD
$ln\ I_{i,t-1}$	0.465***	0.491***
	(0.133)	(0.120)
$P_{i,t-1}$	1.948***	1.941***
	(0.529)	(0.530)
$M_{i,t-1}$	-0.00546	-0.00567
	(0.00490)	(0.00525)
lnO_{it}	-0.0677	-0.0354
	(0.164)	(0.145)
$ln\ y_{i,t-1}$	2.655**	2.583**
	(1.274)	(1.208)
$ln\ N_{i,t-1}$	2.051*	2.025
	(1.187)	(1.250)
$G_{i,t-1}$	-0.370	-0.303
	(0.278)	(0.206)
$ln\ v_{i,t-1}$	0.369	0.343
	(0.489)	(0.490)
A		0.0326
		(0.143)
Observations	286	260
Obs. Per region	11	11
No. of instruments	8	8

Instrumented variables: $lnI_{i,t-1}$, lnO_{it}, $lny_{i,t-1}$.

Stata module for IV-FE models: xtivreg2.

Robust SE's in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Year dummies included in all estimations.

TABLE 5.
GMM ESTIMATION RESULTS

	Diff-GMM		FOD-GMM		Sys-GMM		Sys-FOD-GMM	
Lag Limits:	2,3	2,4	2,3	2,4	2,3	2,4	2,3	2,4
$ln\ I_{i,t-1}$	0.564*	0.883***	0.831***	0.882***	0.840***	0.749***	0.913***	0.780***
	(0.315)	(0.240)	(0.150)	(0.125)	(0.280)	(0.266)	(0.162)	(0.268)
$P_{i,t-1}$	1.855	2.398	1.000*	1.200*	1.296	2.155**	0.396	1.086
	(1.376)	(1.549)	(0.523)	(0.594)	(0.921)	(1.039)	(0.567)	(0.845)
$M_{i,t-1}$	-0.00686	-0.0118	-0.00540	-0.00872	-0.00695	-0.00461	-0.00137	- 0.000923
	(0.00828)	(0.00893)	(0.00544)	0.00514	(0.00742)	(0.0128)	(0.00612)	(0.00699)
lnO_{it}	-0.366	-0.217	0.0346	-0.0388	-0.180	-0.620	0.108	-0.510
	(0.263)	(0.339)	(0.117)	(0.139)	(0.239)	(0.750)	(0.137)	(0.475)
$ln\ y_{i,t-1}$	7.634	-2.735	4.063	4.243	-0.816	0.503	-0.912	-0.467
	(9.567)	(7.654)	(3.093)	(4.068)	(1.553)	(2.792)	(1.933)	(4.383)
$ln\ N_{i,t-1}$	7.212	-3.497	2.985	3.068	0.381	1.355	0.143	1.041
	(9.803)	(7.381)	(2.144)	(2.811)	(0.464)	(1.186)	(0.290)	(0.677)
$G_{i,t-1}$	-0.876*	-0.958*	-0.365**	-0.368*	0.0418	0.0221	0.0279	0.0352
	(0.481)	(0.481)	(0.168)	(0.207)	(0.0634)	(0.162)	(0.0783)	(0.172)
$ln\ v_{i,t-1}$	0.429	-0.0616	0.156	0.261	0.518	-0.695	0.489	0.0799
	(1.474)	(1.292)	(0.318)	(0.348)	(0.879)	(1.120)	(1.102)	(2.550)
A					9.854	-15.08	7.819	1.010
					(16.00)	(20.38)	(20.37)	(49.23)
Observations	286	286	286	286	312	312	312	312
Obs. Per region	11	11	11	11	12	12	12	12
No. of instruments	22	25	22	25	26	29	26	29
AR1 test (p-val)	0.0249	0.00152	0.000891	0.000435	0.00681	0.00365	0.0012	0.00541
AR2 test (p-val.)	0.708	0.561	0.603	0.684	0.746	0.741	9.987	0.74
Hansen test (p-val.)	0.17	0.157	0.216	0.197	0.122	0.541	0.116	0.573

Instrumented variables: $lnI_{i,t-1}$, lnO_{it}, $lny_{i,t-1}$.

Stata module for GMM models: xtabond2.

Robust SE's in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Year dummies included in all estimations.

TABLE 6.

ESTIMATION RESULTS FOR SPATIAL MODELS

	GSM-FE	SDM-FE	GSM-FOD	SDM-FOD
$ln\ I_{i,t-1}$	0.394***	0.399***	0.263***	0.276***
	(0.0582)	(0.0607)	(0.0635)	(0.0655)
$P_{i,t-1}$	1.882***	1.843***	1.571***	1.751***
	(0.430)	(0.410)	(0.430)	(0.434)
$M_{i,t-1}$	-0.00344	-0.00505	-0.00580	-0.00708
	(0.00426)	(0.00421)	(0.00418)	(0.00436)
lnO_{it}	0.000412	0.0580	0.00357	0.0340
	(0.0926)	(0.0976)	(0.111)	(0.111)
$ln\ y_{i,t-1}$	1.241	1.325	0.486	0.575
	(1.071)	(1.092)	(1.195)	(1.190)
$G_{i,t-1}$	-0.282	-0.239	-0.0631	-0.0574
	(0.292)	(0.312)	(0.301)	(0.320)
$ln\ N_{i,t-1}$	2.174*	1.895	0.888	0.405
	(1.259)	(1.343)	(1.103)	(1.169)
$ln\ y_{i,t-1}$	0.381	0.379	0.160	0.0574
	(0.423)	(0.505)	(0.443)	(0.524)
$\hat{U}_O$	-0.0812	-0.0974	-0.0155	0.0623
	(0.197)	(0.212)	(0.153)	(0.158)
$\hat{U}_I$	-0.0125	-0.0883	0.391***	0.348***
	(0.146)	(0.156)	(0.108)	(0.110)
$\hat{U}_y$	1.635	1.569	0.864	0.446
	(1.521)	(1.531)	(1.516)	(1.510)
P	-0.441	-0.740***	-0.356	-0.698***
	(0.282)	(0.203)	(0.294)	(0.212)
Λ	-0.288		-0.388	
	(0.312)		(0.336)	

$\sum_{j=1}^{N} w_{ij}\, lnI_{j,t-1}$		0.530		0.427
		(0.325)		(0.330)
$\sum_{j=1}^{N} w_{ij}\, lnP_{j,t-1}$		-3.070**		-3.435**
		(1.471)		(1.511)
$\sum_{j=1}^{N} w_{ij}\, lnM_{j,t-1}$		0.0366**		0.0298*
		(0.0157)		(0.0168)
$\sum_{j=1}^{N} w_{ij}\, lnO_{jt}$		0.960*		0.701
		(0.516)		(0.538)
$\sum_{j=1}^{N} w_{ij}\, lny_{j,t-1}$		-0.444		0.0333
		(3.596)		(3.735)
$\sum_{j=1}^{N} w_{ij}\, lnG_{j,t-1}$		4.388**		1.498
		(2.159)		(2.020)
$\sum_{j=1}^{N} w_{ij}\, lnN_{j,t-1}$		2.624		3.036
		(6.322)		(6.611)
$\sum_{j=1}^{N} w_{ij}\, lnv_{j,t-1}$		-3.187		-1.353
		(3.058)		(3.215)
Observations	286	286	260	260
Obs. Per region	11	11	10	10
Log-likelihood	-219.4	-211.8	-233.1	-228.5

Stata module for spatial models: xsmle. GSM: General Spatial Model.

SDM: Spatial Durbin Model. Region FE's included in all estimations.

Robust SE's in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE 7.

DIRECT AND INDIRECT EFFECTS OF VARIABLES OF INTEREST

	$ln\ I_{i,t-1}$	$ln\ y_{i,t-1}$	$P_{i,t-1}$	$M_{i,t-1}$
FE				
Direct	0.412***	1.158	1.861***	-0.004
Indirect	-0.178***	-0.488	-0.799***	0.002
FOD				
Direct	0.285***	0.367	1.757***	-0.007
Indirect	-0.118***	-0.140	-0.724***	0.003

Concluding Discussion and Policy Implications

Our point of departure was the stylized fact that transportation and communication public infrastructure provides a positive contribution to an economy through various channels. The most important result of our study is that there is competition for public investments in transportation and communication among regional economies in Turkey, possibly exacerbated by political biases. Regions that are politically more affiliated to the government receive higher amounts of investments, and if there are nearby regions with strong affiliations to the government, regions are negatively affected in terms of investment inflows. We also observe evidence - albeit less strong compared to the competition and political effects – that infrastructure presence, investments in other sectors made in regions in proximity, and population are determinants of investment allocation over space.

Aside of regional competition and political influences, the equity efficiency trade-off has been an integral concept in this paper. Armstrong and Taylor classify public investments in infrastructure as an instrument to revive the disadvantaged regions based on the “interventionist approach” in contrast to the "free market approach."[109] They clarify this view by stating "the interventionist approach argues that it is vitally important to improve the stock of social infrastructure in high-unemployment areas in order to improve their competitiveness" while the free market approach "... views the regional problem as being the result of market inefficiencies, a lack of entrepreneurial 'culture' and excessive state intervention," and argues that regional policy needs to be minimal.[110] The free market approach was first emphasized in Britain during the 1960's when regional policy was seen as a method to achieve faster regional growth versus the previous approaches that focused on reducing regional disparities.[111] These contrasting approaches imply the classic equity-efficiency trade-off in regional policy-making. In our empirical models, this trade-off was represented by the output and population variables. We observed that a clear trade-off was not apparent, perhaps overridden by the strength of other region-specific influences.

These findings allow us to observe the intentional or unintentional regional policy-making approaches in Turkey. Given specific regional targets, our findings would serve as a basis for useful information in shaping future policies, and allow us to understand the policy attributes that should either be strengthened or avoided. For instance, if decreasing regional disparities is a policy goal, then policies that may exacerbate regional competition for investments should not be adopted. Reducing the influence of politics in the spatial allocation of transportation and communication public capital, targeting lagging regions subject to infrastructure deprivation, and turning regional competition into regional collaboration through a complementary approach in infrastructure allocation would be possible policy improvements that can result from our study.

109 Armstrong-Taylor, *loc. cit.*
110 *Ibid.*
111 *Ibid.*

Appendix

Presenting a modified income and public investment series for Turkish regions

In the empirical models, our designation of a "region" as a unit of observation corresponds to a NUTS 2 level statistical area.[112] Turkey is composed of twenty-six NUTS 2 regions. Each NUTS 2 region is composed of a varying number of NUTS 3 provinces which add up to a country total of eighty-one.[113] This study specifically addresses certain shortcomings in the available datasets on Turkish regions. The fragmented and inconsistent nature of the regional output data imposes limitations on the time span a study on Turkey can cover. The output data is available in

TurkStat in the following structure:

- a series for 1987-2001 in GDP form and NUTS 3 level (call *Series 1*),
- no sub-national data for 2002 and 2003,
- a series for 2004-2011 in GVA form and NUTS 2 level (call *Series 2*).
- a series, retrospectively published in late 2016, of gross regional product in NUTS 3 level for the period 2004-2014. However, this new series revises the country GDP upwards by about 20 percent (IMF, 2018). The methodological differences involved in the generation of this retrospective series makes it incompatible with the previously published data and thus hinders the possibility of studying investment allocation decisions for the years where different governments were in office, as discussed in Section 4.

We reconciled Series 1 (renamed S^1) and Series 2 (renamed S^2) by taking the following steps in succession:

112 "NUTS" is a statistical unit designated by EUROSTAT and stands for "Nomenclature of Units for Territorial Statistics."

113 Appendix Table: 1 lists the twenty-six statistical regions and their NUTS 2 level codes.

1. S^1 was aggregated to NUTS 2 level by summing the GDP values of the NUTS 3 units within each NUTS 2 region (call ^{1}).

2. ^{1} and S^2 were deflated to constant 1998 national currency using the GDP deflator.

3. For each region, and S^2 were concatenated into a single series, leaving the observations 2002 and 2003 blank (call S^{1+2}).

4. A dummy variable (G^t) that equals one for the years that S^{1+2} is in terms of GVA is introduced. The country GDP series (obtained from TurkStat) for the period 1987-2011 is denoted as Y.

5. For each region *i*, the model lnS_it^(1+2)=α_0i+α_1i lnY_t+α_2i G_t+u_it was estimated with ordinary least squares (OLS) (*t = 1987, ..., 2011*) where is a constant and is the error term.

6. Using the estimation results from the above regression, observations for the period 1987-2003 were predicted for each region (call ^{1}).

7. ^{1} and S^2 were combined as one continuous NUTS 2 GVA series. As a result, this study presents a reconciled regional output series for Turkey for the period 1987-2011.

An additional shortcoming exists regarding the transportation and communication public investment figures. The public investment data is reported only for province exclusive investments, leaving out the investments that are shared among provinces. These regionally missing figures are reported as country aggregates under a "multifarious provinces| category. Fortunately, individual projects and their values are separately recorded by location (for example as "Ankara-Eskisehir road construction"). As an exploratory exercise, we have distributed the values listed under "multifarious Provinces" into the corresponding provinces for the three most populous provinces of Turkey. Each figure was equally divided among the provinces included in the specific project. The transformed series presented roughly an upward shift of the trend in the original data. Based on this observation, for all provinces, we inflated the province specific investments by the share of the countrywide investments that were not reported regionally. Finally, the provincial values were aggregated to NUTS 2 level.[114]

TABLE Appendix Table: 1

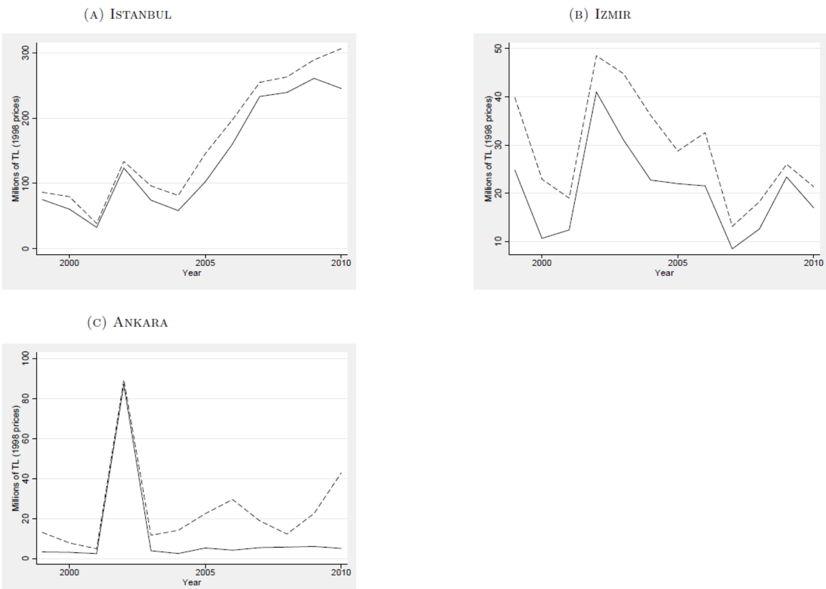
REGION CODES AND NAMES

TR10: İstanbul
TR21: Tekirdağ, Edirne, Kırklareli
TR22: Balıkesir, Çanakkale
TR31: İzmir
TR32: Aydın, Denizli, Muğla
TR33: Manisa, Afyon, Kütahya, Uşak
TR41: Bursa, Eskişehir, Bilecik
TR42: Kocaeli, Sakarya, Düzce, Bolu, Yalova
TR51: Ankara
TR52: Konya, Karaman
TR61: Antalya, Isparta, Burdur
TR62: Adana, Mersin
TR63, Hatay, Kahramanmaraş, Osmaniye
TR71: Kırıkkale, Aksaray, Niğde
TR72: Kayseri, Sivas, Yozgat
TR81: Zonguldak, Karabük, Bartın
TR82: Kastamonu, Çankırı, Sinop
TR83: Samsun, Tokat, Çorum, Amasya
TR90: Trabzon, Ordu, Giresun, Rize
TRA1: Erzurum, Erzincan, Bayburt
TRA2: Ağrı, Kars, Iğdır, Ardahan
TRB1: Malatya, Elazığ, Bingöl, Tunceli

114 The available and transformed series are presented in Appendix Figure: 1. This approach would not work for the investment figures in sectors other than transportation and communication as for those sectors the “multifarious provinces” item provides little geographic information.

TRB2: Van, Muş, Bitlis, Hakkari
TRC1: Gaziantep, Adıyaman, Kilis
TRC2: Şanlıurfa, Diyarbakır
TRC3: Mardin, Batman, Şırnak, Siirt

Figure A.1.
Comparison of original and modified transportation and communication public investment data for three regions



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