



Regional and local development in Europe: Public policies, investment strategies, institutions

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September 2017

Thesis submitted to the Department of Geography and Environment of the London School of Economics for the degree of Doctor of Philosophy in Economic Geography.

Declaration

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Statement of conjoint work

I confirm that paper 2 was jointly co-authored with Riccardo Crescenzi (LSE, Geography & Environment) and Andres Rodríguez-Pose (LSE, Geography & Environment); paper 3 was jointly co-authored with Andres Rodríguez-Pose; paper 4 was jointly co-authored with Nicola Mastrorocco (Trinity College Dublin). My contribution amounts to at least 80% of the total work on papers 2 and 3 and to 50% of the total work on paper 4.

To my father

Abstract

The development strategies being promoted in the EU – Europe 2020 and the 2014-2020 Cohesion Policy – aim to supersede the presumed incompatibility between efficiency and equity through a policy approach tailoring interventions to the key specificities of all territories, including the most disadvantaged. In this view, the socio-economic progress of lagging regions would help keeping under control any increase in inequalities potentially associated with the economic development process. However, the idea of promoting spatially-targeted interventions in economically backward areas has been conceptually questioned, and the effectiveness of the Cohesion Policy programme in poorer regions is yet to be convincingly proven.

In the policy framework underpinning EU strategies, a key role is assigned to the quality of regional and local government institutions. Public institutions are conceived as instrumental for identifying and solving the bottlenecks inhibiting economic growth and perpetuating social exclusion in poorer places. Nevertheless, local governments may also be responsible for wastes and misallocations of financial resources. While theoretical contributions on the importance of government institutions for regional and local development abound, empirical evidence on their functioning is scarce. Through which mechanisms they influence the design and outcomes of public policies is unclear.

Drawing from cross-country investigations and case-studies in the European context, the four quantitative studies composing this Thesis contribute to shed light on these related issues.

Focusing on the United Kingdom, the first paper evaluates the economic and labour market impact of EU Cohesion Policy. Counterfactual analyses demonstrate that EU regional policies may have a beneficial impact on the labour market and growth path of peripheral regions. The study warns over possible negative repercussions of a discontinuation of EU financial support to poorer areas, a result of obvious relevance for the country after ‘Brexit’.

By exploiting panel samples of EU regions, the second and third papers shed light on the role of government institutions for the returns of regional investments and for labour market and social conditions in Europe. The second paper examines the link between institutional quality, transport infrastructure investments, and economic growth. It shows that improvements in secondary (local) roads are conducive to a better economic performance only in presence of sound regional governments. The third paper investigates the extent to which the factors at the centre of European growth strategies – institutions, innovation, human capital and transport infrastructure – contribute to the generation of employment and to social inclusion in EU regions. The evidence

produced suggests that regional government institutions have been essential to mitigate social exclusion issues in EU regions.

The fourth paper focuses on Southern Italy to examine how public finances are distorted by ‘local governments captures’ operated by organised crime. Collusions between mafia and local politics have a significant impact on the selection of investments and on the collection of fiscal revenues. The local policy agenda is modified to the advantage of the interests of organised crime.

Overall, the evidence emerging from this Thesis suggests that policy interventions have the potential to boost the economic and labour market performance of the less developed EU regions. However, any favourable policy outcome (both in terms of efficiency and equity) is conditioned by the competence and the goodwill of government institutions responsible for defining development targets and enforcing investment plans. When politicians are conditioned by illegal pressures from criminal groups, investment decisions follow special interests rather than general welfare goals. In turn, inadequate governance harms the economic impact of selected interventions. The results are particularly relevant for the lively debate, within economic geography, on the pre-conditions and policy measures enabling ‘smart and inclusive’ development at the sub-national level.

Acknowledgments

I am indebted to all the people that accompanied me in this long and rewarding journey.

I owe my utmost gratitude to my supervisors, Riccardo and Andrés, for the insightful guidance, constant encouragement and great recognition of my work. You have helped me to realise the LSE was a place where I could fit in, and you have given me the intellectual freedom I needed to gain confidence as a researcher. But above all, I am deeply thankful to you, as well as to Simona, for the understanding and sincere support in my most difficult period of the PhD.

I am deeply grateful to all my PhD colleagues and especially to Alex, Davide, Mara, Filippo, Eduardo, Elisabetta, Pablo, Viola, Susanne, David, Paula, Andrea, Martin, Luca, Patrizia, Mara, Yimin, Alexandra. Thanks to all that have contributed to transform St Clement's 5th floor PhD room into a pleasant place to work in. I am also thankful to Nicola, for the intense and fruitful collaboration on my fourth PhD paper, and to Martina, Marci, and Riccardo, for keeping my window to the non-academic world always wide open.

My work has benefited from discussions with other faculty and colleagues at the LSE. In particular, I thank Steve, Olmo, Henry, Vassilis, and all other participants of the LSE Economic Geography seminar for the helpful comments.

I also thank my family and in particular my mother, always there for me, and Giovanna, Elisa and Margherita, who shared with me the pain of the darkest days. You gave me the strength I needed to keep going.

Last but not least, my gratitude goes to Laura, whose support and unconditional love has been so important for me during my PhD. Thank you for your patience every time I felt overwhelmed by the PhD stress and when, for escaping it, I needed to scream in front of useless football matches on tv. I am immensely grateful for all the sacrifices you have made and you make every day just to be by my side.

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Introduction

The role of public and investment policies has long been disputed among scholars. Government intervention on behalf of the whole society is seen as necessary in the interests of both economic competitiveness (efficiency) and equality of opportunities (equity) (Musgrave, 1959; Okun, 1975; Just et al., 1985). Yet, the appropriate measures to achieve these two goals and the extent to which redistribution works at the expense of efficient resource allocation remain arguments of intense discussion (van Dijk et al., 2009). In this respect, the last decade has been characterised by a lively intellectual debate among regional scientists and economic geographers, with scholars divided in two contrasting schools of thought. On the one hand, proponents of a ‘people-centred’ approach considering the formation of agglomeration economies as catalysts of economic growth (inter alia, World Bank, 2009; Gill, 2010; 2011); on the other hand, advocates of a ‘place-based’ (or ‘place-sensitive’) perspective favouring context-specific interventions, in the belief that all areas display some development potential (inter alia, Barca, 2009; OECD, 2009; 2012a; McCann & Rodríguez-Pose, 2011; Iammarino et al., 2017). As such, the latter approach rejects any trade-off between efficiency and equity, assuming that interregional inequality reduction can go hand in hand with enhanced economic capabilities (Barca et al., 2012).

In Europe, a key role in the promotion of development policies is played by the European Union (EU). These years, the EU is spending a vast amount of resources to generate ‘smart and inclusive’ growth in the continent (European Commission, 2012). The extent to which this effort will revamp the European economy and its labour market, both still severely affected by the economic crisis, will crucially depend on the effectiveness of the policy design. Stimulated by the scholarly debate, the EU is embracing the ‘place-based’ approach as a rationale behind the design of its regional investment programmes.

This policy paradigm fits well with the EU’s commitment towards increased economic and social cohesion. To this aim, EU regional policy – or Cohesion Policy – has invested a large amount of resources for growth (e.g. infrastructural) and social (e.g. tackling long-term unemployment) projects in the less developed areas of the continent. Nonetheless, whether this effort has produced the expected outcomes is still an open question in the literature (Pienkovski & Berkovitz, 2015).

According to the ‘place-based’ logic, fundamental condition for the success of spatial policies aiming to be simultaneously growth-conducive and socially inclusive is the presence of adequate regional and local institutions (Barca et al., 2012; European Commission, 2014). The outcome of public policies is seen as dependent on the quality of the governments in charge of designing and

implementing them. In this view, a recurrent problem of failing policies in EU regions is the lack of capacity and/or willingness of local governments to act primarily in the interests of the citizens (Farole et al., 2011). That is, a non-transparent selection or inadequate implementation may lie at the root of the policy's ineffectiveness.

The importance of effective public institutions for socio-economic development, in general, and for the effectiveness of investment policies, in particular, is by no means a new concept. Their role, however, has mainly been explored at the national level (*inter alia*, North, 1990; Tanzi & Davoodi, 1997; Hall & Jones, 1999; Acemoglu et al., 2001; Rodrik et al., 2004), overlooking the high degree of heterogeneity in institutional quality within countries (Charron et al., 2014).

While theoretical contributions on the importance of institutions for regional and local development policies abound (e.g. Putnam, 1993; Amin, 1999; Rodríguez-Pose & Storper, 2006; Rodríguez-Pose, 2013), empirical evidence on their functioning is extremely scarce. It is still unclear which kind of institutions matter in which context, or which mechanisms are at play influencing the development path of regions and cities. Similarly, the extent to which the generation of smart and inclusive growth depends on the quality of regional governments remains unproven empirically.

This Thesis contributes to unpack the 'black box' of public institutions by delving into their relationship with economic growth, employment, and social inclusion in Europe, as well as by empirically analysing their conditioning role for investment policies. The focus lies on the study of the regional and local dimension of government quality and government failures. A regional, macroeconomic approach accounts for the diversity of institutional structures across space. A local focus, instead, allows to scrutinise phenomena in greater detail by exploring specific micro-institutional mechanisms triggering governments' decisions.

In the following sections, this introductory chapter will outline the theoretical and conceptual strands within which the Thesis is set, present the structure of the Thesis and the objectives of the four papers composing it, discuss the key research themes and summarise the papers belonging to each theme. The chapter ends by drawing the overall conclusions and policy implications.

Conceptual framework

This Thesis touches upon a number of related issues and areas of research. First, the research broadly relates to the longstanding debate on the rationale and impact of government intervention in the economy. Second, it links with the ongoing scholarly discussion regarding the optimal targets for sub-national development strategies and the role of government institutions within the framework inspiring EU regional policies. Third, it connects with the literature examining the relationship between the quality of government institutions and the design and outcomes of public policies. In the present section, these themes are introduced in turn, linked with each other and with the specific research topics to which the Thesis seeks to make a contribution.

Traditionally, the general role of the public sector has been conceived as a regulator of the market and facilitator of development, through efficiency-type of policies, and as responsible for an equal distribution of opportunities and income, via equity-type of policies¹ (Atkinson & Stiglitz, 1980). At the *sub-national* level, public policy intervention is motivated by the fact that persistent disparities in living standards within countries – bearing harmful economic and social consequences – are not self-adjusting (Armstrong & Taylor, 2000).

As regards public intervention aiming at economic growth and development, for decades physical capital accumulation (Solow, 1956; Swan, 1956), particularly transport infrastructure (Aschauer, 1989), was seen as the centrepiece of expenditures stimulating the economy. This view was challenged by theories recommending investment policies centred on technological development, innovation, and human capital promotion (e.g. Romer, 1986; Lucas, 1988; Lundvall, 1988; Cooke et al., 1997). Following, different contributions have identified the quality of (formal and informal) institutions as the driving factor behind the economic progress of countries and regions (e.g. North, 1990; Putnam, 1993; Storper, 1997; Morgan, 1997; Amin, 1999; Acemoglu & Robinson, 2000). All these different growth-enhancing factors have been incorporated into the policy strategies funded by the European Union, an institution adopting a clear ‘interventionist’ approach to economic development promotion (Armstrong, 2011; Barca et al., 2012).

¹ The extensiveness of the role of the government may vary, according to different theoretical perspectives. Different schools of thought have proposed diverse views. On the one extreme, the classic (and neo-classic) economics approach, arguing for a minimalist presence of the public sector acting exclusively as ‘market adjuster’. The opposite extreme is the interventionist conception of Keynesian (and neo-keynesian) economics, proposing an active fiscal policy to achieve (full) employment and promote economic development (Keynes, 1936). Others (e.g. Musgrave, 1959) have attempted to synthesise the different views.

In regards to government initiatives favouring equality and better social conditions, labour market policies, redistributive fiscal arrangements, measures fostering education are considered effective (OECD, 2012b), but key economic factors and growth policies can contribute as well (Hoeller et al., 2012). However, incentives to increase economic outputs may also give rise to conditions that end up injuring the level of inclusion in the society.

Balancing the trade-off between efficiency and equity goals has long been viewed as the main policy task of the public sector (Musgrave, 1959; Okun, 1975). Yet, the very existence of the trade-off has been put into question. First, in the 90s, when economic theories argued that more equal societies tend to have faster rates of human capital acquisition and economic growth (Persson & Tabellini, 1994; Osberg, 1995). And again, more recently, when the debate on which areas should be targeted by territorial policies has divided economic geographers. Strategies fostering the concentration of economic activity, prioritising expenditures in the core at the expenses of lagging regions, have been criticised for exacerbating aggregate economic and social disparities (OECD, 2011; Iammarino et al., 2017). To this view, the ‘place-based’/ ‘place-sensitive’ perspective opposes the maximisation of collective returns, by arguing that individual policies should be promoted not just in the most dynamic places, but also in geographically dispersed and disadvantaged regions. Such policy formula, it is claimed, allows to mobilise the untapped assets of otherwise marginalised places, keeping under control any social cost associated with the economic development process (Barca, 2009; Camagni & Capello, 2015; Iammarino et al., 2017).

Following this approach, the modern development strategies adopted by the EU – Europe 2020 and the 2014-2020 Cohesion Policy – aim to supersede the presumed incompatibility between economic effectiveness (efficiency) and social cohesion (equity) through a policy framework that tailors interventions to the key specificities and assets of each territory² (Barca et al., 2012; European Commission, 2014; Capello & Camagni, 2015). The intended outcome of these investment strategies is the generation of *inclusive* economic growth with “a strong emphasis on job creation and poverty reduction” (European Commission, 2010). Whether EU investment policies are actually capable of delivering socio-economic development in the periphery of

² In fact, the extent to which the rationale and objectives of Europe 2020 and Cohesion Policy strategies are coherently coordinated has been questioned. While the European Commission argues that the 2014-2020 Cohesion Policy is “fully aligned with the Europe 2020 strategy and its headline targets” (European Commission, 2014: xvii), it has been argued that the existence of expenditure quotas for specific policy goals of the Europe 2020 strategy is in contrast with the place-based logic at the basis of the new Cohesion Policy, because ‘place-based’ policies should reject any form of one-size-fits-all approach (Mendez, 2013).

Europe is a hotly debated question which will be taken for examination in the empirical works of the Thesis.

According to the ‘place-based’ policy framework, a key role is played by institutional quality. As compared to theoretical perspectives advising for institutions as centralised structures (replicable elsewhere) administering the implementation of top-down policy schemes (e.g. World Bank, 2009), the logic underpinning EU strategies conceives the function of institutions in a different way. Any local context is seen as characterised by idiosyncratic (non-replicable) institutional elements, both formal and informal, regulating the interplay among economic agents and shaping the evolution of each territory. Local institutions are regarded as instrumental for understanding the development bottlenecks inhibiting economic growth and perpetuating social exclusion in poorer places (Barca et al., 2012). They are functional to the ‘process of discovery’ of key assets of a region and, in their interaction with institutions at higher levels (national, supra-national), they contribute to the definition of policy priorities and the implementation of effective measures (Camagni & Capello, 2015). The presence of sound institutions, and in particular of effective local and regional governments, is regarded as pivotal for promoting ‘smart and inclusive’ growth in Europe (Bachtler et al., 2017). This Thesis complements the large strand of theoretical literature discussing institutions as drivers of social and economic progress at sub-national level by empirically assessing how this function is exercised.

Local institutions may be determinant for devising programmes truly tailored to the specific needs of a given place, but they may also be responsible for wastes and misuses of financial resources. Indeed, overlooking the role of local institutional factors means ignoring a potential source of failure of public investment programmes (Farole et al., 2011; Iammarino et al., 2017). At the centre of the new EU policy paradigm lies the conviction that one of the main motives for policy failures in the past was the presence of local political elites not just unable, but also unwilling to implement interventions correctly.

The consequences of ‘bad governance’ for public interventions have been studied extensively in the economic literature. For scholars, analysing the connection between governments and policy effectiveness represents one way to understand the role of institutions as underlying drivers of socio-economic progress. To describe the economic inefficiencies directly determined by the action of public institutions, political economists have introduced the concept of ‘government failure’. This is related to the idea that policy-makers may be promoting sub-optimal policies rather than acting as benevolent social welfare maximisers (Buchanan and Tullock, 1962; LeGrand, 1991). Government failures occur if the public sector intervening in the economy does not have the omniscient knowledge necessary to avoid policy mistakes (lack of government

capacity), or when public authorities do not have the adequate incentives to act in the interests of the general public. This can occur if government officials are fuelled by personal motives, such as desire of re-election, or if they are plied by organised groups lobbying for policy benefits towards them (Krueger, 1990; Besley, 2006). In the latter case, at the root of the sub-optimal policies there is an unequal distribution of power in the society. Power asymmetries may imply that some actors are capable of influencing the agenda-setting of policy-makers (Persson & Tabellini, 2000), perpetrating illegal activities such as corruption, political collusion, and rent-seeking.

Political ‘capturing’, i.e. the attempt to direct public policy priorities away from collective interests in order to extract rents (Carpenter & Moss, 2014), may occur through multiple channels and with different objectives. Public officials, either elected or unelected, can be influenced by powerful members of the private sector (lobbyists, business owners/managers, criminal organisations) through illegal payments (bribes), manipulated information, or, in the most extreme case, through threats (e.g. smear campaigns, physical violence) (Dal Bo’ & Di Tella, 2003; Dal Bo’ et al., 2006). Due to the large variety of means through which government capturing may occur, the phenomenon cannot be treated homogeneously. Consequently, in examining its consequences for political decision-making, this Thesis focuses on one very specific source of government failure, unexplored in the applied economics literature – the collusion between public officials and criminal organisations.

Policy capturing leads to misallocations of public resources and distortions in the provision of public goods and services (Acemoglu & Verdier, 2000; Bandiera et al., 2009) with harmful effects for economic development (Besley & Coate, 1997; Mauro, 1995; Easterly & Levine, 1997), either because of budgetary losses derived by inflated prices, lower product/service quality, or simply because of expenditures in less growth-conducive sectors (Mauro, 1998).

In light of the significant role, resources and responsibilities assigned to regional and local governments within the multi-level-governance framework of the European Union, a key task for research is therefore to understand how local governments’ capacity may condition the design and the returns of public policies. Shedding light on these issues is important particularly for the most peripheral and underprivileged EU territories, recipient of a large portion of EU financial resources, where the quality of local governments is often below par.

Themes of research

Three main themes for research can be derived from this conceptual framework.

- (1) The first relates to the study of territorial policies focusing on lagging areas. The idea of sustaining the aggregate level of development in Europe through interventions in the most economically disadvantaged territories has been conceptually questioned, and the effectiveness of the Cohesion Policy programme in poorer regions is yet to be convincingly proven.
- (2) Second, a vast body of literature has demonstrated that public investments aiming at growth, employment, and social inclusion are not occurring in a vacuum, but rather they are deeply entrenched into the surrounding socio-economic environment and pre-existing institutional conditions. The problem of government failures threatens the ambitious spending effort undertaken in Europe by the EU and its Member States, aiming to achieve higher aggregate economic competitiveness in combination with strengthened social cohesion. However, whether the adequate conditions are in place in EU regions – and whether the most effective policies are being promoted – allowing to improve economic performance while simultaneously reducing social exclusion remains an open question.
- (3) Third, in spite of the burgeoning literature on the mechanisms through which political decision-making can be manipulated by powerful interest groups, the capturing of policy choices can take multiple different forms, some of which (with their implications) are yet to be empirically explored.

This Thesis contributes to shed light on these related issues, drawing from cross-country investigations and case-studies in the European context.

Structure and objectives of the Thesis

The Thesis focuses on each of the macro-themes for research introduced in the conceptual framework, addressing very specific questions and topics. There are three main research blocs in which the Thesis can be sub-divided.

1. The first building bloc links with the debate on the effectiveness of development policies targeting lagging areas. This bloc comprises one paper, focusing on *the impact of the regional investment policies of the European Union*. It aims to investigate whether EU Cohesion Policy has produced its intended outcomes, which areas have most benefitted from the policy support, and what impact the development programmes have had in the medium/long-term. The paper looks at the case of the United Kingdom. This context is particularly interesting due to the UK's decision to withdraw from the European Union, with the subsequent loss of eligibility for EU financial support. Britain's choice calls for a thorough impact assessment of EU development strategies, examining the potential effects of being deprived of EU funding.

Paper 1. *The impact of EU funds on regional development: Evidence from the UK and the prospect of Brexit.*

(published in the *Journal of Regional Science*)

2. The second building bloc connects with the scholarly discussion over the importance of regional institutions for achieving ‘smart and inclusive’ development. The bloc is composed of two papers, studying *the role of regional government institutions for the promotion of socio-economic development in the EU regions*. More specifically, the first paper focuses on transport infrastructure investment and tests the extent to which the economic returns of the investments are mediated by the quality of regional governments. The analysis aims to identify the places and the type of transport improvements for which higher-quality institutions help translating the investment into faster economic growth. This research is complemented by the following paper, assessing the determinants of employment generation and social inclusion in Europe. The objective of this work is to verify whether regional government institutions and other key factors behind EU development strategies – transport infrastructure, innovation and human capital – are associated to the promotion of employment and labour market inclusion.

Paper 2. *Government quality and the economic returns of transport infrastructure investment in European regions.*

(published in the *Journal of Regional Science*)

Paper 3. *Drivers of employment and social inclusion in the regions of the European Union.*

(published in *Regional Studies*)

3. The third building bloc relates to the growing literature analysing the presence of distortions in the selection of public investments. The broad theme investigated by the last paper is *the conditioning role of government ‘captures’ for the allocation of public resources and the management of public finances*. The paper focuses on a very specific type of institutional failure, that is, the collusion between local politicians and criminal organisations. The analysis, focusing on Southern Italy, presents extensive evidence on the way in which local public finances – government expenditures and revenues collection – are distorted when members of local governments collude with organised crime groups, i.e. when criminal organisation ‘infiltrate’ municipal governments.

Paper 4. *Organised crime, captured politicians, and the allocation of public resources.*

Overall, the evidence emerging from the four, non-sequential papers composing this Thesis suggests that public policies have a vital role to play in the development of European regions and cities. Public capital investment has the potential to boost regional economies and revitalise labour markets, contributing to the progress of the less developed areas of the continent. Whether policy initiatives are effective, however, crucially depends on the quality of public institutions. Government institutions condition the returns of some specific investment strategies, and they are relevant especially for the development of peripheral regions. The active presence of criminal groups in lagging areas can capture government choices and direct investment decisions towards economic sectors of their preference. In turn, institutional failures may harm both the economic and the social impact of interventions.

1. The impact of EU regional policies in the UK

The Cohesion Policy of the European Union: functioning, rationale, empirical evidence

The Cohesion Policy is a programme through which the EU intends to promote economic and social cohesion in Europe. Since its introduction in 1970, the size of EU regional policy has greatly increased³, up to the point of representing the most important public investment arm in several recipient Member States (European Commission, 2014; Bubbico & Catalina Rubianes, 2015).

The policy has not only evolved in size, but also in its approach to development promotion. In its origin, the rationale for the intervention was based on the presumed need to foster economic convergence by counterbalancing market integration and agglomeration forces (Boldrin & Canova, 2001; Armstrong, 2011; Fernandez, 2011). This type of redistributive policies have been criticised for being inefficient (Boldrin & Canova, 2001; Dall'erba & Le Gallo, 2008) distortive (Midelfart-Knarvik & Overman, 2002; Puga, 2002) and inadequately targeted (Rodríguez-Pose & Fratesi, 2004).

Nowadays, EU regional investment programmes are justified and designed differently. The policy has moved away from assistentialist logics, towards a design that recognises the development potential of all places (Barca, 2009). From the 2014-2020 period, each region is encouraged to design ‘smart specialisation’ strategies, engaging local stakeholders in the identification of regional competitive advantages and combining different sources of funding to reach encompassing development targets⁴ (Bachtler et al., 2017).

Whether EU subsidies have contributed to improve the performance of the less developed regions – which the EU defines as those with a GDP per capita below the 75% of the EU average – has

³ EU regional policy corresponded to 3% of the EU budget in 1970, increasing up to 34 % for the 2007-2013 period – equal to €347 billion (Baldwin & Wyplosz, 2015). And in spite of a debate dominated by fiscal consolidation and austerity in the years following the financial crisis, for the 2014-2020 period it was further increased to €352 billion, 32.5% of the total EU budget (European Commission, 2014).

⁴ Several instruments have been created for the 2014-2020 programming period in order to help combining different priority objectives and to involve a larger number of actors. Integrated Territorial Investments (ITIs), Community-Led Local Development (CLLD) and Joint Action Plans (JAPs) allow EU regions to define integrated local strategies streamlining ERDF and ESF together (European Commission, 2012).

been hotly debated in the applied economics literature. The first evaluations of Cohesion Policy reported highly contrasting results. Some authors were sceptical over the potential of the programme to generate growth and convergence (e.g. Sala-i-Martin, 1996; Boldrin & Canova, 2001), while others were more positive (e.g. Ederveen et al., 2003; Cappelen et al., 2003).

In view of these mixed results, more recent research has considered issues previously unaccounted for that may be at the root of the initial unclear empirical evidence. In particular, a consensus has emerged in the literature in identifying the quality of national (de Freitas et al., 2003; Beugelsdijk & Eijffinger, 2005; Ederveen et al., 2006) and regional governments (Becker et al., 2013; Rodríguez-Pose & Garcilazo, 2015) as the conditioning factor behind the capacity of regions to make good use of EU Structural Funds.

Significant progress has been made in the literature also in terms of the methodology adopted to assess EU policies. Due to the high degree of heterogeneity of EU regions, one common empirical difficulty lies in making sure that the estimated effect is not confounded by any of the dimension on which EU regions differ. To avoid that, more and more frequently the impact of Cohesion Policy is identified by making regions receiving the largest portions of Structural Funds (treated) as comparable as possible to low-funded regions (controls). This ‘experimental turn’ in the evaluation of EU regional policy has allowed to uncover more convincing evidence in favour of a positive effect of interventions (Becker et al., 2010; 2013; 2016; Pellegrini et al., 2013).

The adoption of ‘counterfactual’ estimation strategies of this kind has also highlighted that the funds’ impact may differ in each national context (Giua, 2017; Crescenzi & Giua, 2017).

EU Cohesion Policy in the United Kingdom and the prospect of Brexit

The present Thesis evaluates the effectiveness of Cohesion Policy by focusing on one single country. Specifically, it analyses the case of the United Kingdom.

The UK case is interesting for many reasons. First, the UK government has recently embarked in the process of withdrawing from the European Union, a decision with enormous consequences for both the European and the British side. Although many aspects of the future relationship between the two negotiating parts are not yet clear⁵, Britain will surely lose eligibility for EU

⁵ The official negotiations between the UK and EU have started on 19th June 2017 and are expected to be completed by April 2019.

Structural Funding as a result of ‘Brexit’⁶. Hence, the UK regions currently receiving the most EU funds may be affected by this transition. The total amount available for the UK for the 2014-2020 EU programming period rounds up to €16.5 billion⁷, of which around 25% have been allocated to Cornwall and West Wales, the two regions with a GDP per capita below the 75% of the EU average.

How these and other regions will react to the loss of eligibility for Cohesion Policy is unclear. Much will depend on what EU policies have accomplished in the UK, and what a discontinuation of funds entails. The existing scholarly research cannot help to draw future scenarios, as the evaluation of Cohesion Policy in the UK has attracted very limited attention in the literature. Policy impact assessments either leave the role of EU funds at the margins (Criscuolo et al., 2016), or look at specific EU projects with no attempts to identify the overall effect of Cohesion interventions (Armstrong & Wells, 2006; Munday & Williams, 2009). The paper in the first bloc of this Thesis aim to fill this gap and empirically test the impact of EU funds in UK regions.

Considering that the UK is a net contributor to the EU budget, Brexit may also imply saving national public resources – the difference between payment to and receipts from the EU has been of around €10 billion per year during 2009-2015 (HM Treasury, 2015) – which could then be used to replace the programmes currently funded through EU funds⁸. How urgent is a replacement of EU funds with new development policy tools? A thorough assessment of Cohesion Policy in the UK aims at providing key insights on the extent to which the ‘repatriated’ resources should be adopted to devise new spatially-targeted policies.

⁶ Depending on the terms of the future UK-EU relationship, some alternative sources of EU funding may become available to the UK. As an example, members of the European Free Trade Association (EFTA) contributing to the EU Framework Programme budget, such as Norway, Israel and Switzerland, can apply for EU research funding and take part in Horizon 2020 projects. However, these funds do not classify as part of Cohesion Policy programmes, only available to EU Member States. The UK will also have to renounce to Common Agricultural Policy (CAP) support.

⁷ <https://cohesiondata.ec.europa.eu/countries/UK>

⁸ Indeed, the UK government formed in the aftermath of the 2016 Referendum had guaranteed EU funding for projects stretching into 2020 will be honoured by the Treasury, provided that they (1) are good value for money and (2) are in line with domestic strategic priorities (<https://www.gov.uk/government/news/further-certainty-on-eu-funding-for-hundreds-of-british-projects>). However, no clarity has been made on regional funding in the UK for the period after 2020 (<https://www.ft.com/content/aaecb834-6092-11e6-b38c-7b39cbb1138a?mhq5j=e3>).

Paper 1. *The impact of EU funds on regional development: Evidence from the UK and the prospect of Brexit*

The high support received by Brexit in some of the UK regions most financed by the European Union may suggest that Cohesion Policy has failed in triggering greater development in these areas. But has this been the case? And will the loss of EU Structural Funds due to Brexit have any impact in the UK regions? The article tackles these unexplored questions by investigating the effect of EU regional policies in the British context.

The impact of the policy is causally assessed by adopting counterfactual methods – synthetic control method and difference-in-differences – in two selected regions, Cornwall and South Yorkshire. They were both awarded the ‘Objective 1’ status – the highest form of EU aid, available to regions with GDP per capita below the 75% of EU average – for the first time in 2000. By exploiting the consequent increase in funding resulting from this change in eligibility, the analysis investigates the impact of Objective 1 programmes on their labour market and economic performance. The results unveil a positive effect of Objective 1 eligibility, leading to a significant reduction of unemployment and to a higher growth rate in Cornwall and South Yorkshire. When taking part in the Objective 1 programme, both regions managed to decrease unemployment and increase GDP per capita significantly more than comparable regions not similarly subsidised by the EU. Regression analysis performed on all UK regions complements this evidence to show that the positive (short-term) impact of Objective 1 funds does not apply just to the two case-studies but is generalisable to other British regions in receipt of the programme.

Unlike Cornwall, which conserved the status of European region ‘in highest need’ after the end of the 2000-2006 programming period, South Yorkshire only qualified for Objective 1 funds for one EU budget period. In 2007, due to its progress in terms of GDP per capita relative to the EU average, the region lost Objective 1 eligibility and the amount of EU funds available reduced considerably. The empirical analysis suggests that as this happened, South Yorkshire lost much of the labour market and economic gains achieved while in receipt of Objective 1 funds, evidence that the funds produced very little permanent/structural effects overall in this region.

These findings indicate that the loss of Structural Funds – a consequence of Brexit – may have significant adverse impacts on the socio-economic development of the UK regions that are currently most subsidised by the EU.

2. The role of regional government institutions for the promotion of socio-economic development in the EU

Government institutions and development

Since the surge of the ‘new institutional economics’ in the 90s, institutions have been rediscovered⁹ as a key element in shaping the development path of all places (North, 1990; Ostrom, 1990). The essential role played by institutions for social and economic outcomes is now widely recognised by economists and geographers (North, 1994; Storper, 2005; Rodríguez-Pose & Storper, 2006; Rodrik, 2007; Tabellini, 2008; Lakshmanan & Button, 2009). Having acknowledged that, scholars aim to understand *which* institutions matter, *how*, and *when*.

One type of institutions attracting considerable attention has been the quality of government (QoG). This is a multifaceted concept, encompassing all elements conditioning the government capacity/will to provide public goods and services, including the level of corruption, the enforcement of the rule of law, and the efficiency and accountability of the public administration. Among the many definitions of government institutions in the literature, one of the most often referred to is provided by the World Bank, according to which ‘governance’ is made of “the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them” (Kauffman et al., 2009: 5). Rothstein & Teorell (2008) summarise the QoG concept into “the impartiality of institutions that exercise government authority and apply public policies”¹⁰.

A strong connection between government quality and both efficiency- and equity-related development outcomes is now a well-established theoretical and empirical proposition. The quality of governance can influence efficiency by affecting the degree of risk for opportunistic

⁹ Institutions were seen as influencing economic behaviour already in the thinking of Mill (1857) and Tonnies (1887), and later in the work of Marshall (1920).

¹⁰ The definition of the quality of government institutions remains debated. For a review of conceptualisations see Gisselquist (2012).

behaviours, the incentives for investments and for cooperation among investors, the level of market competition, the costs of economic transactions, and the distribution of resources among economic agents (Olson Jr et al., 2000; Rothstein and Tannenberg, 2015; World Bank, 2017). The way in which public resources are distributed is of obvious relevance for equity as well. The effectiveness of investments intended to equalise opportunities and the government capacity to provide goods and services to all categories of citizens both contribute to the equality of societies (World Bank, 2005; 2017).

Abundant empirical evidence confirms the importance of good government institutions for economic growth (Knack & Keefer, 1995; Mauro, 1995; Easterly & Levine, 1997; Olson Jr et al., 2000; Kauffman & Kraay, 2002), employment (Knack, 1999), poverty reduction and social welfare (Chong & Calderon, 2000; Grindle, 2004; Rothstein et al., 2012; Charron, 2013a), subjective wellbeing (Helliwell, 2006), and life expectancy (Holmberg et al., 2009).

Quality of government in the EU regions

The above-mentioned literature analyses the concept of government institutions and their role for development operationalises governance by exploiting country-level data, relying on the implicit assumption that intra-national variation in institutions is either insignificant or non-existent.

This approach overlooks the fact that some aspects of governance may be significantly more pronounced at the sub-national level than at the national level. Fewer obstacles for corruption may exist locally, as politicians and bureaucrats may be subject of more pressing demands from interest and pressure groups due to their weight in local elections (Preud'homme, 1995). Additionally, the lower visibility to the press and the public at the local level corresponds to a lower transparency (OECD, 2015). In absence of adequate systems of legal control and punishment, local elites may be able to reap most of the benefits of economic development (Chong & Calderon, 2000).

Furthermore, ignoring differences in QoG within countries fails to account for the high degree of administrative autonomy of many regions and cities. Today, in the majority of OECD countries, regional and local spending accounts for more than 50% of the total public investments made (OECD, 2015). In the EU, public and investment policies are more and more defined through a complex process of multilevel agreements, involving negotiations at the sub-national, national and supranational levels. Through the principle of subsidiarity, many of the EU interventions are implemented by regional governments who, furthermore, have a significant say in the design of the intervention (Farole et al., 2011). In presence of multilevel and decentralised political systems,

idiosyncratic features of regional and local government institutions may have an impact on the success or failure of these policies.

Until recently, empirical analyses accounting for the sub-national dimension of government institutions were constrained by data availability. However, research carried out at the Quality of Government Institute of Gothenburg in the past few years has allowed to produce the first homogeneous QoG index for European regions¹¹ (Charron et al., 2011). This indicator has shown a large degree of within-country variability in government institutions in many EU countries. Further work by Charron et al. (2014) has integrated the index with the World Bank Governance Indicators (Kauffman et al., 2009), extending the regional QoG index across a longer time period and obtaining a sub-division into four pillars of governance, namely (1) effectiveness of regional government and bureaucracy, (2) rule of law, (3) accountability of the regional administration and strength of democracy, (4) level of corruption.

Geared with this new set of indicators, researchers have demonstrated the prominent role of regional government quality for innovation, growth, and the economic efficiency of Cohesion Policy strategies (Becker et al., 2013; Rodríguez-Pose & Di Cataldo, 2015; Rodríguez-Pose & Garcilazo, 2016; Ketterer & Rodríguez-Pose, 2016).

However, while these studies assign a key role of government quality in conditioning the returns of investment strategies in European regions, they provide little evidence on the mechanisms through which these effects are at play and on the type of investments most conditioned by the quality of regional governments. In addition, whether governance affect labour markets and the social development of regions is yet to be tested empirically. This Thesis contributes to the literature by focusing on these unexplored research questions.

Paper 2. *Government quality and the economic returns of transport infrastructure investment in European regions*

A key element of growth-promoting strategies in European regions is investment in transport infrastructure. The construction of large-scale infrastructure projects have been at the centre of development programmes in the periphery of Europe over the last years. Yet, recent studies have

¹¹ The index was obtained from a survey with 34,000 respondents from the then 27 EU countries. Questions were centred on the quality of public services, the impartiality of public services provision, and the level of corruption.

underlined that the economic returns of transport infrastructure investment made in the EU have been limited if not absent. Why have these efforts not delivered the expected economic results? One possible explanation, explored in this article, is that when a minimum endowment of infrastructure is in place, the returns of expenditures for additional transports depend on the quality of government institutions co-responsible for the selection, design, and realisation of infrastructure projects.

The transport sector is particularly vulnerable to governance problems such as political interference, corruption, and collusion. While the literature acknowledges that the characteristics of the governance system play an important role in determining future efficiency gains (or the lack thereof) of transport infrastructure spending, the relationship between government quality, transport investment, and growth has seldom been proven empirically. No study has ever focused on European regions.

The article tests whether the quality of regional governments shapes the growth effects of investment in transport infrastructure in the EU regions. It does so by considering different typologies of investment: improvements in motorways and in secondary roads. This distinction aims to reflect a structural difference in the underlying investment decisions. Motorways represent large-scale projects whose selection may have been conditioned by political and individual interests rather than economic and collective ones. Motorways are more visible, costly to build, and normally connect major urban centres across different regions. The development of local roads, instead, is much less glamourous from an electoral point of view, but less likely to give rise to the same ‘hub-and-spoke’ effects as motorways.

Growth regressions interacting the two proxies for transport investment with the regional Quality of Government (QoG) index provide little evidence of a positive correlation between regional investments in motorways and economic growth, even if associated with better regional government institutions. By contrast, variations in the endowment of secondary roads display a robust connection with regional economic performance, but only in regions with higher quality regional governments. The role of government quality as mediator of the economic returns to local road investment appears to be stronger in the less developed regions, those for which good institutions emerge as essential drivers of growth.

Paper 3. Drivers of employment and social inclusion in the regions of the European Union

The Europe 2020 development strategy of the European Union puts “a strong emphasis on job creation and poverty reduction”. However, concerns remain about the capacity of investments associated to this strategy to stimulate employment and favour the creation of more inclusive labour markets. Key economic factors on which the EU aims to invest in the next years include the stock of human capital, research and technological development, the endowment of infrastructure, and the quality of institutions. To what extent are these factors contributing to foster employment and address issues of labour market exclusion in European regions? There is little or no evidence in the literature to answer this question.

The aim of the article is to investigate the relationship between the four elements behind EU development strategies – human capital, innovation, infrastructure, and government institutions – and labour market and social dynamics in European regions. The article studies the extent to which each of these factors has been associated to employment generation and social inclusion in EU regions, distinguishing employment by skill level and sub-dividing regions by level of economic development. The aim is to identify the conditions that exacerbate or reduce labour market disparities in different economic contexts.

The findings indicate that the economic factors behind employment growth are not always the same as those conditioning the evolution of social exclusion. While the generation of employment in Europe has been facilitated by the presence of larger shares of highly-educated population and higher innovative capacity, no direct relationship with jobs creation is found for transport infrastructure. The key result of the analysis is that the quality of government institutions affects the dynamics of labour market inclusion. Regional government quality makes a difference for the promotion of low-skilled employment – and hence of labour market inclusion – particularly in the poorer areas of Europe. Moreover, EU regions with better governance have significantly reduced the share of people excluded from the labour market. These findings suggest that the presence of adequate government institutions is a prerequisite for the success of any social inclusion policy in Europe.

3. The impact of local government captures on public policies and finances

Government captures and public policies

Policy captures result from secretive illegal agreements between public officials and third parties, whereby political power is misused for private gains (Rose-Ackerman, 1999). As such, they distort the functioning of administrative systems by compromising the efficient and equitable provision of goods and services to citizens. Public capital expenditures, more than current expenditures, are vulnerable to the influence of corruptive and collusive practices, due to the higher discretion of government authorities in capital projects (Haque & Kneller, 2008).

These phenomena pervert the activity of governments in many ways (Shleifer & Vishny, 1993; Bandiera et al., 2009; Ohashi, 2009; OECD, 2010). For instance, they may condition the fair competition for public procurement tenders. The price paid by governments for given projects may rise considerably if procurers are bribed to design tenders that favour undeserving firms. Collusive accords ensuring that given companies obtain government contracts reduce the incentives for firms to enter the market for bids, further compromising competition and encouraging the reproduction of illegal mechanisms (Soreide, 2002). These distortions imply that the allocation of contracts for public investment projects is modified to the advantage of powerful pressure groups (OECD, 2017).

Extensive empirical research has shown that the composition of government expenditure is influenced when politicians are captured by interest groups. Tanzi and Davoodi (1997) and Haque and Kneller (2015) posit that both the typology and the amount of investments are conditioned in these cases. They argue that political corruption is likely to increase the number of infrastructure investment projects undertaken by governments, enlarging their size and complexity. Along similar lines, Ohashi (2009) argues that absence of transparency in government procurements significantly inflates the cost of public works. Mauro (1997) and Gupta et al. (2005) demonstrate that corrupt politicians can channel government expenditures away from investment areas which are not sufficiently lucrative in the short term.

This evidence leaves little doubt that public investments are prone to undue influence of interest groups. Yet, in studying the distortions they introduce to the composition of public spending, the literature treats pressure groups homogeneously, assuming they all behave in the same way when

interfering with political choices. This approach fails to account for the fact that different kinds of collusion modes exist. The links between pressure groups and political power may be so deep that, in the most extreme case, the political representatives are a direct emanation of such groups. When this happens, bribing politicians with the purpose of distorting investment choices may be superfluous, as public authorities already have incentives to act in accordance with the interests of those to which they owe their political career. This type of link with politics is common for organised crime (Cantone, 2010).

Organised crime's collusion with local politics and the appropriation of public investments

The development of strong ties with the political sphere is a fundamental link in the chain of power of organised crime groups (Schelling, 1971; Gambetta, 1993). In Southern Italy, since the 90s, the mafia relies on a model of collusion based on positioning their trustees within political institutions. Mafia-related politicians are often white collars with no direct kinship with organised crime or criminal records. Their political career begins at the local level, where the control of the central State is weaker and the power of mafia clans is stronger (Cantone, 2010). Their compliance with the will of criminal organisations is guaranteed.

Therefore, unlike 'traditional' pressure groups, criminal organisations can find themselves in the privileged position to be able to contaminate and leverage policy decisions *from the inside*, by relying on referents and affiliates with a primary role in the decision-making system of government structures. This so-called 'infiltration' facilitates the capturing of public procurement contracts. Acquiring public work contracts, in turn, enables criminal groups to provide business opportunities to the firms they control and launder in legal sectors of the economy the liquidity generated from illicit activities, further increasing economic profits (Gambetta & Reuter, 1995; Leonardi, 1995; Lavezzi, 2008; Sciarrone, 2011).

The involvement of the mafia in the legal economy through public investments often occurs where their control of the territory is stronger, i.e. the areas in which mafias are most deeply rooted (Sciarrone, 2011; Transcrime, 2015).

While extensive qualitative, judiciary, and anecdotal evidence has been produced to analyse the consequences of this extreme form of collusion, empirical evidence in the applied economics literature is nearly absent. This Thesis contributes to investigate the largely unexplored

phenomenon of mafia-politics collusions by performing a comprehensive study of their impact on the composition of local government finances.

Paper 4. *Organised crime, captured politicians, and the allocation of public resources*

As part of their strategy to dominate local economic activities, organised crime groups aim to take control of local policy-making systems. When they manage to do it – i.e. when they ‘infiltrate’ local governments – they find themselves in the position to condition the legislative process and distort the selection mechanisms of public policies to their advantage. In which way does this unwanted influence over local government activity affect the public finances of municipalities? The article investigates this question by focusing on the regions of Campania, Calabria and Sicily in Italy, home of some of the most developed criminal organisations in Europe.

According to the existing studies on Italian mafias, criminal groups exploit infiltrations as a mean to get their hands on public investment projects. The article empirically assesses the impact of mafia-politics collusions on the finances of municipal governments. Detailed data on the composition of municipal balance sheets – disaggregated both in terms of current/capital expenditure chapters and in terms of financial revenues – are combined with precise information on which local governments have been infiltrated by the mafia. A difference-in-difference model compares the public spending and revenues collection of infiltrated governments with non-infiltrated governments between 1998 and 2013.

The results of the analysis shed light on the strategy adopted by organised crime groups when manipulating government decisions. Politicians captured by the mafia do not appear to modify the total level of public spending of municipalities. Instead, mafia interferences are found to determine selected variations in key local expenditure sectors. In particular, as compared to non-infiltrated governments, infiltrated municipalities invest higher shares of public funds for construction and waste management, and invest less for municipal police. Moreover, they are less efficient in collecting waste and garbage taxes. Considering the deep interests of organised crime in the construction and waste collection sectors, these findings seem to suggest that infiltrations are strategically exploited by the mafia in order to protect their businesses and further increase their profits.

Finally, the analysis investigates the connection of organised crime with local politics by studying the link between political characteristics of municipal elections and infiltrations. This exercise uncovers a set of interesting relationships, among which the most robust – further confirmed with an RDD model – is a preference of mafia groups for infiltrations within right-wing governments.

Conclusions

Empirical findings and policy implications

The four papers composing this Thesis explore different issues related to the public policies and investments of European regions, the determinants of socio-economic and labour market performance in the EU, and the role of dysfunctional government institutions for the selection and the returns of investment policies. The results of the empirical investigations can be interpreted both in relation to the specific framework within which each research paper is set, and to the broader framework within which the Thesis is constructed.

Evaluating the labour market and economic impact of EU Cohesion Policy in the UK regions, the first paper demonstrates that EU funds for the most economically disadvantaged British regions (Objective 1 funds) have been effective, at least in the short-term. The poorest regions of the country have witnessed higher economic growth and faster unemployment reduction than other areas when in receipt of Objective 1 policies. However, the results warn over possible negative repercussions of a discontinuation of EU aid, one of the consequences of Brexit. A drastic interruption of development funds to poorer regions may undermine any improvement obtained under EU financial support.

These findings have strong implications for the future of the UK. They suggest that Cohesion Policy has been a significant stimulus to regional (and national) growth in the UK and, due to its focus on economically backward regions, a significant force for regional convergence in the country. The prospective withdrawal of the UK from the EU and the loss of eligibility for Cohesion Policy funding will deprive the UK's regional economies from an important source of investment funds, without which the areas currently most subsidised may struggle to keep up with the rest of the country. It follows from the analysis that filling the policy vacuum that will be left by the loss of EU subsidies would be an effort worth making – despite all difficulties this would involve (Bachtler & Begg, 2017) –, given that if the UK government is unwilling to replace EU funds the poorest regions may suffer a negative economic shock.

More broadly, the results also contribute to the debate on the effectiveness of public investment policies, in general, and EU Cohesion Policy, in particular. The analysis provides evidence showing a beneficial role of EU spatially-targeted development programmes focusing mainly on disadvantaged territories. Hence, the key takeout of the paper is that EU investment policies *can*

be successful, even in a causal sense, in the areas presumably most in need of support. However, when putting in place development projects, EU regions should think carefully about the legacy of the measures they implement, in order to avoid seeing all achievements vanish when the financial resources will be cut down.

An important question is whether the observed positive effect of Objective 1 funds in the UK is due to economic activity being shifted around (from richer to poorer areas) or if, instead, the policies are actually optimising the aggregate economic performance. In support of the latter hypothesis, the results do not appear to be driven by cross-regional spillovers. In addition, the positive economic effects of Cohesion Policy, while being stronger in less developed areas, seem to unfold across all UK regions.

Considering the mixed evidence in the literature regarding the effect of Cohesion Policy in European regions, one might wonder what factors have contributed to the good use of EU funds of UK regions particularly. The presence, in the UK, of well-functioning administrative structures may have favoured the success of the projects, even though, at least in the case of South Yorkshire, public authorities managing the programmes could not cope just as well with the drastic reduction in EU funding. The empirical analysis, however, does not directly attempt to identify the factors at the root of the investments' impact.

The link between the quality of regional governments and the effects of public capital expenditures is instead explored by the second paper of the Thesis. The findings of the empirical study highlight the strong conditioning role played by government institutions for the economic returns of investments. The analysis, focusing on EU regions, reveals that good governance helps translating improvements in transport infrastructure into economic growth. However, the presence of credible, competent and transparent regional governments is a necessary, yet not a sufficient, condition for guaranteeing positive returns of public investments. The selection of appropriate interventions is crucial too. It emerges from the analysis that while a better network of secondary road is associated with stronger economic performance – but only in combination with sound governments – no relationship with growth exists for investment on motorways roads.

The latter result is particularly relevant for the less developed European regions, given that large-scale infrastructural projects such as motorways have been at the centre of many development strategies in peripheral places in Europe. The creation, through motorways, of long-distance transport infrastructure corridors connecting peripheral with core areas does not appear to be the most effective measure to facilitate the development of poorer areas (Puga, 2002). In contrast, the findings of the analysis support the idea that in economically backward places the priority should

be to strengthen regional and local roads, which would favour the creation of linkages between local economic actors.

As mentioned, the key finding of the paper is that even this type of investment (i.e. the improvements of secondary roads) is unlikely to be economically productive if promoted by corrupt and self-interested governments. Important implications for European development strategies can be derived from this result. The large transport infrastructure expenditure effort ongoing in Europe may produce limited economic effects if funds are ‘unconditionally’ disbursed to regional and local authorities. Growth-promoting financial resources should be made conditional to policy reforms aimed at solving key institutional failures, e.g. by ensuring a more transparent allocation of resources, and improving the monitoring and evaluation processes of investment projects.

Finally, the results of the paper show that alongside transport infrastructure and government institutions, key drivers of regional economic performance in Europe are the stock of human capital and the capacity to produce innovation. These four elements – infrastructures, institutions, human capital and innovation – are indeed among those identified by European development programmes as a target for the generation of economic growth in the continent. Europe 2020, the strategy expected to bring the EU permanently out of the crisis and revive the European economy, includes specific objectives related to each of these elements. The ambitious goal of Europe 2020 and of Cohesion Policy 2014-2020 is to promote inclusive growth, i.e. to improve economic efficiency while simultaneously creating employment *for all* (European Commission, 2014). In relation to this, the third paper of the Thesis investigates the extent to which these four growth-conducive factors are able to improve not just economic, but also labour market and social conditions in EU regions.

The analysis of the third paper reveals that only some of the pillars underpinning growth strategies in Europe contribute to the generation of employment and to social inclusion. Over the past 15 years, the less developed EU regions that have managed to create more jobs are those with larger human capital bases and stronger innovative potential, while among the European core regions those witnessing higher employment increases have been the most innovative areas. Additionally, the findings indicate that having a higher share of highly-educated individuals has been associated with high-skilled employment creation, whereas low-skilled employment has increased in regions with higher quality of government institutions. Low-skilled employment is closely associated to the degree of social inclusion in a region. The results show that government quality helps generating low-skilled jobs (and hence fostering labour market inclusion) particularly in the poorer

areas of Europe. Consistent with that, labour market exclusion is found to have been reduced more in regions with better governance conditions.

Therefore, as in the second paper, the key takeout of the analysis concerns the benefits – particularly for poorer regions – associated to having a more transparent, accountable, effective and free of corruption regional government. In this case, good governance structures appear to guarantee a better capacity to reduce labour market marginalisation and offer employment opportunities for the low-skilled, i.e. they help achieving equity-related goals.

Hence, in order to aim at ‘smart and inclusive’ growth with an emphasis on jobs promotion, the objective of the Europe 2020 strategy, the EU should be aware that employment and social inclusion in disadvantaged regions are conditional on adequate government institutions implementing successful labour market policies. It follows that, together with initiatives promoting education and the upskilling of the most underprivileged and marginalised workers, the poorer EU regions should introduce institutional reforms to make sure that any expenditure intended to improve labour conditions is not mistargeted or misappropriated.

The second and third papers of the Thesis, therefore, present extensive evidence on the role played by public institutions in the most economically disadvantaged regions of Europe. The studies unveil important insights on *how* regional government quality influences economic competitiveness and the success of investment policies, and reveal that the framework of local institutions is crucial also for the generation of inclusive economic development in the European periphery.

The two empirical studies, however, do not shed light on the phenomena leading to governments’ misallocation of resources and wrongly-targeted investments in the poorer regions of the continent. The fourth and final paper of the Thesis takes on this task, by focusing on three lagging regions of Europe (Campania, Calabria and Sicily), and on a specific type of institutional distortion, that is, the ‘infiltration’ of organised crime within municipal governments.

The results of the study suggest that the capturing of local governments by criminal organisations leads to a manipulation of public expenditure choices to the advantage of organised crime. During infiltrations, the overall spending of Southern Italian municipalities remains essentially unaltered. Instead, the selection of investment objectives changes significantly. Capital spending for public construction works increases, while investment for law enforcement is reduced. Municipal governments are also less efficient in collecting taxes for waste and garbage. Construction and waste collection are known to be two sectors in which the mafia holds great interests and makes large profits. In addition, fewer resources for law enforcement facilitate its illegal traffics. Hence, it appears from these findings that organised crime exploits the control of local governments to

protect its interests, but in a subtle way, making a detection of infiltrations more complicated for judicial authorities.

As a consequence, in local territories where the presence of the mafia is more pervasive, efforts to ‘clean up’ legal institutions from politicians linked to criminal organisations must be considerable. Laws such as the one through which the Italian State can dissolve infiltrated local administrations have allowed to discover and put an end to hundreds of collusion cases, but the relative frequency of repeated dissolutions in the same municipality (sometimes after just a few years) demonstrates that more powerful legislative tools are needed to completely eradicate the phenomenon of political infiltrations. A strengthening of the law allowing mafia-related government dissolutions, under discussion in these years (Cantone, 2010), may prove helpful. However, this reform could be insufficient if not coupled with measures preventing any potential distortions to democratic competition at local elections. Equally important to limit the local power of mafia clans would be to guarantee a fair provision of public services and employment opportunities in the small towns and urban neighbourhoods where organised crime currently has the upper hand.

Given the diffusion of mafia groups in Europe (Transcrime, 2015), the empirical results may have implications for other contexts besides those chosen for the analysis. Although imperfect and improvable, the Italian legislation in matters of organised crime remains one of the most advanced in the world. In countries representing easy targets for money laundering from criminal organisations due to the absence of such legislation, the public finances of local governments may withstand enduring distortions in presence of links between criminal organisations and the political power.

The fourth paper’s findings demonstrate how (specific types of) government dysfunctions work in practice and can affect local governments’ choices. Combining these results with the evidence emerging from all other papers, implications can be drawn regarding the definition and effectiveness of public policies aiming at social and economic progress in Europe.

This Thesis has shown that development interventions have the potential to successfully spur economic and labour market performance in EU regions. The first paper demonstrates that investment policies may have a beneficial effect on the development trajectory of regions. However, as illustrated by the second and third paper, any favourable outcome (both in terms of efficiency and equity) is determined by the competence and the goodwill of government institutions responsible for selecting policy priorities and enforcing investment plans. The fourth paper reveals that, when politicians are conditioned by lobbying and illegal pressures from criminal groups, public investment decisions follow special interests rather than general welfare goals.

A lesson can be drawn from these findings for the programme of investments currently being promoted in the EU as part of Europe 2020 and the reformed Cohesion Policy. The modern regional policy of the EU considers economic competitiveness and social cohesion as non-mutually exclusive targets. On the basis of that, it promotes development strategies expected to harness the untapped potential of all regions. This Thesis suggests that, in the European periphery, a disbursement of funds to local public authorities is unlikely to bear fruits if politicians discretionally use resources without having the interests of the public community in mind. Given that the ‘place-based’ orientation of the investment policies tends to be associated with a ‘bottom-up’ and localistic focus (Crescenzi & Giua, 2016; Bachtler et al., 2017), it seems essential to make sure that the assignment of more responsibilities to local governments in the definition and implementation of investments is combined with mechanisms monitoring whether the devolved power and resources are transparently used. The risk of ‘local government failures’ should be a serious concern for the EU, that could be avoided by reinforcing the systems of *ex ante* conditionality that links the earmarking of financial resources to specific pre-existing institutional standards or to administrative reforms. Prioritising this type of issues would help ensuring that the ongoing public investment effort undertaken by the EU and by the single Member States leads to the much-needed employment and economic boosts, as well as to processes of social inclusion, rather than to ‘strategies of waste’.

Avenues for future research

The four papers of the Thesis cover specific questions from the research blocs within which they are set. As such, they offer several areas for future explorations.

First, the evidence of a causal impact of EU Cohesion Policy documented in the first paper is limited to the UK context. Further research is required to test whether, in other countries, the responses to EU regional policies replicate the dynamics observed in the case-studies chosen for the analysis. In order to produce credible inferences of external validity, the findings must be complemented with evidence on the key channels (e.g. facilitating conditions, strategies adopted) driving the estimated labour market and economic effects. Additionally, more research is needed in order to fully discard the possibility that the observed effect of EU funds in the UK is (at least partially) due to displacement effects.

The second paper, aiming to shed light on the role of governance for regional investments in EU regions, certifies positive growth effects of specific types transport investments in presence of adequate institutions. However, this work only focuses on two transport modes (highways and

secondary roads). Future quantitative research intended to estimate the role of institutions for the effectiveness of investment strategies may extend the analysis by looking at other forms of infrastructure investment, or at other productivity-enhancing sectors. Furthermore, issues in data availability currently do not allow to produce precise monetary estimates of the transport expenditures made, while government quality is measured on the basis of citizens' perceptions rather than from more objective standards (e.g. norms, laws, traditions as in La Porta et al., 1999).

The third paper uncovers a number of associations between economic factors and labour market dynamics in EU regions. In order to provide additional insights on the inclusiveness of EU growth strategies, future research may adopt more advanced proxy variables for key economic factors and for the evolution of social exclusion patterns, and/or assess the employment effects of different combinations of growth factors rather than analysing each of them separately.

Taken together, the second and third papers describe the importance of regional institutions for socio-economic development in Europe. Yet, the use in both studies of cross-country panel datasets limits the possibility to illuminate the underlying mechanisms explaining the link between the functioning of governments and the effects of public policies. Adopting data at a more fine-grained spatial scale would allow for a more detailed examination of the factors linking institutions to the economic impact of public investments and to social or labour market outcomes. Uncovering the relevant channels explaining the findings obtained in the two articles is an important task for future research.

Drawing on micro-level aggregations (Italian municipalities), the fourth paper examines the effect of organised crime's local governments captures on the composition of expenditures and the management of public revenues. While the study provides a detailed assessment of the bias to the local balance sheets introduced by mafia infiltrations, it leaves a major gap involving the welfare impacts of such distortions. An extension to this research would therefore investigate whether and how political infiltrations, and the misallocation of resources they entail, are detrimental to the local economy and society. Moreover, the legislative setting adopted for the analysis inevitably narrows the spatial scale of the investigation to three regions of Italy. Future research may explore whether undue influences of government activity from criminal organisations take the same form in other contexts.

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The impact of EU funds on regional development: Evidence from the UK and the prospect of Brexit

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Abstract

Brexit means that regions of the United Kingdom will lose access to EU Cohesion Policy. Have EU funds been effective, and what might be the consequences of an interruption of EU financial support? This paper studies how EU structural funds have affected the labour market and economic performance of UK regions. The analysis is performed with counterfactual methodologies on two specific regions, Cornwall and South Yorkshire, in order to capture the causal impact of Cohesion Policy interventions in the medium-long term. Fixed effects models complement this evidence to test the effects of EU funds in all UK regions. The results provide evidence of a positive impact of ‘Objective 1’ funding – the highest form of EU aid available to the poorest European regions – on labour market and economic performance of UK regions. However, the counterfactual analysis looking at South Yorkshire suggests that when the region lost Objective 1 eligibility – massively reducing its share of EU funds – it was unable to sustain the gains obtained in previous years. This suggests that while Structural Funds may be effectively improving socio-economic conditions of poorer regions, the performance of subsidised areas could be deeply affected by a reduction (or worse, an interruption) of EU aid.

Keywords: EU Cohesion Policy, Objective 1, Brexit, synthetic control method, UK.

JEL Classification: R11; O18; J60.

Published in the *Journal of Regional Science*.

1. Introduction

In June 2016, the United Kingdom voted to leave the European Union. ‘Brexit’ received high support from some of the UK regions that have been among the largest beneficiaries of EU Structural Funds. This reflects discontent with the EU and the way in which EU financial resources have been spent, and would seem to imply that EU Cohesion Policy has not succeeded in triggering greater development in these regions. But has this really been the case? When the UK will leave the EU, these areas will no longer be eligible to receive EU funds, and the shift from a status of high subsidisation to one in which no more European funds are available may bring about a number of unexpected consequences. Might the loss of EU funding have any adverse impacts on future employment levels and economic performance of currently subsidised regions?

In order to answer these questions, this study assesses the labour market and economic impact of EU policies in the UK. It looks in particular at two UK regions, Cornwall and South Yorkshire, which voted to leave the EU in the referendum on Brexit¹² despite being among the highest recipients of EU funds in the country. Cornwall has been and continues to be eligible for ‘Objective 1’ funding, the most significant form of EU financial help. The region was first classified as Objective 1 in 2000 and has continued to receive funding since then. Therefore, the flow of EU funds will be interrupted when the UK leaves the European Union. Conversely, South Yorkshire was heavily supported in the past but lost its eligibility for this stream of funding in 2006. The particular evolution of this region’s eligibility status allows us to investigate how the loss of Objective 1 funding affected its economy, gleaned relevant lessons on the potential impact a similar loss could have in Cornwall and in other highly funded regions.

The effects of EU Objective 1 funds in these two regions are studied by using counterfactual methods. Moreover, an empirical model covering all UK regions tests the extent to which EU policies have been successful across the country. Regression methods analyse the relationship between EU funding (and Objective 1 funds in particular) and regional labour market and economic conditions.

Our contribution to the literature is threefold. First, we produce a thorough empirical investigation showing how EU regional policies have contributed to UK regional development. Second, we provide evidence on the causal impacts of Objective 1 programmes in UK regions and illustrate how the policy effects evolve over time. Third, following an increasingly common approach in place-based policy evaluations (see Neumark & Simpson, 2015), we analyse the impact of policy

¹² 56% of Cornwall’s and 61% of South Yorkshire’s voting population favoured leaving the European Union in the referendum on Brexit, held on 23rd June 2016.

interventions taking into account both the period in which the implementation takes place and the period following the programme's completion.

The few works evaluating the impact of EU Cohesion Policy with counterfactual techniques have documented the potential for EU funds transfers to foster growth, spur investments, and generate jobs (Becker et al., 2010; 2013; Pellegrini et al., 2013; Giua, 2017). None of these studies focuses on the UK specifically, a context remaining largely unexplored for what concerns the effects of EU development policies. In addition, no study has ever investigated the effects of EU programmes by considering their full cycle, i.e. from the moment in which a region is awarded the Objective 1 status to the period following the loss of Objective 1 funds. By looking at the performance of South Yorkshire after Objective 1 eligibility is lost, our analysis examines the persistency of the policy's impacts and investigates its capacity to produce self-sustaining regional development paths.

In the counterfactual study, we compare the trajectory of Cornwall and South Yorkshire with the one of 'synthetic' control regions, created as the combination of English regions ineligible for Objective 1 funds. Our findings provide clear evidence of a significant reduction in unemployment in Cornwall, relative to the synthetic control, during the period in which it was classified as Objective 1. South Yorkshire also displays a significant decrease in unemployment between 2000 and 2006, but the improvements are gradually offset during the following years. The empirical estimates suggest that after Objective 1 status is lost, South Yorkshire evolves towards the trend of a similar untreated region, indicating that Objective 1 funds produced very little permanent/structural effects overall. Difference-in-differences models of local unemployment growth estimated at the level of wards confirm this evidence. In addition, Cornwall appears to be closing the gap in GDP per capita relative to untreated regions during the Objective 1 period, while South Yorkshire's economic catch-up process loses pace and begins to revert when Objective 1 funds are no longer available.

When extending the analysis to all UK regions, the positive effect of Objective 1 policies on unemployment reduction and economic growth is confirmed. Additionally, a clear association is found between the proportion of EU funds received and the economic performance of British regions. This relationship appears to be strictly linear, i.e., a larger proportion of EU funds have led to higher growth rates particularly among the most funded (Objective 1) regions.

Overall, the results indicate that the poorer areas receiving highest shares of EU funds seem to be those having most benefitted from the financial aid. However, any achievement obtained through EU policies may not be persistent, and may quickly disappear after the end of the high-intensity funding period, even in the presence of transitional programmes that make the reduction of EU funds more gradual. Hence, the sudden interruption of Structural Funds to poorer regions that

would result from Brexit could have relevant medium-run consequences on the economy and labour market of areas currently receiving the highest proportions of EU funds.

The paper is organised as follows. Section 2 introduces the background of the Objective 1 programme and reviews the literature on EU Cohesion Policy evaluations; section 3 presents the quasi-experimental design; section 4 discusses the data and descriptive statistics; section 5 presents the empirical results, beginning with the study performed at the regional level using the synthetic control method, followed by the difference-in-differences model estimated at the level of wards, and concluding with the fixed effect model estimated at the NUTS2 level for all UK regions; section 6 concludes by summarising the results and defining some paths for future research.

2. Institutional background and overview of the literature

Cohesion Policy and the Objective 1 programme

The European Cohesion Policy was established in 1988 as a set of regional investment programmes aiming to promote social and economic cohesion in the EU. Starting from the 1994-1999 EU investment period, Cohesion Policy expenditures represent approximately one third of the EU's total budget. Periodic variations have changed the way in which regions are classified for Cohesion Policy purposes. At the beginning of every new programming period, the European Commission revises the regional allocation of funds and the list of regions considered 'in most need of support'. The eligibility rule for determining Objective 1 status – i.e. "Regions whose development is lagging behind" (European Commission, 2008a) – has always remained the same¹³. Objective 1 regions, receiving the large majority of Structural Funds¹⁴, are those whose average GDP per head is below 75 percent of the EU average for the last three years of available data before the start of a new programming period (Gripaios & Bishop, 2006).

Under the Objective 1 programme, regions are entitled to be financed through the European Regional Development Fund (ERDF), the European Social Fund (ESF), the European

¹³ The name 'Objective 1' regions was changed into 'Convergence regions' for the 2007-2013 period and again into 'Less developed regions' for 2014-2020, but the rule of eligibility has not been modified.

¹⁴ Objective 1 regions received 71.6% of the total 2000-2006 Cohesion Policy budget (€213bn), despite representing only 37% of the total EU population (European Commission, 2010). For the 2007-2013 period the proportion of funds to 'Convergence regions' was increased to 82% (European Commission, 2008b).

Agricultural Fund for Rural Development (EAFRD), and the European Maritime and Fisheries Fund (EMFF)¹⁵. Among these, the most important sources of funding are the ERDF and the ESF. While the development goals to be achieved in each Objective 1 region vary according to specific regional plans, there exist a number of broad themes on which the ERDF and the ESF focus. Generally, the former fund is used for developing new infrastructure, fostering the competitiveness of SMEs, and promoting technological development and innovation, while the latter aims to improve employment opportunities, equip the workforce with better skills and better job prospects, and help unemployed and inactive people enter work (European Commission, 2008a).

The share of available financial resources is established before the beginning of each programming period by the European Commission on the basis of development plans jointly defined with the regions' managing authorities. Every managing authority is in charge of providing information on the programmes, advertising and selecting projects, and monitoring their implementation. Depending on the type of project, the beneficiaries of the funds can be local governments, education institutions, other public entities, enterprises, non-governmental organisations, or private citizens.

Regions classified as Objective 1 are expected to implement development programmes which would allow them to converge to higher levels of income and eventually lose their status of areas in highest need of support. As a consequence, the proportion of EU subsidies to these regions would progressively diminish. As the per capita GDP of Objective 1 regions becomes higher than 75 percent of the EU average, 'Phasing-in' or 'Phasing-out' transitional programmes are put in place, reducing the amount of funds available to former Objective 1 regions¹⁶.

¹⁵ A fifth source of funding is the Cohesion Fund, available to Objective 1 regions of Member States with a Gross National Income below 90% of the EU average. This rule has made UK regions not eligible to receive these grants.

¹⁶ While the phasing-in programme substantially reduces the share of EU funds for the programming period following the one in which a region was classified as Objective 1, the phasing-out programme allows for a more gradual reduction, such that in the first non-Objective 1 period a region may be entitled to receive almost as much as it was previously obtaining (see Table A1.1: South Yorkshire for a case of phasing-in regions, Northern Ireland for a case of phasing-out region).

Literature review

The effectiveness of Cohesion Policy has been assessed in a vast number of evaluations performed with many different empirical methodologies. The majority of studies draw on samples of EU NUTS2 regions and employ cross-sectional or panel data (Cappelen et al., 2003; Ederveen et al., 2003; Rodríguez-Pose & Fratesi, 2004; Beugelsdijk & Eijffinger, 2005; Ederveen et al., 2006; Puigcerver-Peña, 2007; Esposti & Bussoletti, 2008). More recent works have attempted to address endogeneity issues by using instrumental variable models in combination with spatial econometric techniques (Dall'erba & Le Gallo, 2008; Ramajo et al., 2008; Mohl & Hagen, 2010; Bouayad-Agha et al., 2013). In spite of the large number of studies produced, this literature has not reached a consensus on whether Structural Fund spending is beneficial (Cappelen et al., 2003; Bahr, 2008; Esposti & Bussoletti, 2008; Becker et al., 2012), beneficial under certain conditions (Rodríguez-Pose & Fratesi, 2004; Mohl & Hagen, 2010; Becker et al., 2013; Bouayad-Agha et al., 2013; Rodríguez-Pose & Garcilazo, 2015; Crescenzi & Giua, 2016), insignificant (Garcia-Milá & McGuire, 2001; Dall'erba & Le Gallo, 2008) or even detrimental and unjustified (Boldrin & Canova, 2001; Dall'erba et al., 2009).

In order to provide more conclusive evidence on the effect of EU funds in European regions, a new strand of the literature has proposed novel estimation methodologies based on quasi-experiments and counterfactual comparisons.

A commonly used counterfactual approach evaluating EU Cohesion Policy exploits the eligibility rule for Objective 1 status as a threshold for a regression discontinuity design (RDD). Areas classified as Objective 1 (treated) are compared to similar areas with a GDP just above the 75 percent of the EU average. Becker et al. (2010; 2013) and Pellegrini et al. (2013) use this methodology and find a positive and significant effect of Structural Funds on economic growth in Objective 1 regions, while Accetturo et al. (2014) uncover a negative impact of the funds on the degree of trust and cooperation among citizens. Gagliardi & Percoco (2016) demonstrate that the positive effect of EU funds on growth is stronger in rural areas close to urban agglomerates. Adopting a spatial RDD methodology that compares areas across the boundaries of Objective 1 regions, Giua (2017) provides evidence on the beneficial and causal effect of Cohesion Policy in the municipalities of Italian Objective 1 regions. In these studies, the effects of EU funds are assessed in a static framework, which does not allow for a change over time in the eligibility status of the regions. Whether a region is affected by reductions in the flow of funds deriving from the loss of Objective 1 status is a question that has been investigated by Barone et al. (2016), finding that the growth rate of Abruzzo (Italy) has significantly reduced in the period following the change in Objective 1 eligibility.

Increasingly, spatially targeted policy interventions are evaluated across their full cycle, considering both treatment and post-treatment outcomes (e.g. Kline & Moretti, 2014; Einio & Overman, 2016). Yet, no study has ever looked at the impact of the EU Objective 1 programme from the moment in which eligibility is obtained by a region to the moment in which it is lost and beyond.

We do so in this paper, by testing the effect of Cohesion Policy on unemployment and economic growth. The effectiveness of Cohesion strategies has already been evaluated in the literature by using labour market outcomes (Garcia-Milá & McGuire, 2001; Becker et al., 2010; Giua, 2017), while economic growth is the most commonly used indicator to measure the success of EU development policies (e.g. Becker et al., 2010; 2013).

In addition, this paper contributes to the literature assessing the impact of EU funds in the UK. While extensive research has been carried out to evaluate the effects of regional and local development policies promoted by the UK government (e.g. Harris & Robinson, 2004; Devereux et al., 2007; Wren & Jones, 2011; Criscuolo et al., 2012; Faggio, 2015; Einio & Overman, 2016), very little evidence exists on the impact of European regional policies in the UK context. Studies on the UK have either a rather narrow programme-specific focus (Armstrong & Wells, 2006; Munday & Williams, 2009) or they look at issues of governance and institutional fit rather than at questions of economic performance (Bache, 1999; Gripaios & Bishop, 2006; Gore, 2008). An exception is the study by Criscuolo et al. (2016), investigating the role of firm subsidies granted by the British Government for stimulating employment in poorer regions, and finding a positive correlation between Objective 1 eligibility and changes in firms' employment.

The scarcity of research on the effects of Cohesion Policy in the UK is surprising, considering that the country's significant regional disparities (McCann, 2016) made it one of the highest absolute recipients of EU funds for a long time¹⁷.

¹⁷ As an example, during the 2000-2006 period the UK received approximately €17 billion. Only Spain, Italy, Germany and Greece received more EU Funds during the same years.

3. Objective 1 eligibility in the UK and the cases of Cornwall and South Yorkshire

EU Structural Funds and Objective 1 eligibility in UK regions

A peculiarity of the UK context is the way in which the geography of regions targeted by EU Cohesion Policy has evolved over time. As shown in Figure 1, during the 1994-1999 period the UK Objective 1 regions were Merseyside in England, the Highlands and Islands of Scotland and Northern Ireland. For the 2000-2006 programming period the list of ‘lagging behind regions’ was radically modified. Of the aforementioned regions, only Merseyside retained Objective 1 support while three new regions were declared eligible: Cornwall and South Yorkshire in England, and West Wales and The Valleys in Wales. From 2007 Merseyside and South Yorkshire were no longer considered Objective 1, while Cornwall and West Wales conserved the status for the 2007-2013 and the 2014-2020 periods (Figure 1).

Table A1.1 in the Appendix summarises the amount of EU funds per inhabitant¹⁸ in 1994-1999, 2000-2006, and 2007-2013 obtained by UK regions. It can be noted that all regions received some form of financial support, but the amount of funds awarded to those not eligible for Objective 1 is far lower than what was obtained by those considered in highest need of help^{19,20}.

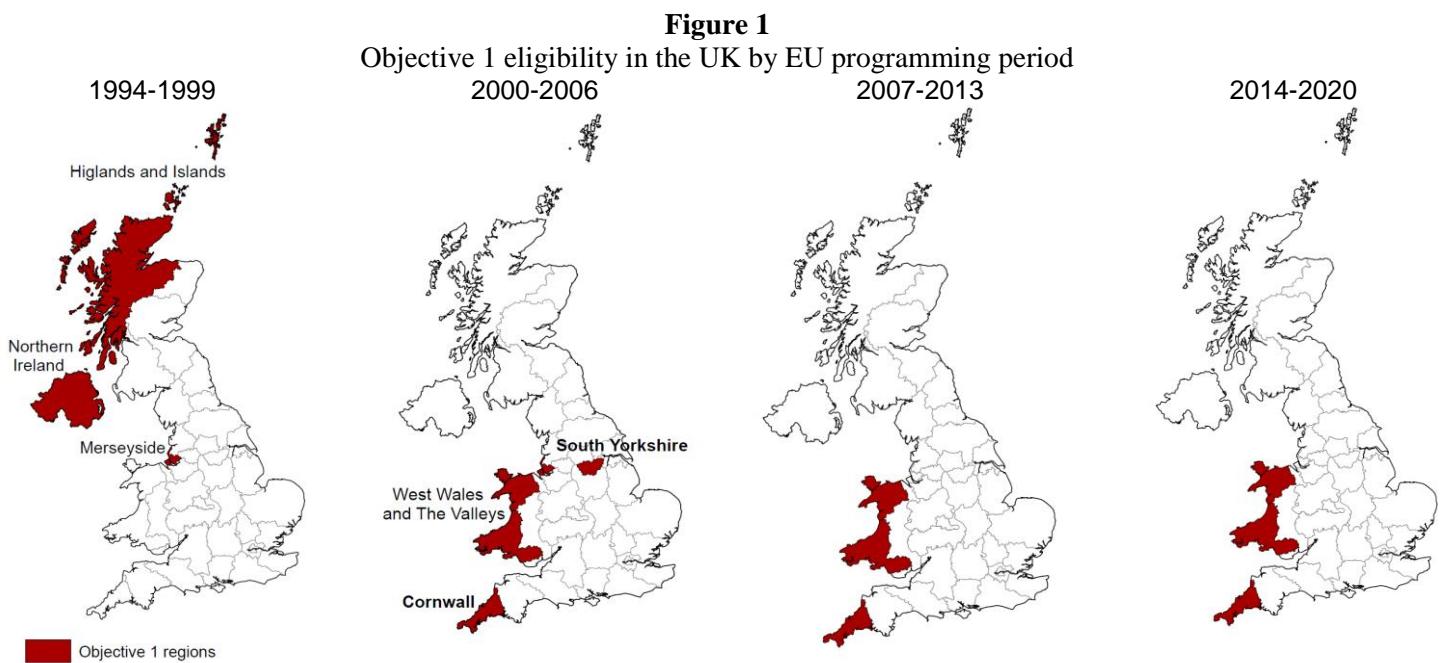
Given the strict and specific criterion adopted to assign the Objective 1 status, variations in eligibility like the ones experienced by Cornwall and South Yorkshire in 2000 represent almost unique cases in the history of Cohesion Policy. As Objective 1 regions are expected to use Structural Funds to improve their economies and converge to the average level of per capita income of the EU, it is very unusual for regions to switch to Objective 1 in countries that have been part of the EU for a long time.

¹⁸ These figures are based on ‘payments’ from the European Commission. Payments refer to the resources paid by the European Commission to EU regions and are available to be spent. Although they do not reflect the exact final spending of regions, they represent more accurate estimates of actual spending than European Commission’s ‘commitments’, often used by Cohesion Policy evaluations as proxies for funds’ expenditures.

¹⁹ Exceptions are phasing-out regions such as Northern Ireland and Highlands and The Islands during the 2000-2006 period (see also footnote 17).

²⁰ During 1994-1999, the territory of Cornwall was classified as Objective 5b, i.e. ‘Adapt agricultural structures and promote the development of rural areas’, while South Yorkshire was classified as Objective 2, i.e. ‘Reconvert region affected by declining industry’. The fact that the two regions were among the top receivers of Structural Funds in England before 2000 is accounted for in the empirical analysis.

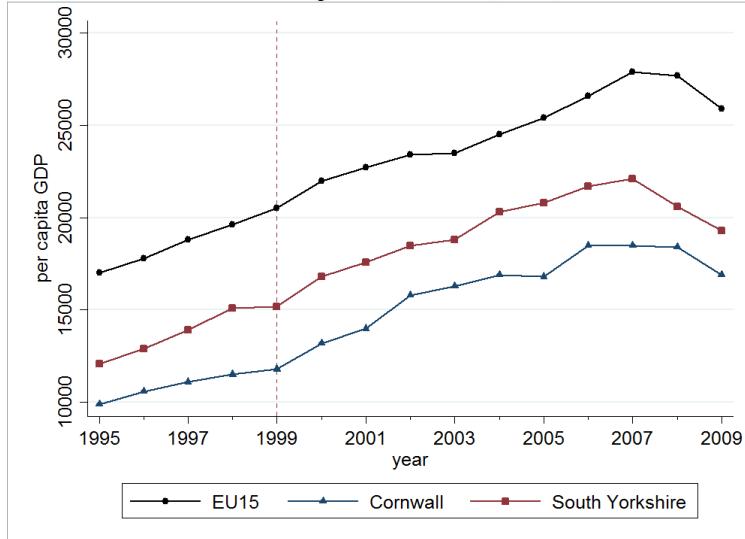
In the following paragraphs, we analyse the historical reasons that have brought Cornwall and South Yorkshire to be classified as Objective 1, and the evolution of their Cohesion Policy status from that moment until today.



Cornwall

Figure 2 plots the evolution of per capita GDP purchasing power standard, comparing the trends in Cornwall and South Yorkshire with the average of the EU as of 1999 (with 15 Member States). Between 1995 and 1999, Cornwall was growing at a slightly lower pace with respect to the EU15 – the 1995-1999 average growth rate of Cornwall was 4.5 percent, while in the EU15 it was 4.8 percent. On average, however, the growth rate of the region is comparable to that of the EU, as Cornwall's GDP per capita was €9,900 in 1995, equal to 58.2 percent of the EU15, and €11,800 in 1999, corresponding to 57.6 percent of the EU15.

Figure 2
GDP PPS per inhabitant (EUR)



Source: OECD.

Despite the fact that Cornwall's GDP per capita was well below the 75 percent threshold in the 90s, the European Commission only entitled Cornwall to receive Objective 1 funding from the programming period which started in 2000. The reason for this is that until 1998 Cornwall and its neighbour Devon were incorporated into a single statistical area with a GDP per capita above 75 percent of the EU. In 1998 the UK Government introduced a reform revising NUTS regional borders, splitting the Cornwall-Devon region into two separate statistical areas. Previously, under the 'Devonwall' political concept promoted by the UK Conservative Party from the 1970s, Cornwall and Devon had been linked together in an economic, political and statistical sense.

After the 1997 UK general elections and the Conservatives' defeat, the Liberal Democrats withdrew their support to the 'Devonwall' project, opening the doors to the statistical separation of the two regions and the possibility for Cornwall to be awarded Objective 1 status. Despite the existence of a political campaign for Cornwall's separation from Devon, the change in regional borders and in EU funds eligibility was hardly predictable (Willett, 2013). The requests for separation were complicated by the presence of political elites and stakeholders in Cornwall believing that the unity between Devon and Cornwall was best serving their interests, due to the possibility of having a stronger 'lobbying voice' by staying together (Stanyer, 1997). In addition, the Labour party which won the 1997 national elections was not particularly keen on devolving political autonomy to territories it did not control politically²¹ (Willet & Giovannini, 2014).

²¹ In the 1997 elections the Labour party obtained the relative majority of votes only in one of five Cornish constituencies (the other four were won by the Liberal Democrats), while in the 1992 elections the Labour was the third party after Conservatives and Liberal Democrats. The 1998 reform was promoted by the Labour-led central government. Given the historical political weakness of the Labour in Cornwall, the Devon-Cornwall 1998 separation

Importantly, the reasons behind the attainment of the Objective 1 status in Cornwall are independent from any circumstance directly affecting the long-term economic trajectory of the region. The 1998 reform justified the division of Devon and Cornwall on the basis of “the very different economic conditions of the two counties, and Cornwall’s sparsity of population, geographical peripherality and distinct cultural and historic factors reflecting a Celtic background” (House of Commons, 1998). The economic differences between Cornwall and Devon emphasised by the UK Government are evident if the levels of per capita GDP of the two regions are compared²². However, when looking at other measures of economic prosperity such as the Total Household Income or the Gross Disposable Household Income²³, the figures for 1997-1999 appear very similar for the two regions and in both cases above the 75 percent EU threshold (Gripaios and McVittie, 2003). This suggests that Cornwall was “somewhat fortunate to be awarded Objective 1 status” (Gripaios & McVittie, 2003: 372), as the principal reason for the region’s qualification for financial support was the way borders have been re-drawn (Gripaios & McVittie, 2003; Gripaios & Bishop, 2006).

Therefore, the sudden increase in EU grants can be considered exogenous to the pre-treatment economic trend of the region, making it possible to identify the effect of EU-financed programmes by looking at the evolution of the regional labour market before and after the attainment of the Objective 1 status. The Objective 1 status of Cornwall was confirmed in 2006 for the 2007-2013 period, and again in 2013 for the 2014-2020 period (Figure 1). This makes Cornwall the region that received the largest proportions of EU funds per capita in England from 2000 onwards (for details on Cornwall’s investment strategy through EU funds see Appendix A2).

South Yorkshire

With respect to Cornwall, the attainment of Objective 1 eligibility in South Yorkshire occurred in a ‘less unexpected’ way. Formerly specialised in manufacturing, South Yorkshire has gone through a period of deindustrialisation which brought about the closure of most coal mines in the early 1990s. The region’s economic decline was seriously addressed by the central government only from 1997 onwards, when the newly-elected Labour government promoted interventions

was not easily foreseeable, due to the fact that it would have meant a political victory for an opposition party, the Lib Dem, which had begun to back the separatists’ requests. The separation has been the result of lobbying activities which eventually led the national government to include the Cornwall-Devon division in the reform (Willet, 2013).

²² In 1999, the per capita GDP of Cornwall was €11,800, while Devon’s was around €15,900.

²³ Total Household Income (THI) is calculated as all income received by household residents in a region, while Gross Disposable Household Income deducts from THI expenditures on taxes, social security, pension contributions and interest payments.

tackling the growing unemployment by matching national resources with the EU funds (Kirk et al., 2012). From 1994 to 1999, the South Yorkshire territory was classified as Objective 2. The proportion of EU funds available to the region increased massively from 2000, when South Yorkshire became eligible for Objective 1 support.

Unlike the case of Cornwall, there has been no border re-definition behind South Yorkshire's change of status. Hence, anticipation effects and externalities may affect our estimates if we assume that people and businesses react to the change in eligibility before this has actually occurred. However, the fact that South Yorkshire's per capita GDP was swinging above and below the 75 percent threshold just before 2000 – it was 74.2 percent of the EU15 in 1997 and 76 percent in 1998²⁴ – made it more difficult to predict a future Objective 1 eligibility, and therefore behave in such a way that could anticipate the inflow of EU funds to the region.

Moreover, the per capita GDP trend of the region has been almost parallel to the one of the EU15 in the years preceding the eligibility change (Figure 2). South Yorkshire's growth rate during the 1995-1999 period was 5.9 percent, slightly above the EU15's 4.8 percent. The region continued to catch up with the EU average during 2000-2006 period and due to this increase in income and to the Eastern Enlargement – an exogenous event which made the 75 percent threshold easier to be exceeded– during the 2007-2013 period South Yorkshire lost the status of Objective 1 becoming a Phasing-in region.

The Phasing-in status entitled South Yorkshire to receive ‘transitional funding’, that is, more resources than any other non-Objective 1 region but less than Cornwall, the only English Objective 1 region during the programming period starting in 2007 (Table A1.1). This status was confirmed in 2013, when South Yorkshire was defined as a ‘Transition region’ for the 2014-2020 period, i.e. with an average GDP per capita between 75 percent and 90 percent of the EU average. This gives South Yorkshire the possibility to obtain more funds than ‘more developed regions’ (GDP per capita above 90 percent of the EU average), but less than ‘less developed regions’ (former Objective 1) (more details on South Yorkshire's investment strategy through EU funds can be found in Appendix A2).

²⁴ The region was entitled to receive Objective 1 funds despite the fact that its GDP was above 75% of EU average in 1998 because the EU considers the average GDP of the three years of available data before the beginning of the period to classify the regions. Final data for 1998 was presumably not yet available in 1999, when the final decision over eligibility was made.

Potentially confounding policies

The main policy for employment promotion in the UK besides EU Cohesion Policy²⁵ was the Regional Selective Assistance (RSA) programme (renamed in 2008 as Grant for Business Investment (GBI)), financed by the UK national Government and intended to create and safeguard employment in the poorest areas of the country (Criscuolo et al., 2016). The RSA schemes are no longer in force in England since 2014.

Through this policy, the National government provided grants to manufacturing firms located in UK areas characterised by low GDP per capita and high unemployment. Changes in eligibility for RSA occurred in coincidence with the start of new EU programming periods. In the ward-level analysis we attempt to minimise the potentially confounding effect of this policy, by exploiting variations over time in the geography of RSA support schemes.

4. Data

The main outcome variable used to evaluate the effectiveness of EU funds in UK regions is unemployment, proxied by the share of people claiming Job-Seeker's Allowance (JSA) unemployment benefits²⁶. Data are obtained from the Office for National Statistics (ONS) Nomis database and are available from the year 1992. Although the share of unemployment benefit claimants is not an official measure of unemployment, it is a less noisy indicator than the unemployment rate²⁷ and the only one available for areas smaller than UK Local Authorities. As shown in Appendix A3.1, during the period in which Cornwall and South Yorkshire have received Objective 1 funds, the rate of UK unemployment benefit claimants and the unemployment rate display similar trajectories.

²⁵ Regional data on expenditures for other national investment policies is not available. However, it must be noted that Cohesion Policy expenditures tend to be much more concentrated, geographically and thematically, and targeted on more specific development activities than national investments. Hence, particularly in poorer UK regions, EU funds represent substantial portions of the total investments made.

²⁶ Job-Seeker Allowance unemployment benefit is paid by the UK national government to unemployed people who are actively seeking work. All citizens of England, Wales, Scotland and Northern Ireland are equally entitled to apply for JSA.

²⁷ The JSA claimant count is often used as a proxy for unemployment. Due to sampling variability, the estimates of unemployment produced by the Labour Force Survey (LFS) are highly volatile. For this reason, JSA benefit claimant count is a less distorted and more reliable indicator than the unemployment rate, particularly when focusing on subsets of the UK population and on small administrative areas (ONS, 2013).

A second outcome variable used in the analysis is per capita GDP, available only at the regional level from 1995 onwards. Information on this variable is obtained from OECD statistics. Appendix A4 describes the levels and growth of the two outcome variables in English regions over the analysed period.

The empirical study adopts two different spatial dimensions: regions and wards.

Regions. The analysis performed at the regional level exploits two main sources of data. The first is Eurostat Regio, providing data from 1995 until 2014; the second is the Quarterly Labour Force Survey Local Area Data (LFS LAD), containing information on employment, economic activity and related subjects at the level of UK Local Authority Districts from 1992 to 2006. The period is collapsed from quarterly to yearly. The final dataset is composed of LFS variables from 1992 to 2006, Eurostat and OECD variables from 1995 to 2014 and the unemployment proxy available from 1992 to 2014.

NUTS2 regions are characterised by an average population of 1.7 million inhabitants, of which 2.8 percent claiming unemployment benefits (2000-2014 average).

Wards. The lowest level of aggregation used in this study is the one of electoral wards. Ward-level units allow to capture localised unemployment clusters, because most ward boundaries have been used by the ONS in 2001 to draw Output Areas (for which data are not available), a geographical classification of socially homogeneous areas in terms of household tenure and population size. The wards of England have an average population of around 5000 inhabitants (with high variance across wards, see descriptive Table in Appendix A5).

Due to the 1996 revision of frozen ward boundaries, the unemployment variable is only available for wards from 1996. Data on other variables at ward level are obtained from the 1991 UK Census. The following Censuses cannot be used because they relate to different ward classifications. The variable for wards' residents is given by the number of 1991 residents interpolated between 1996 and 2014 by assigning the average population growth rate of the region to its constituent wards.

5. Results

Synthetic control method – effect on unemployment

The analysis begins by performing a counterfactual analysis comparing the unemployment trend of the two case-studies, Cornwall and South Yorkshire, with appropriate counterfactuals. For that, we adopt the synthetic control method developed by Abadie and Gardeazabal (2003) and Abadie et al. (2010; 2015). This method allows to assess the effect of policy interventions taking place at

an aggregate level, using data for geographical units not exposed to the treatment but comparable to the treated region (see the Annex for a more detailed explanation of this methodology). The synthetic control regions are constructed on the basis of a number of labour market indicators related to the typology of the labour force, the sectorial composition and the level of education and training. In addition, we control for the level of GDP per capita²⁸. We also account for the fact that Cornwall and South Yorkshire were receiving EU funds during 1994-1999 by controlling for the amount of Structural Funds obtained in the pre-treatment period.

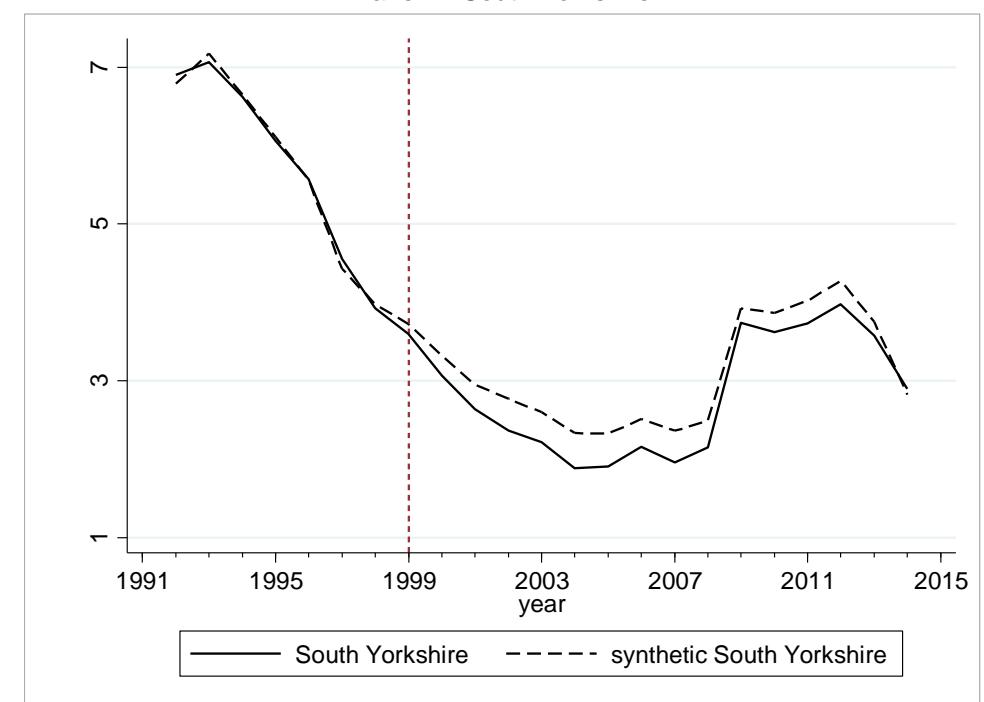
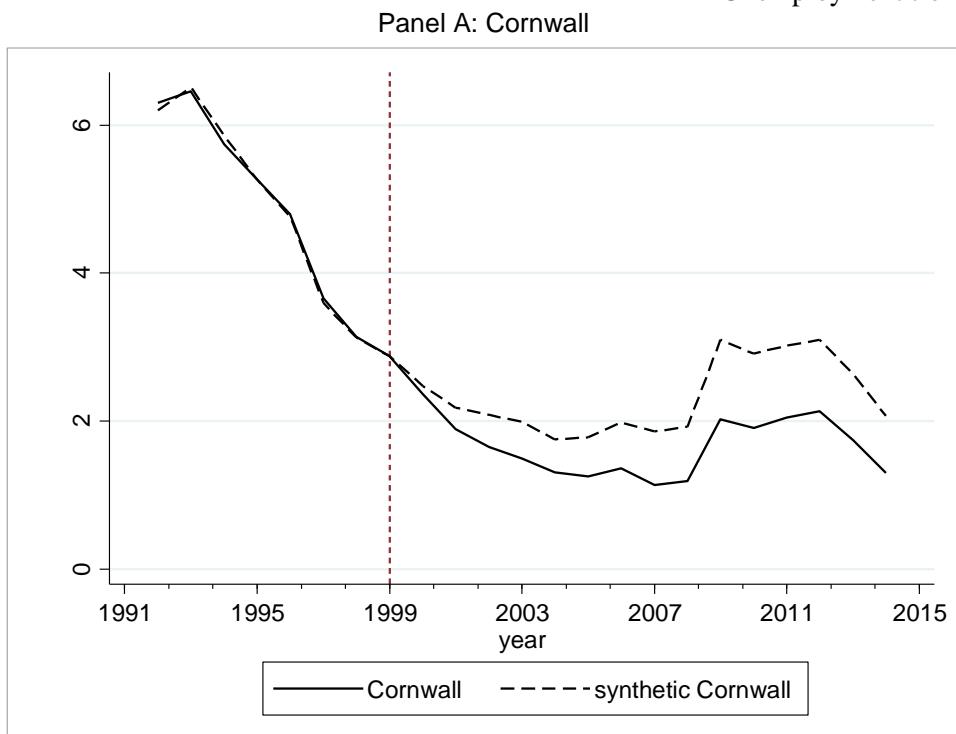
Table A6.1 in the Appendix summarises pre-treatment average values of all variables used to construct the synthetic regions, comparing them to the averages for Cornwall, South Yorkshire and England. Table A7.1 presents the list of weights on which the synthetic regions are created. In the case of Cornwall, Devon provides almost 60 percent of the weights, not surprisingly given the strong connection with the Cornish economy as discussed above. The remaining weights are from regions being among the highest recipients of Structural Funds during 1994-1999. In the case of South Yorkshire, the main weights come from Tees Valley and East Yorkshire, which were also obtaining high shares of EU funds before 2000²⁹. In both cases, the synthetic regions have an average value of per capita Structural Funds in the pre-treatment period that is above the English average and close to the figure of the two treated regions.

Figure 3 plots the unemployment trend for Cornwall and South Yorkshire with the estimated trend of the respective synthetic regions between 1992 and 2014. The pre-treatment indicators predict well the evolution of unemployment trajectories of the treated regions until 1999, suggesting that treatment and control regions are running in parallel before the start of the treatment.

²⁸ By construction, Cornwall and South Yorkshire are the regions with the lowest per capita GDP among all regions in the sample (Merseyside is excluded), making it impossible for the synthetic region to perfectly match the treated region on this characteristic. Nonetheless, including this control is important in order to minimise convergence effects not being determined by Structural Funds support.

²⁹ As discussed, South Yorkshire kept receiving a large amount of EU funds during the years in which it was classified as phasing-in. The synthetic control method constructs the counterfactual region for South Yorkshire mainly using Northumberland, Tees Valley and East Yorkshire, the 3 most funded regions after South Yorkshire (€39, €37 and €27 p/c respectively) during the 2007-2013 period. So the funding period post-Objective 1 in South Yorkshire is largely accounted for.

Figure 3
Unemployment trends, treated vs. synthetic regions



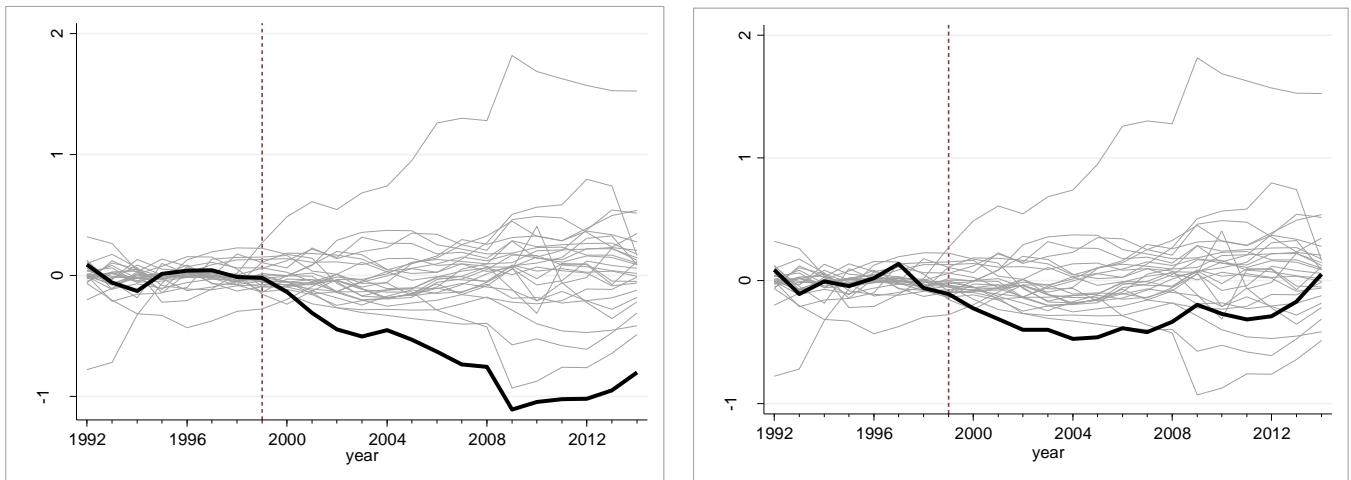
Panel A of Figure 3 reports the evolution of unemployment in Cornwall and its synthetic counterpart. From 2000 onwards a gap is clearly visible, indicating that Cornwall reduced its unemployment more than the synthetic control during the 2000-2006 and the 2007-2013 programming periods. South Yorkshire and synthetic control are displayed in panel B of Figure 3. In this case, the two unemployment trends diverge marginally in 1999. Nevertheless, the largest gap between the two lines is visible during the period in which South Yorkshire was entitled to receive Objective 1 funds, i.e. 2000-2006. South Yorkshire's lower line suggests that the region has reduced the proportion of unemployed people more than a region similar in all other relevant characteristics except for not having received Objective 1 aid. South Yorkshire's gap with the synthetic region tends to reduce over time. From the year 2008, treated and control regions report increasingly similar levels of unemployment, up to the point that the two lines overlap again in 2013-2014. This suggests that when South Yorkshire was classified as Phasing-in, unemployment has grown faster than in the synthetic region, completely offsetting all labour market improvements of the previous seven years.

In order to test for the significance of the estimated effects we follow Abadie et al. (2010) and run a series of placebo studies by iteratively applying the synthetic control method to every other untreated English region. Cornwall and South Yorkshire are shifted among the control units and the treatment is reassigned to each one of the regions in the sample. The computed gap between the two trends for all iterations is then compared to the one estimated for the two treatment regions. The results of the placebo test are displayed in Figure 4.

Panel A provides clear evidence of a significant effect for Cornwall. No other region in the sample has witnessed a reduction in unemployment as large as the one experienced by Cornwall. A difference in the gap between Cornwall and every other English region is visible from 2002 and increases over time, until it stabilises in 2009. This suggests that throughout the Objective 1 period Cornwall has reduced the proportion of unemployment benefit claimants more than regions not eligible for Objective 1 grants. The difference between Cornwall's and the synthetic region's unemployment changes is equal to 0.93 percentage points³⁰, corresponding to a percentage of unemployment benefit claimants approximately 30 percent lower than the control region.

³⁰ This has been calculated as: $(U_{\text{Cornwall 2013}} - U_{\text{Cornwall 1999}}) - (U_{\text{synthetic 2013}} - U_{\text{synthetic 1999}}) = (1.74 - 2.88) - (2.69 - 2.89) = -0.93$.

Figure 4
 Unemployment gap in treated regions and placebo gaps
Panel A: Cornwall **Panel B: South Yorkshire**



Note: the black bold line in Panel A represents the gap between Cornwall and the synthetic region; the black bold line in Panel B represents the gap between South Yorkshire and the synthetic region; grey lines are placebo gaps.

Panel B of Figure 4 tests the significance of the estimated gap for South Yorkshire. Between 2001 and 2005, South Yorkshire's proportion of unemployment benefit claimants was lower than any other English region not eligible for Objective 1 policies, indicating a statistically significant difference between treatment and control during the period. However, during the following years the gap becomes progressively closer to zero. This means that South Yorkshire was capable of reducing unemployment more than regions not in receipt of Objective 1 funds, but only temporarily. In the long-run, we do not find any significant effect on the unemployment trend of the region.

Synthetic control method – robustness tests

One concern with these estimates is the presence of externalities potentially confounding the selection of untreated areas. The regions neighbouring Cornwall and South Yorkshire might have benefitted from the improved economic and labour market conditions of Objective 1 regions, or they might have lost out key assets (in the form of human capital and firms) due to the attractiveness of EU projects. In an attempt to minimise spillover effects, the main estimations are replicated by excluding from the donor pool of the synthetic controls all regions which share a border with Cornwall or South Yorkshire.

In the case of Cornwall, the strong proximity between the Cornish and the Devon economy makes Devon the region most likely to be affected by treatment externalities. Similarly, all regions neighbouring South Yorkshire (North Yorkshire, East Yorkshire, West Yorkshire, Lincolnshire, Derbyshire and Nottinghamshire) may be conditioned by the fact that the region was awarded

Objective 1 funds. The results of the ‘leave-neighbours-out’ empirical exercise are reported in Table A8.1 alongside synthetic controls’ weights. Spillovers do not seem to be a major factor in this context as the results of these estimations are not significantly different from the ones presented in Figure 3³¹.

As a second test to assess the credibility of the main synthetic control estimates, we artificially anticipate the start of the Objective 1 period. If, as we argue, the reduction in unemployment is driven by EU funds, then by anticipating the treatment we should find no significant difference in unemployment before 2000.

This placebo study is performed by using 1992-1996 values of the control variables to construct the synthetic regions, and allow for treatment effects to materialise in 1997. The results of the test are displayed in Table A8.2. As shown in the two figures, there is no evidence of a significant divergence of unemployment trends between treated and synthetic regions before 2000. This is reassuring regarding the existence of any anticipation effect. The estimated effect during Objective 1 years seems to have little to do with labour market and economic changes occurring in expectation of future Objective 1 eligibility.

Ward-level analysis: difference-in-differences

As an additional robustness test of these results, we replicate the analysis using data at the level of wards and perform a difference-in-differences (DiD) estimation. By taking the 134 wards of Cornwall and the 94 wards of South Yorkshire as treatment units, we estimate their mean unemployment growth during periods of highest EU financial support.

For each of the two Objective 1 regions, the comparison groups are obtained from the 8,269 wards of all English regions not eligible for Objective 1 funds. Rather than comparing the 134 and 94 treated wards to all 8,269 wards from untreated regions, the analysis is limited to the wards in the control group which are most comparable in terms of their observable characteristics. In order to identify the control wards most similar to the treated wards, we resort to the propensity score matching (PSM) method. The *psmatch2* estimator (Leuven & Sianesi, 2003) is used to match wards from either Cornwall or South Yorkshire one-to-one without replacement with a set of untreated wards, using the nearest neighbour algorithm. The matching is based on a number of key socio-economic characteristics from the 1991 Census and on pre-treatment unemployment³².

³¹ This way of controlling for externalities is imperfect. However, in absence of data on migration and mobility of firms across regions, it is the possible best way to control for the relocation of economic activity towards the treated regions.

³² Given that almost all covariates are taken from the 1991 Census, they have no time variation. Therefore, the PSM has been performed with a collapsed (cross-section) dataset for the pre-treatment period. The selection of control groups has been done by matching one-to-one treatment wards with untreated wards on the basis of 1991 covariates and wards’

In such a way, we obtain a set of control wards whose *ex ante* probability of receiving treatment – as predicted by pre-treatment variables – is sufficiently similar to the one of treated units (Rosenbaum & Rubin, 1983).

Table A9.1 in the Appendix reports the covariates' balancing tests for wards of Cornwall and South Yorkshire. There is no statistical difference between treated and control wards for all observable socio-economic characteristics, suggesting that the PSM has produced suitable control groups.

The DiD analysis is performed with panel data from 1996 to 2014. We estimate different versions of the following model:

$$\text{Unemployment growth}_{i,t} = \alpha \text{Obj1 region}_i + \beta (\text{Obj1 region}_i \times \text{period}_t) + \tau_t + \varepsilon_{i,t},$$

Where:

$\text{Unemployment growth}_{i,t}$ is the annual growth rate of unemployment benefit claimants in ward i at year t ; Obj1 region_i is a dummy taking value one for wards belonging to treated regions (either Cornwall or South Yorkshire) and zero otherwise; period_t is a dummy referring to the post-2000 treatment period of reference (either the full period, 2000-2014, or one of the two sub-periods, 2000-2006 and 2007-2014); τ_t are a full set of year dummies; and $\varepsilon_{i,t}$ is an idiosyncratic error term. Given that eligibility for EU funds is assigned at the regional (NUTS2) level, standard errors are clustered at this level throughout the analysis. Our DiD specification, similar to Redding and Sturm (2008), allows for unobserved fixed effects in wards, which are differenced out as we compute unemployment growth rates. The coefficient of interest of the model, β , compares the unemployment growth of treated wards with the one of respective groups of untreated wards, selected through PSM.

The results of the DiD model are presented in Table 1.

We begin the discussion of the results with the estimates for Cornwall in columns (1) to (6). First, it can be seen that the dummy variable for Cornwall wards is insignificant in all different specifications, indicating no difference in unemployment growth between Cornwall and matched wards prior to 2000. Hence, the propensity score matching has produced comparable treatment and control groups on the basis of pre-treatment labour market conditions.

unemployment averaged between 1996 and 1999. For each treated ward, our matching algorithm finds a control unit with similar characteristics. The selection of wards as controls from the cross-section dataset has been used to compute DiD estimates. Hence, the sample of wards used for DiD estimates is made of treated wards (Cornwall or South Yorkshire) and matched wards.

The interaction term between Cornwall wards and the $period_t$ dummy refers to the difference in unemployment growth between treated and control wards during Objective 1 periods. According to our results, unemployment in Cornwall wards decreased 3.8 percentage points faster than in control wards. This is a larger difference with respect to the one obtained from synthetic control estimates. The estimated gap between Cornwall and the synthetic control region corresponds to an annual average difference in unemployment growth of 2.5 percentage points. The discrepancy between the two results is probably due to the fact that the pre-treatment matching in the ward-level analysis is performed on a lower number of covariates (for example, data on Structural Funds' shares are not available at the ward level) and on a shorter time-span. For these reasons, the regional-level point estimates are considered more reliable.

Column (3) shows that the difference in the rate of decrease of unemployment was higher during the first EU programming period, while in the second Objective 1 period it reduced in magnitude but remained marginally significant (column (5)). These trends are in line with the results of the synthetic control method, reporting a gap between treated and synthetic region developing mainly during the 2000-2006 period.

As discussed in section 3, other policy initiatives for the promotion of employment were implemented in Cornwall in coincidence with the Objective 1 programme. In particular, the main national policy aiming at the creation of new jobs was the Regional Selective Assistance (RSA). Before 2000, the large majority of Cornwall's territory was already considered eligible under RSA support schemes, but 48 wards of Cornwall became eligible to receive RSA transfers in 2000. Hence, one way to partially test whether RSA policies are confounding our estimates is to verify whether the results are sensitive to the exclusion of these wards. Columns (2), (4) and (6) of Table 1 report the estimate results of the model excluding the 48 wards eligible for RSA from 2000. As compared to full sample estimates, the coefficients are virtually unchanged. Therefore, it seems plausible to assume that Cornwall's change in unemployment can be ascribed to the success of employment-promoting programmes funded by Structural Funds rather than to RSA policies.

The results of the model for South Yorkshire are displayed in the three final columns of Table 1. In all specifications, the growth rate of unemployment of South Yorkshire wards is not significantly different from the one of control wards before 2000, again suggesting that the PSM based on pre-treatment covariates has allowed to create comparable treatment and control groups.

The coefficient of the interaction term between treated wards and treatment periods in column (7) reports the difference in unemployment growth between South Yorkshire and control wards. The unemployment growth rate of South Yorkshire is not statistically different from the one of comparable wards. This confirms the synthetic control results in that EU policies seem to have produced no effect in the region over the 2000-2014 period.

Table 1
Difference-in-differences estimates

Dependent variable: Unemployment growth	Treatment period:						(7)	(8)	(9)			
	2000-2014		2000-2006		2007-2014							
	(1)	(2)	(3)	(4)	(5)	(6)						
Cornwall wards	0.00575 (0.0092)	0.00891 (0.0092)	0.00574 (0.0092)	0.00892 (0.0092)	0.00575 (0.0092)	0.00892 (0.0092)						
(Cornwall wards) × (period)	-0.0381*** (0.0130)	-0.0439*** (0.0131)	-0.0494*** (0.0135)	-0.0561*** (0.0135)	-0.0282* (0.0151)	-0.0334** (0.0151)						
South Yorkshire wards							-0.00087 (0.0081)	-0.00087 (0.0081)	-0.00087 (0.0081)			
(South Yorkshire wards) × (period)							-0.0035 (0.0113)	-0.0258* (0.0134)	0.0160 (0.00974)			
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Observations	4,787	3,923	2,659	2,179	2,932	2,385	3,382	1,880	2,065			
R-squared	0.372	0.353	0.091	0.084	0.458	0.440	0.643	0.332	0.694			
Wards	268	220	268	220	268	220	188	188	188			

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Sample of treated and matched wards. Yearly data from 2007 to 2014 excluded from sample in columns (3), (4), (8); yearly data from 2000 to 2006 excluded from sample in columns (5), (6), (9). Cornwall's wards not eligible for RSA in 1993-1999 excluded from sample in specifications (2), (4), (6).

When the full period is sub-divided into two sub-periods, the results are again in line with those obtained with regional-level data. The negative and significant coefficient of the interaction term in column (8) shows that for 2000-2006 the unemployment reduction in South Yorkshire is significantly higher than in control wards. Conversely, for 2007-2014 the coefficient comparing the unemployment growth rate of South Yorkshire wards to untreated areas of England is positive (albeit insignificant), suggesting that unemployment has increased relative to control wards (column (9)).

Synthetic control method - effect on per capita GDP

The main intention of Cohesion Policy is to foster the economic development of European territories. The effectiveness of EU regional policies is generally evaluated by looking at the impact they produce on the economic growth rate of targeted regions. For this reason, in this section we perform a synthetic control analysis on the two case-studies by using per capita GDP as the outcome variable.

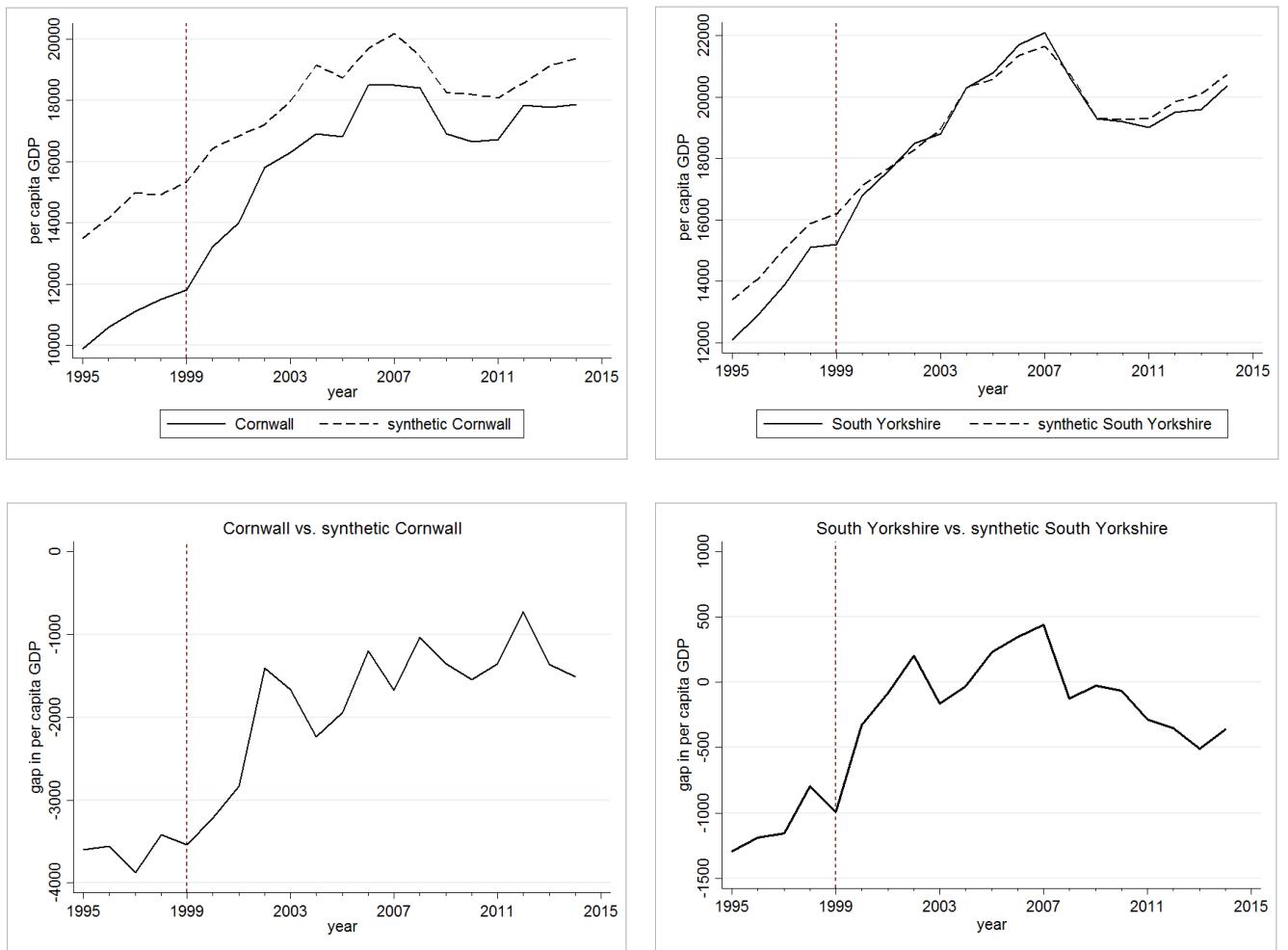
In order to create comparable counterfactuals, we adopt a number of variables referring to key factors generally identified as growth determinants in the literature. The level of private capital investment, the stock of infrastructure, and the degree of technological development and innovation – regarded as key drivers of long-run regional economic growth (e.g. Sala-i-Martin, 1996; OECD, 2009) – are proxied by: the percentage of gross fixed capital formation, the number of kilometres of roads per regional area, the share of human resources in science and technology and the number of patent applications per thousand inhabitants, respectively. These variables are used to predict the synthetic control regions' pre-treatment trends of GDP per capita (pre-treatment averages in Table A6.2 in the Appendix).

Given that Cornwall and South Yorkshire are the regions in the sample with the lowest income per inhabitant, by definition the pre-treatment GDP per capita levels of treated units cannot be replicated by the synthetic controls. This implies that the lines of treated and counterfactual regions are not overlapping in the pre-treatment's synthetic control estimates. However, as shown in Figure 5, both Cornwall and South Yorkshire's trajectories run in parallel with the ones of their relative synthetic counterparts before 2000, indicating that the growth rates of treatment and relative synthetic units are similar prior to the beginning of the Objective 1 period.

The results of the empirical test indicate that Cornwall has partially closed the income gap with the synthetic control region. The bottom-left quadrant of Figure 5 illustrates that the distance between Cornwall and the control region is progressively reducing over time. The fastest catch-

up of Cornwall is visible during the first treatment years. Hence, we can infer that Objective 1 funds have had a positive impact on the economic growth rate of the region.

South Yorkshire has grown faster than its synthetic region over the analysed period. The top-right quadrant of Figure 5 indicates that the treated region has experienced high growth rates while receiving Objective 1 funds, overcoming the control region in terms of GDP per capita in 2005. This tendency is interrupted and reverted from 2008, when South Yorkshire's worse growth performance widens the income gap between treatment and control region (bottom-right quadrant, Figure 5).



These results should be taken with caution, due to the imperfect method of calculating the synthetic controls, and to the relatively short number of pre-treatment years. Having taken these caveats into consideration, the findings are generally in line with the ones obtained using unemployment as outcome variable. Objective 1 funds seem to be effective in both regions, but

South Yorkshire's conditions deteriorate – relative to a similar untreated region – when the region loses the Objective 1 status.

Unemployment and economic growth in all UK regions

The above results show how Objective 1 eligibility has had strong, positive, and causal effects on the labour market and economic performance of the two selected UK regions, and warn over the possible negative consequences of losing Objective 1 funds. However, they do not reveal what has been the effect of EU funding in the rest of the country. In this section, we complement the previous evidence by testing for a relationship between EU funds and the two outcome variables of interest – unemployment and GDP per capita – in all British regions. We estimate a fixed effects model using yearly data from 1994 to 2013 and NUTS2 UK regions as sample. The model is as follows:

$$\Delta y_{i,t} = \alpha y_{i,t-1} + \beta \text{EU}_{i,t} + \vartheta X_{i,t} + \varphi_i + \tau_t + \varepsilon_{i,t}$$

Where:

Δ is the first-differencing operator, i and t index regions and year, respectively; $y_{i,t}$ is either the percentage of unemployment benefit claimants, or the natural log of GDP per capita; $\text{EU}_{i,t}$ is the measure relating to EU funds, which can either be a continuous variable reflecting the proportion of EU funds paid to UK regions per inhabitant, or a dummy variable taking value 1 for each region with Objective 1 status in any particular year; $X_{i,t}$ is a set of regional control variables including key determinants of labour market and economic conditions: the share of tertiary education degree holders in the regional workforce, the share of agricultural employment, the share of employed people in manufacturing, the stock of total motor-roads per inhabitant, and a measure of innovation capacity (patent applications per 10000 inhabitants); φ_i and τ_t are vectors of region-specific and time dummies capturing permanent differences in growth rates across regions and national business-cycle effects, respectively; and $\varepsilon_{i,t}$ are residuals. Standard errors are clustered at the NUTS2 level.

The model is estimated for all 37 UK regions and for a restricted sample made of the 30 English regions. The results for all UK regions are presented in Table 2, while the results for the restricted sample are in Table A10.1 in the Appendix.

The first three columns of the two Tables report results with the annual change in the percentage of unemployment benefit claimants as dependent variable. The coefficient of EU funds per capita is negative but insignificant in columns (1), while the Objective 1 dummy in columns (2) returns a strongly significant and negative coefficient in both Tables. This

suggests that, *ceteris paribus*, unemployment has decreased faster in UK (and English) regions receiving Objective 1 funds during the analysed period. In column (3), we remove Cornwall and South Yorkshire from the sample, to test if the significant unemployment reduction is driven by the two case-studies or it is generalisable to the whole of the UK. The coefficient remains significant, indicating that the beneficial treatment effects of Objective 1 policies on unemployment apply to the UK at large.

Turning to the economic growth effects of EU funds (columns (4)-(7) of Tables 2 and A10.1), we find clear evidence of a positive relationship between EU grants and regional growth. The estimated coefficient of EU funds per capita shows a rather sizeable effect. A similarly large, positive and statistically significant effect is obtained also in columns (5), where we examine the growth effect of assignment into Objective 1 status. Our results show that UK regions obtaining Objective 1 funds grew on average by 0.8 percentage points faster than other regions, annually, during the 1994-2013 period. The coefficient reduces marginally in magnitude to 0.5 when the sample is restricted to English regions³³, and in both cases it remains significant when Cornwall and South Yorkshire are excluded from samples (columns (6)).

The interesting result of a positive significant growth effect of EU funds in UK/English regions brings us to perform one additional test and verify which type of regions (Objective 1 or non-Objective 1) have displayed the fastest growth rates. In columns (7), the EU funds variable is interacted with the Objective 1 dummy. The positive and significant coefficient of the interaction term shows that, even among the highly-funded Objective 1 regions, those receiving more funds have grown faster. This suggests that Structural Funds have non-exhaustive effects on growth in UK regions, that is, a higher share of EU transfers keeps improving economic performance³⁴.

All in all, these findings provide evidence that the effectiveness of Objective 1 policies has not been limited to Cornwall and South Yorkshire. Although the interpretation of estimated relationships requires some caution, due to potential issues of endogeneity, the analysis indicates that the highest form of EU funding has been successful in stimulating the economic performance and improving the labour market conditions across the whole UK territory.

³³ Note that, in both Tables, the inclusion of the Objective 1 dummy changes little the obtained beta-convergence coefficient of lagged GDP per capita in columns (3). Therefore, the estimated effect of Objective 1 status cannot be seen as capturing an inverse income-selection effect, i.e., that poorer regions become assigned to Objective 1 status and at the same time grow faster due to neoclassical convergence.

³⁴ Consistent with that, when testing for a non-linear effect of EU funding by including the quadratic term of EU funds per capita in the model, the squared term returns an insignificant coefficient while the linear term remains statistically significant (regression results available upon request). This finding contrasts with empirical studies claiming that Cohesion expenditures display decreasing returns in EU regions (Becker et al., 2012; Pellegrini & Cerqua, 2017). However, Pellegrini & Cerqua's (2017) estimates show that only an intensity of EU transfers above €340 per capita diminishes the returns of EU funding, a threshold which is not overcome by any of the regions in our sample.

Table 2
EU funds, unemployment, and economic growth in UK regions

Dep. Variable:	Δ Unemployment bc			Δ In GDP per capita			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lagged unemployment	-0.144*** (0.0170)	-0.145*** (0.0151)	-0.149*** (0.0146)				
Lagged In GDP per capita				-0.307*** (0.0350)	-0.297*** (0.0340)	-0.240*** (0.0413)	-0.303*** (0.0364)
EU funds per capita		-0.000188 (0.000359)		0.000114** (4.49e-05)			0.000132* (6.96e-05)
Objective 1 regions			-0.100*** (0.0348)	-0.0533* (0.0339)		0.00857* (0.00437)	0.00683* (0.00387)
(Obj1 regions) x (EU funds per capita)							0.000082** (3.27e-05)
Controls	✓	✓	✓	✓	✓	✓	✓
Region dummies	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓
Observations	646	646	610	613	613	579	613
R-squared	0.914	0.915	0.913	0.778	0.776	0.759	0.778
NUTS2 regions	37	37	35	37	37	35	37

Note: Clustered standard errors at NUTS2 level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Controls are: the share of tertiary education degree holders in the regional workforce, the share of agricultural employment, the share of employed people in manufacturing, the stock of total motor-roads per inhabitant, and a measure of innovation capacity (patent applications per 1000 inhabitants). Cornwall and South Yorkshire excluded from sample in specifications (3) and (6).

6. Conclusions

The exit of the United Kingdom from the European Union will leave poorer UK regions without access to EU Structural Funds. This paper has tested whether EU financial support has been successful in Britain, and the extent to which a reduction of EU subsidies may affect the development trajectories of UK regions.

A counterfactual analysis has been performed on two regions, Cornwall and South Yorkshire, which have been compared to synthetic control regions similar to them but not eligible for Objective 1 policies. The results indicate that EU development policies in Cornwall have helped to lower the proportion of people claiming unemployment benefits and reduce the income gap with richer regions. South Yorkshire received Objective 1 funds for one single programming period, during which significant improvements were visible. As compared to regions not eligible for Objective 1 support, South Yorkshire has grown faster and has seen unemployment diminish. Additional regression results confirm that Objective 1 policies have had positive effects all across the UK, not just in Cornwall and South Yorkshire. Hence, the EU programme dedicated to poorer regions seems to have accomplished substantial results in the UK context.

However, the case of South Yorkshire also demonstrates that the gains obtained during the period of highest funding (Objective 1) may not lead to a self-sustainable development path. When

Objective 1 funding was lost, South Yorkshire displayed one of the worst performances among English regions, despite still being subsidised by the EU as part of the phasing-in programme.

These findings should foster a careful reflection over the future of poorer UK regions in the event of an imminent exit of the country from the EU. The loss of eligibility for Cohesion Policy funding will deprive the UK's regional economies from a key source of investment funds. Given the success of Objective 1 policies in the country, the prospective withdrawal from the EU may leave the UK without a mechanism through which economic disparities in the country have been reduced. In addition, losing the possibility to access EU Structural Funds is likely to expose the economy of less developed UK regions to potential adverse effects.

A region like Cornwall, which has benefitted from Objective 1 policies for a long period of time, faces the highest risks. In this sense, the experience of South Yorkshire may represent a valuable lesson; losing Objective 1 funds can produce a short-term shock, and the labour market and economy can continue to struggle in the medium-term. Cornwall is not necessarily bound to follow the same destiny of South Yorkshire as the two regions differ in many respects, including the investment strategies adopted during Objective 1 periods. These differences, however, may not be sufficient for Cornwall to take a different post-policy development path. Unlike EU regions shifting from a status of 'Objective 1' to 'Phasing-out' or 'Phasing-in', Cornwall will not have the possibility to obtain EU transitional funding. Hence, the loss of EU subsidies may be more likely to produce negative consequences on its economy if the UK national Government does not put in place any compensatory policy supporting its transition in funding environment. If new regional policies are to be devised in the UK, much attention should be paid to make sure that such policy initiatives produce structural (i.e. permanent), not temporary, improvements in the local socio-economic conditions.

Even if substitute regional policies were to be introduced, agreeing their contours would be far from simple and regions currently most funded might temporarily be left without external support should the negotiations last too long (Bachtler & Begg, 2017). These potential negative repercussions apply in particular to UK economically disadvantaged regions dependent on EU aid, such as Cornwall and West Wales and The Valleys, the two Objective 1 regions at the time of the Brexit vote.

More generally, the results of the analysis contribute to the current debate on the effectiveness of EU Cohesion Policy. The analysis on Cornwall has shown that Objective 1 funding may be successful, even in a causal sense. However, the effects produced by these policies may not be long-lasting, rather they may disappear when the funding period has ended. Hence, when designing and implementing development projects, EU Objective 1 regions should think carefully about what the legacy of the interventions will be. EU funds should be used to prepare the less advantaged territories for the moment when, inevitably, the resources will be cut down. Not doing

so may imply that any improvement obtained during the Objective 1 period will vanish in the long term.

The present work is the first in the literature to empirically study the impact of a sudden increase and decrease in the availability of Structural Funds on the performance of less developed regions. The results of the analysis can be extended and improved in several ways. An important task for future contributions is to test the validity of our findings in other contexts, assessing whether regions evolve similarly to the two case-studies analysed in this paper. In addition, the data at our disposal do not allow us to provide clear answers regarding the key mechanisms producing the observed effects. Future research may attempt to identify the factors conditioning the long-term impacts of EU policies using different identification strategies.

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Annex

Synthetic control method

The synthetic control method for comparative case studies (Abadie & Gardeazabal, 2003; Abadie et al., 2010; 2015) allows to assess the effect of policy interventions taking place at an aggregate level, using data for geographical units not exposed to the treatment but comparable to the treated region. The sample is made of $J + 1$ units (NUTS2 regions), with $j = 1$ being the case of interest and $j = 2$ to $j = J + 1$ being potential comparisons. To construct the synthetic control we consider all English NUTS2 regions not receiving Objective 1 funds during 2000-2013, using data from pre-intervention years. The control unit is obtained from a $(J \times 1)$ vector $\mathbf{W} = (w_2, \dots, w_{J+1})'$ made of nonnegative weights all summing up to one. Each value of \mathbf{W} represents a weighted average of values obtained from control regions, that is, a potential synthetic control. Let \mathbf{X}_1 be a $(k \times 1)$ vector of pre-treatment characteristics that can be used as predictors of labour market outcomes, and \mathbf{V} a $(k \times k)$ diagonal matrix whose values indicate the relative importance of each predictor. We look for a vector \mathbf{W}^* that minimises $(\mathbf{X}_1 - \mathbf{X}_0 \mathbf{W})' \mathbf{V} (\mathbf{X}_1 - \mathbf{X}_0 \mathbf{W})$, subject to $w_j \geq 0$ ($j = 2, \dots, J$) and $w_2 + \dots + w_{J+1} = 1$. \mathbf{V} is chosen such that the treated regions' trajectory in the pre-treatment period is best reproduced by the synthetic region.

Let Y_{jt} be the outcome of region j at time t , \mathbf{Y}_1 a $(T_1 \times 1)$ vector collecting post-intervention values of the outcome variable and \mathbf{Y}_0 a $(T_1 \times J)$ matrix containing post-intervention values of the outcome for the control region. The synthetic control estimator of the treatment effect on the treated region is given by the comparison of the different outcomes of the two regions from the beginning of the Objective 1 programme until the end of the period. The synthetic control estimator is obtained as: $\mathbf{Y}_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}$.

Appendix

A1 Structural Funds per inhabitant in UK regions by EU programming period

Table A1.1

Annual euros of Structural Funds per capita in UK regions, 1994-1999, 2000-2006, 2007-2013

Region	1994-1999	Region	2000-2006	Region	2007-2013
Northern Ireland*	110.5	Cornwall & Isles of Scilly*	138.0	Cornwall & Isles of Scilly*	162.7
Highlands & The Islands*	91.1	Merseyside*	137.3	West Wales & The Valley*	159.5
Merseyside*	61.9	South Yorkshire*	126.8	Merseyside	73.4
Tees Valley & Durham	32.1	West Wales & The Valley*	97.3	Northern Ireland	68.3
Greater Manchester	28.7	Northern Ireland	94.2	Highlands & The Islands	60.8
West Wales & The Valley	28.6	Highlands & The Islands	81.9	South Yorkshire	54.3
South Yorkshire	27.5	Tees Valley & Durham	54.2	Tees Valley & Durham	39.3
Northumberland & Tyne & Wear	27.0	Northumberland & Tyne & Wear	52.3	Northumberland & Tyne & Wear	37.3
Cornwall & Isles of Scilly	26.8	West Midlands	45.4	East Yorkshire & Northern Lincolnshire	27.6
West Midlands	26.5	Greater Manchester	44.0	South Western Scotland	26.3
Cumbria	24.3	East Yorkshire & Northern Lincolnshire	40.5	East Wales	24.2
East Yorkshire & Northern Lincolnshire	23.5	Cumbria	36.3	Greater Manchester	23.9
South Western Scotland	22.5	Devon	36.3	Cumbria	23.2
Eastern Scotland	20.3	Lincolnshire	35.5	West Yorkshire	23.1
East Wales	18.6	Shropshire & Staffordshire	32.3	Lincolnshire	22.4
Derbyshire & Nottinghamshire	17.1	Lancashire	31.0	Eastern Scotland	21.7
Devon	16.1	West Yorkshire	30.9	North Yorkshire	21.5
Shropshire & Staffordshire	14.5	Derbyshire & Nottinghamshire	30.0	Derbyshire & Nottinghamshire	21.3
West Yorkshire	10.1	South Western Scotland	27.3	West Midlands	21.2
Lancashire	9.1	North Yorkshire	26.4	Devon	20.8
North Yorkshire	8.6	Est Wales	25.1	Lancashire	20.3
Lincolnshire	7.7	Inner London	22.2	North Eastern Scotland	20.2
Herefordshire, Worcestershire & Warwickshire	7.1	East Anglia	21.1	Cheshire	17.6
Inner London	5.3	Eastern Scotland	21.0	Leicestershire, Rutland & Northamptonshire	15.6
North Eastern Scotland	4.1	North Eastern Scotland	20.6	East Anglia	14.6
Kent	3.8	Herefordshire, Worcestershire & Warwickshire	20.5	Essex	13.7
East Anglia	3.5	Cheshire	18.3	Dorset & Somerset	13.4
Cheshire	3.3	Kent	17.6	Inner London	13.2
Outer London	1.9	Outer London	16.6	Kent	12.7
Essex	1.5	Bedfordshire & Hertfordshire	16.4	Outer London	12.4
Gloucestershire, Wiltshire & Bristol/Bath area	1.4	Leicestershire, Rutland & Northamptonshire	16.0	Gloucestershire, Wiltshire & Bristol/Bath area	12.2
Dorset & Somerset	1.4	Gloucestershire, Wiltshire & Bristol/Bath area	15.5	Bedfordshire & Hertfordshire	11.7
Hampshire & Isle of Wight	1.3	Essex	15.3	Shropshire & Staffordshire	11.4
Leicestershire, Rutland & Northamptonshire	1.2	Dorset & Somerset	15.0	Herefordshire, Worcestershire & Warwickshire	11.3
Bedfordshire & Hertfordshire	1.1	Surrey, East & West Sussex	14.4	Hampshire & Isle of Wight	11.3
Surrey, East & West Sussex	0.9	Hampshire & Isle of Wight	13.9	Surrey, East & West Sussex	10.7
Berkshire, Buckinghamshire & Oxfordshire	0.8	Berkshire, Buckinghamshire & Oxfordshire	13.6	Berkshire, Buckinghamshire & Oxfordshire	9.3

Note: values are calculated as Structural Funds' payments from the European Commission divided by regional population. * **Objective 1 regions**. Source: DG Regional Policy.

A2 EU investment strategies in Cornwall and South Yorkshire

Data from the European Commission allow to reconstruct the development strategies of Cornwall and South Yorkshire and the proportion of allocated funds during 2000-2006 and 2007-2013. In such a way, it is possible to observe how Objective 1 and Phasing-in programmes have been designed prior to their implementation.

The statistics on committed EU funds by the European Commission are displayed in Table A2.1. The total amounts of funds per capita are sub-divided by different fields of intervention. It can be noted that both Cornwall and South Yorkshire's 2000-2006 Objective 1 programmes have allocated a great deal of resources to direct measures for employment promotion and training – mainly through the European Social Fund (ESF). These initiatives were included within the strategic goal 'Developing people' of the Single Programming Document (SPD) for Cornwall (South West Observatory Skills and Learning, 2008), and the priority theme 'Building a learning region which promotes equity, employment and social inclusion' of the SPD for South Yorkshire (Government Office for Yorkshire and The Humber, 2008). Cornwall had planned to spend up to €28.7 per person every year during 2000-2006 in these themes, while South Yorkshire had earmarked up to €37.7 per inhabitant. The total ESF allocations for 2000-2006 were €101m for Cornwall (total EU funds in the region: €520m), and €365m for South Yorkshire (total EU funds in the region: €1,212m).

ESF-financed policies were not the only measures potentially contributing to reduce the number of people claiming unemployment benefits in the two regions. Projects focusing on development goals related to infrastructure, R&D and innovation, human capital, business development, and other investment areas, may have also produced significant employment boosts. Most interventions in these fields were mainly intended to promote economic growth.

In the 2007-2013 programming period, the total funds to South Yorkshire's operational programme decreased by almost 70 percent. This reduction involved all investment pillars, including the proportion of resources directly promoting employment – calculated as the sum of 'lifelong learning, training, entrepreneurship', 'services for employment and training', 'social inclusion', and 'access to employment and sustainability' – which went down to €20.2 per person, i.e. almost halved with respect to the previous period. In contrast, Cornwall's effort to create new jobs and reduce labour market exclusion increased to €55 per person annually.

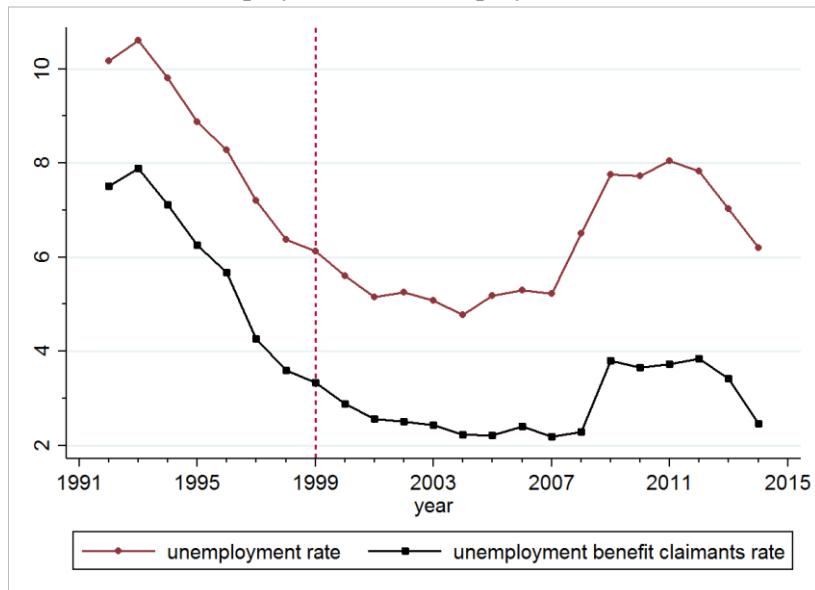
Table A2.1
Committed EU funds by field of intervention in Cornwall and South Yorkshire, 2000-2006 & 2007-2013

Field of Intervention	Annual euros per capita		Field of Intervention	Annual euros per capita	
	Cornwall	South Yorkshire		Cornwall	South Yorkshire
2000-2006			2007-2013		
1. Transport Infrastructure	7.2	9.6	1. Transport infrastructure	8.7	2.1
2. Telecommunication, energy & environment infrastructure	21.5	8.8	2. Telecommunication, energy & environment infrastructure	34.6	7.2
3. Social Infrastructure	1.1	2.1	3. Social infrastructure	0.1	-
4. Research, technological development & innovation	10.0	5.6	4. Research, technological development & innovation	37.8	11.4
5. Tourism & culture	6.3	-	5. Tourism & culture	2.0	0.1
6. Planning & rehabilitation	6.4	34.5	6. Urban & rural regeneration	3.8	5.4
7. Large business organisations	19.3	3.4	7. Investment in firms	15.1	6.5
8. SMEs & the craft sector	13.8	25.4	8. Lifelong learning, training & entrepreneurship	18.7	7.7
9. Workforce flexibility & entrepreneurial activity	13.8	10.3	9. Services for employment & training	2.3	0.4
10. Social inclusion	4.9	5.1	10. Social inclusion	14.9	4.5
11. Labour market policy & labour market actions for women	5.9	10.9	11. Access to employment & sustainability	20.8	6.7
12. Educational & vocational training	4.2	11.3	12. Human capital	1.7	0.6
13. Agriculture, forestry, fisheries, development of rural areas	24.0	-	13. Institutional capacity	0.1	0.1
Total	138.3	127.0	Total	160.4	52.5

Note: values are calculated from European Commission's committed allocations of EU funds by axis, divided by regional population. Source: DG Regional Policy.

A3 UK rates of unemployment and unemployment benefit claimants

Figure A3.1
UK rates of unemployment and unemployment benefit claimants



Source: Nomis.

A4 Unemployment and GDP per capita in English regions

Figures A4.1 and A4.2 describe the level and growth of unemployment and per capita GDP of English NUTS2 regions during the period considered in the empirical analysis. Figure A4.1 illustrates the percentage of unemployment benefit claimants and the level of income before 2000. The two case-studies for the counterfactual analysis, Cornwall and South Yorkshire, were among the regions with the highest percentage of unemployed people, and among the poorest regions in the country. Figure A4.2 suggests that during the 2000-2013 period Cornwall has been one of the top performing regions in England both in terms of unemployment reduction – a decrease by over 3 percent – and in terms of economic growth – an increase by over 2.8 percent. Conversely, South Yorkshire's variation of unemployment and per capita GDP during the same period has been similar to that of most English regions. South Yorkshire experienced one of the largest unemployment reductions and fastest GDP pc growth during the 2000-2006 period; however, the following years have been characterised by growing unemployment – over 9 percent increase – and an economic recession – over 1.2 percent reduction in GDP per capita.

Figure A4.1
Unemployment and GDP per capita levels, English regions

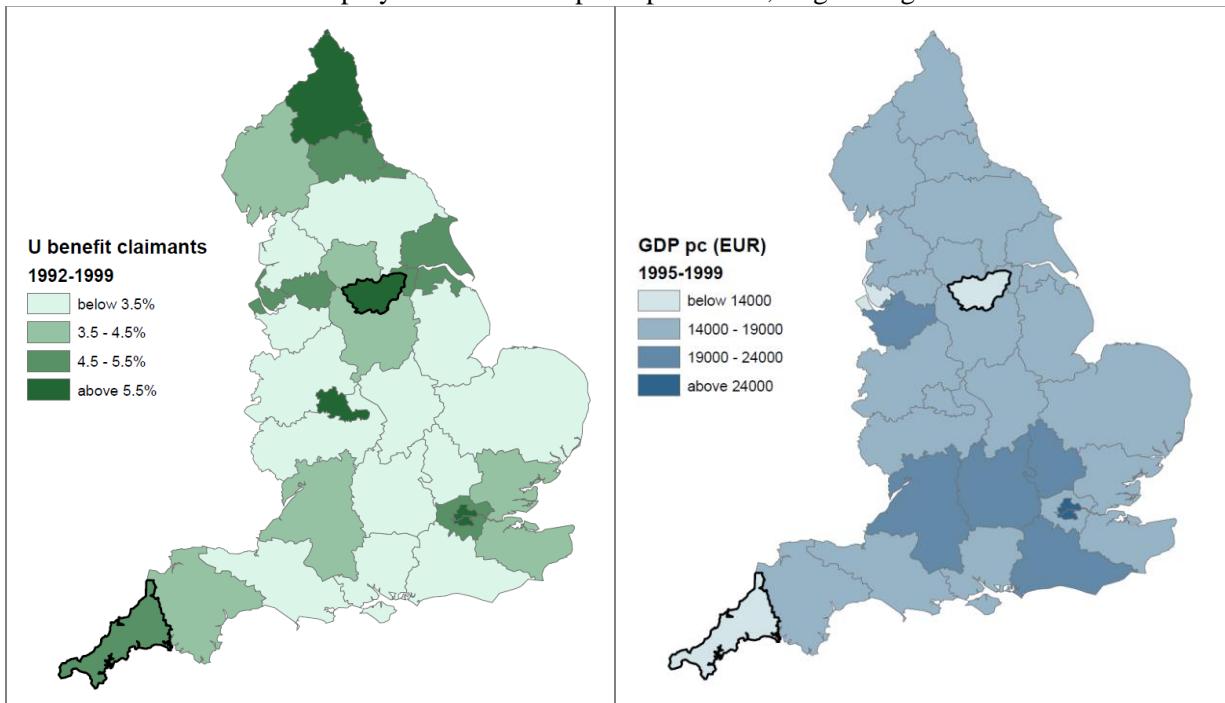
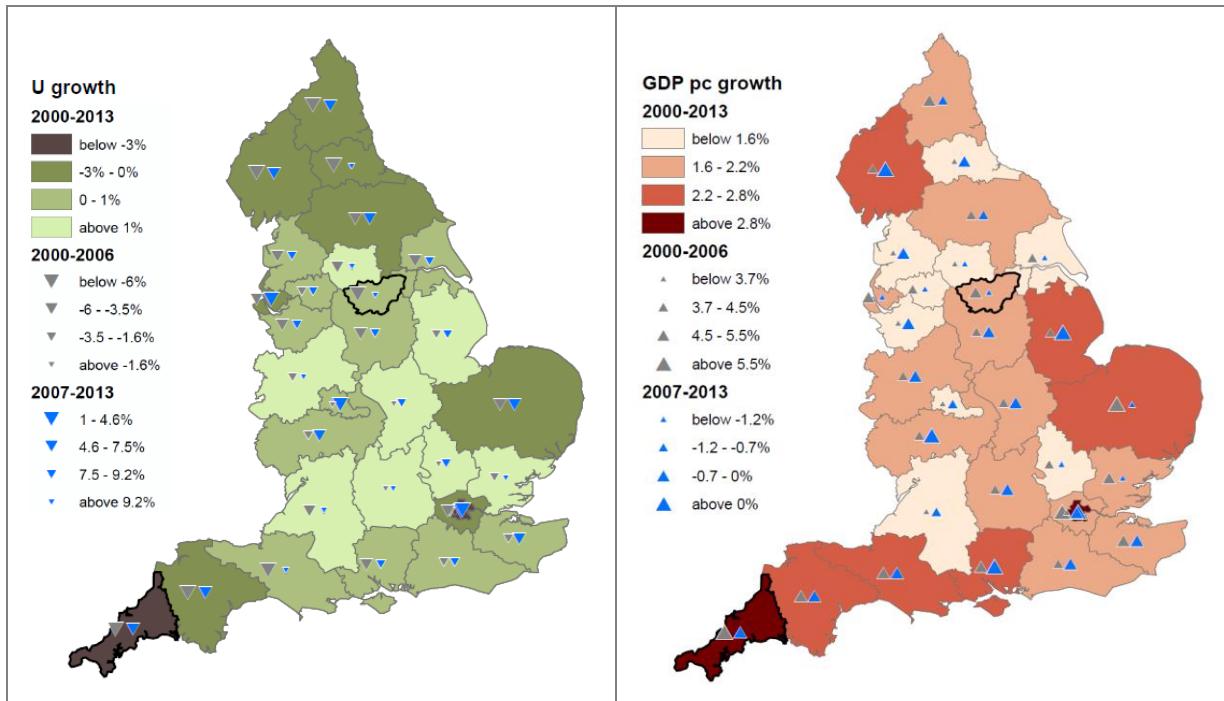


Figure A4.2
Unemployment and GDP per capita growth, English regions



Source: own elaboration with Nomis and OECD data.

A5 Descriptive statistics – wards

Table A5.1
Descriptive statistics, ward variables

Variable	Obs	Mean	Std. Dev.
Ward residents in 1991	8519	5267	3779
Unemployment (1996-2014)	161,240	1.871	1.555
Unemployment growth (1996-2014)	152,260	0.0056	0.401
Unemployment growth (1996-1999)	25,537	-0.177	0.204
Unemployment growth (2000-2014)	126,723	0.0424	0.420
Unemployment growth (2000-2006)	59,095	-0.0181	0.329
Unemployment growth (2007-2014)	67,628	0.0954	0.480
<i>Variables used for PSM:</i>			
Unemployment (1996-1999 average) ^a	8518	2.689	1.857
<i>1991 Census:</i>			
Employed people in agriculture, forestry and fishing ^a	8519	3.357	2.822
Employed people in mining ^a	8519	2.478	1.422
Employed people in manufacturing ^a	8519	15.50	3.663
Employed people in construction ^a	8519	6.817	1.455
Employed people in distribution and catering ^a	8519	18.71	2.609
Employed people in transportation ^a	8519	5.436	1.630
Employed people in banking and finance ^a	8519	10.78	3.336
Employed people in other services ^a	8519	25.11	4.402
Full-time workers ^a	8519	72.81	10.09
Female employment ^a	8519	10.24	1.469
Inactive population ^b	8519	32.80	5.996
People whose ethnic group is white ^b	8519	96.15	8.473
Migrants (within/between wards or from outside UK) ^b	8519	10.19	4.022
Students ^b	8519	3.102	1.417

Note: a / percentage of economically active population; b / percentage of residents.

A6 Pre-treatment characteristics

Table A6.1
Pre-treatment characteristics (1992-1999),
unemployment benefit claimants as dependent variable

Variable	Source	Pre-treatment averages					
		Cornwall	Synthetic Cornwall	England ^e	South Yorkshire	Synthetic South Yorkshire	England ^f
Euros of Structural Funds per capita ^a	DG Regio	26.74	20.62	11.08	28.69	25.92	11.08
Per capita GDP ^a	OECD	10,980	15,665	18,054	13,840	19,640	18,155
Population in employment ^b	LFS LAD	53.23	53.77	58.57	52.20	53.69	58.51
Economically inactive population ^c	LFS LAD	41.14	40.32	36.51	41.04	39.73	36.53
Female employment ^b	LFS LAD	21.33	22.75	23.73	22.24	22.61	23.77
Full-time workers ^c	LFS LAD	52.35	52.92	56.72	49.47	51.58	56.61
Self-employed workers ^b	LFS LAD	11.64	7.54	7.64	5.17	5.41	7.42
Long-term unemployment as % of unemployment ^a	Eurostat	26.18	27.07	25.13	29.98	35.41	25.27
Sectorial shares (percentage)							
Agriculture & Mining ^a	Eurostat	6.28	3.07	2.39	0.6	0.88	2.19
Manufacturing ^a	Eurostat	11.63	16.48	16.59	18.95	18.48	16.85
Construction ^a	Eurostat	5.41	4.87	4.64	5.61	4.83	4.64
Wholesale & retail trade ^a	Eurostat	25.80	25.34	25.90	27.33	25.66	25.95
Financial & insurance activities ^a	Eurostat	9.68	11.97	14.25	11.78	12.50	14.33
Real Estate; scientific activities; public administration and defense; education ^a	Eurostat	31.37	33.62	30.11	30.68	31.06	30.08
Education and training							
16-19 year old in full-time education ^b	LFS LAD	3.37	3.16	3.33	2.73	2.92	3.31
Working age population with NVQ 3 or above ^d	LFS LAD	33.88	33.97	36.37	31.45	33.42	36.35
Working age population receiving job related training ^b	LFS LAD	10.64	11.79	12.14	12.62	12.36	12.20
Regional Quality of Government (QoG) ^a	QoG Institute	1.15	1.04	0.92	0.69	0.82	0.90

Note: Sectorial shares and LSF LAD variables are calculated as percentage of working age population. a / average for 1995-1999; b / average for 1992-1999; c / average for 1993-1999; d / average for 1994-1999; e / average for all English regions excluding Merseyside and South Yorkshire; f / average for all English regions excluding Merseyside and Cornwall.

Table A6.2
 Pre-treatment characteristics (1995-1999),
 GDP pc as dependent variable

Variable	Source	Pre-treatment averages					
		Cornwall	Synthetic Cornwall	England ^a	South Yorkshire	Synthetic South Yorkshire	England ^b
Euros of Structural Funds per capita	DG Regio	26.74	27.32	11.08	28.69	28.63	11.08
Gross fixed capital formation as % of GDP	Eurostat	10.83	10.99	11.6	8.14	10.8	11.5
Patent applications per 10000 inhabitants	Eurostat	0.40	0.44	0.90	0.29	0.34	0.89
Human resources in science and technology	Eurostat	26.16	25.74	33.90	25.09	26.32	33.86
Km of roads per squared km of land	Eurostat	2.13	2.07	3.25	3.80	2.77	3.31
Population in employment	LFS LAD	53.23	53.68	58.57	52.20	52.21	58.51
Economically inactive population	LFS LAD	41.14	39.75	36.51	41.04	41.13	36.53
Long-term unemployment as % of unemployment	Eurostat	26.18	30.96	25.13	29.98	35.96	25.27
Sectorial shares (percentage)							
Agriculture & Mining	Eurostat	6.28	2.16	2.39	0.6	0.71	2.19
Manufacturing	Eurostat	11.63	19.73	16.59	18.95	19.03	16.85
Construction	Eurostat	5.41	5.37	4.64	5.61	5.41	4.64
Wholesale & retail trade	Eurostat	25.80	24.51	25.90	27.33	24.65	25.95
Financial & insurance activities	Eurostat	9.68	8.74	14.25	11.78	10.51	14.33
Real Estate; scientific activities; public administration and defense; education	Eurostat	31.37	31.76	30.11	36.68	33.21	30.08
Education and training							
16-19 year old in full-time education	LFS LAD	3.37	3.17	3.33	2.95	3.21	3.31
Working age population with NVQ 3 or above	LFS LAD	33.88	31.34	36.37	31.45	32.28	36.35
Working age population receiving job related training	LFS LAD	10.64	11.99	12.14	12.62	11.78	12.20
Regional Quality of Government (QoG)	QoG Institute	1.14	0.97	0.92	0.65	0.85	0.90

Note: Sectorial shares and LSF LAD variables are calculated as percentage of working age population. a / average for all English regions excluding Merseyside and South Yorkshire; b / average for all English regions excluding Merseyside and Cornwall.

A7 Synthetic control method, regional weights

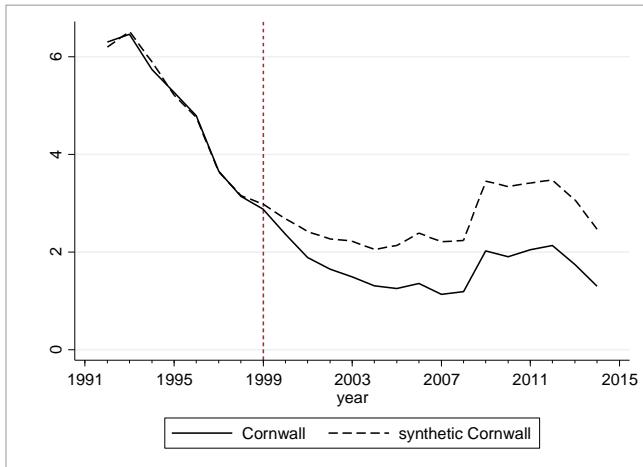
Table A7.1
Regional weights in the synthetic Cornwall and South Yorkshire

Region	Dependent variable:			
	Unemployment		GDP per capita	
	Synthetic Cornwall Weight	Synthetic South Yorkshire Weight	Synthetic Cornwall Weight	Synthetic South Yorkshire Weight
Tees Valley & Durham	0.088	0.365	0.605	0.58
Northumberland	0.125	0.100	0	0.403
Cumbria	0	0	0	0
Cheshire	0	0	0	0
Greater Manchester	0	0.156	0	0
Lancashire	0	0	0	0
East Yorkshire	0	0.251	0	0
North Yorkshire	0	0	0	0
West Yorkshire	0	0	0	0
Derbyshire & Nottinghamshire	0	0	0	0
Leicestershire, Rutland & Northamptonshire	0	0	0	0
Lincolnshire	0	0	0.195	0.001
Herefordshire Worcestershire	0	0	0	0
Shropshire & Staffordshire	0	0	0	0
West Midlands	0.212	0	0	0
East Anglia	0	0	0	0
Bedfordshire & Hertfordshire	0	0	0	0
Essex	0	0	0	0
Inner London	0	0.128	0	0
Outer London	0	0	0	0
Berkshire, Buckinghamshire & Oxfordshire	0	0	0	0
Surrey East & West Sussex	0	0	0	0
Hampshire & Isle of Wight	0	0	0	0
Kent	0	0	0	0.016
Gloucestershire, Wiltshire & Bristol/Bath area	0	0	0	0
Dorset & Somerset	0	0	0	0
Devon	0.575	0	0.2	0

A8 Synthetic control method, robustness tests

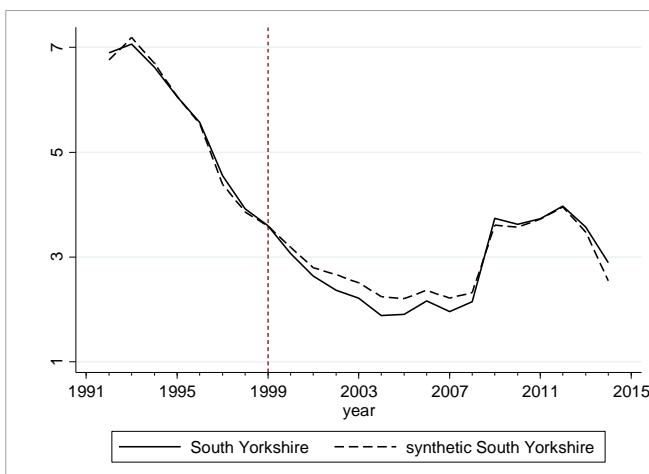
Figure A8.1
 ‘Leave-neighbours-out’ test

Cornwall vs. synthetic Cornwall, excluding Devon



Region	Synthetic CW Weight
Tees Valley & Durham	0
Northumberland	0.052
Cumbria	0.305
Cheshire	0
Greater Manchester	0
Lancashire	0
East Yorkshire	0
North Yorkshire	0
West Yorkshire	0
Derbyshire & Nottinghamshire	0
Leicestershire, Rutland & Northamptonshire	0
Lincolnshire	0
Herefordshire, Worcestershire &	0
Shropshire & Staffordshire	0
West Midlands	0.485
East Anglia	0
Bedfordshire & Hertfordshire	0
Essex	0
Inner London	0
Outer London	0
Berkshire, Buckinghamshire & Oxfordshire	0
Surrey East & West Sussex	0
Hampshire & Isle of Wight	0
Kent	0
Gloucestershire, Wiltshire & Bristol/Bath	0
Dorset and Somerset	0.159

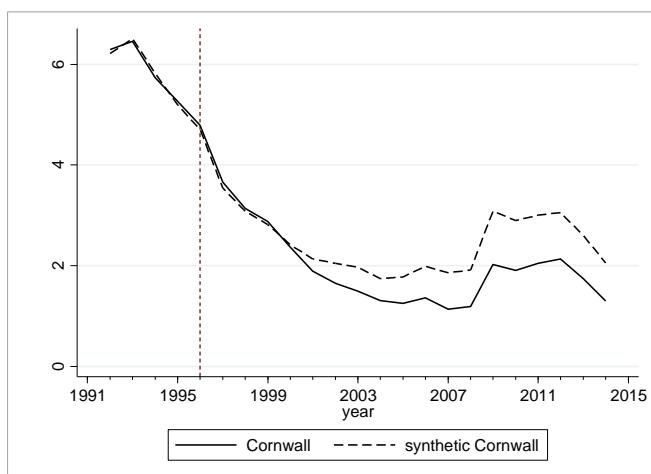
South Yorkshire vs. synthetic South Yorkshire, excluding regions neighbouring SY



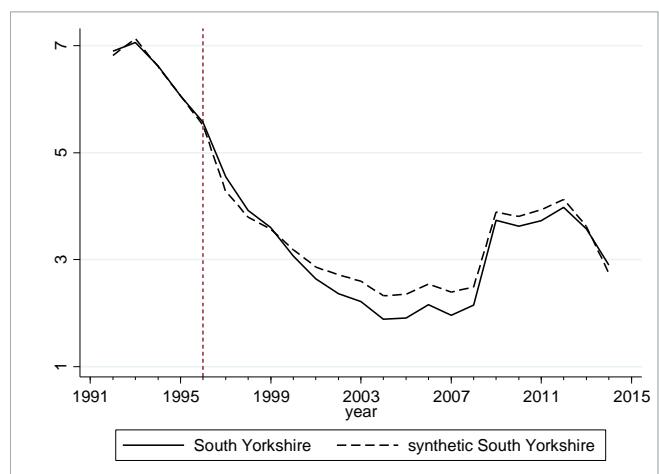
Region	Synthetic SY Weight
Tees Valley & Durham	0.434
Northumberland	0.026
Cumbria	0.124
Cheshire	0
Greater Manchester	0.237
Lancashire	0
Leicestershire, Rutland & Northamptonshire	0
Herefordshire, Worcestershire &	0
Shropshire & Staffordshire	0
West Midlands	0
East Anglia	0
Bedfordshire & Hertfordshire	0
Essex	0
Inner London	0.179
Outer London	0
Berkshire, Buckinghamshire & Oxfordshire	0
Surrey East & West Sussex	0
Hampshire & Isle of Wight	0
Kent	0
Gloucestershire, Wiltshire & Bristol/Bath	0
Dorset and Somerset	0
Devon	0

Figure A8.2
Placebo treatment in 1996

Panel A: Cornwall



Panel B: South Yorkshire



A9 Balancing tests, propensity score matching

Table A9.1
Balancing tests, propensity score matching for ward-level analysis

Variable	Cornwall				South Yorkshire			
	Treated (Cornwall)	Mean Control (matched)	t-test		Treated (South Yorkshire)	Mean Control (matched)	t-test	
		t	p>t				t	p>t
Unemployment (1996-1999)	3.72	3.72	0.00	0.998	4.24	4.46	-0.75	0.453
<i>1991 variables:</i>								
Employed people in agriculture, forestry and fishing ^a	7.40	6.81	0.62	0.536	0.55	0.59	-0.3	0.768
Employed people in mining ^a	2.16	2.43	-0.64	0.521	4.77	5.08	-0.52	0.606
Employed people in manufacturing ^a	8.67	8.39	0.6	0.550	15.62	15.05	0.88	0.379
Employed people in construction ^a	8.62	8.20	1.03	0.302	7.20	7.02	0.59	0.559
Employed people in distribution and catering ^a	21.79	22.54	-0.84	0.404	18.48	17.93	0.91	0.363
Employed people in transportation ^a	4.45	3.93	1.47	0.142	5.82	5.45	0.9	0.369
Employed people in banking and finance ^a	6.78	6.60	0.49	0.626	4.57	4.75	-0.73	0.469
Employed people in other services ^a	26.44	26.78	-0.36	0.723	22.70	22.84	-0.13	0.896
Self-employed workers ^a	11.25	10.94	0.51	0.607	4.09	3.98	0.43	0.669
Full-time workers ^a	57.91	57.57	0.27	0.786	50.87	51.63	-0.73	0.466
Female employment ^a	21.38	21.39	-0.03	0.979	21.01	21.20	-0.93	0.356
Inactive population ^b	38.38	38.93	-0.66	0.511	35.39	35.64	-0.35	0.724
People whose ethnic group is white ^b	99.49	99.44	1.19	0.237	97.22	98.01	-1.13	0.261
Migrants (within/between wards or from outside UK) ^b	10.39	10.93	-1.18	0.238	9.02	9.96	-1.76	0.081
Students ^b	3.17	3.11	0.29	0.768	2.73	2.53	0.82	0.411
no of wards	134	134			94	94		

Note: a / percentage of economically active population; b / percentage of residents.

A10 Fixed effects model, sample of English regions

Table A10.1
EU funds, unemployment, and economic growth in English regions

Dep. Variable:	Δ Unemployment bc			Δ ln GDP per capita			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lagged unemployment bc	-0.129*** (0.0116)	-0.135*** (0.0114)	-0.135*** (0.0114)				
Lagged ln GDP per capita				-0.321*** (0.0366)	-0.314*** (0.0345)	-0.250*** (0.0364)	-0.319*** (0.0372)
EU funds per capita		-6.35e-05 (0.000201)		0.000166** (6.89e-05)			0.000166* (9.51e-05)
Objective 1 regions			-0.114*** (0.0351)	-0.0463*** (0.0162)	0.00587* (0.00331)	0.00189* (0.00114)	0.00506 (0.00407)
(Obj1 regions) x (EU funds per capita)							0.000141** (6.05e-05)
Controls	✓	✓	✓	✓	✓	✓	✓
Region dummies	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓
Observations	536	536	500	507	507	507	507
R-squared	0.939	0.941	0.940	0.790	0.790	0.790	0.791
NUTS2 regions	30	30	28	30	30	28	30

Note: Clustered standard errors at NUTS2 level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Controls: share of tertiary education degree holders in the regional workforce, share of agricultural employment, share of employed people in manufacturing, stock of total motor-roads per inhabitant, patent applications per 10000 inhabitants. Cornwall and South Yorkshire excluded from sample in specifications (3) and (6).

Government quality and the economic returns of transport infrastructure investment in European regions

Riccardo Crescenzi, Marco Di Cataldo and Andrés Rodríguez-Pose

Abstract

Transport infrastructure investment is a cornerstone of growth-promoting strategies. However, the link between infrastructure investment and economic performance remains unclear. This may be a consequence of overlooking the role of government institutions. This paper assesses the connection between regional quality of government and the returns of different types of road infrastructure in the regions of the European Union. The results unveil the influence of regional quality of government on the economic returns of transport infrastructure. In weak institutional contexts, investment in motorways – the preferred option by governments – yields significantly lower returns than the more humble secondary roads. Government institutions also affect the returns of transport maintenance investment.

Keywords: Transport infrastructure, public capital investment, economic growth, government quality, regions, Europe.

JEL classification: O43, R11, R40, R58.

Published in the *Journal of Regional Science*.

1. Introduction

Infrastructure investment has always been considered key for economic growth and has been one of the cornerstones of regional development strategies in the European Union (EU) and elsewhere. So intense has the focus on infrastructure been that formerly lagging regions have become leaders in transport infrastructure endowment. After 20 years of intensive European investment in transport infrastructure, Spain had the largest motorway network among the first 15 members of the EU, while Portugal leads in kms per GDP. The United Kingdom came last in the latter two rankings.

However, whether efforts to promote greater economic, social and territorial cohesion by developing new transport infrastructure have delivered the expected economic results has come under considerable scrutiny. Recent scholarly literature has underlined that the returns of transport infrastructure investment have been more limited than that of expenditures in other development axes, such as human capital and innovation (Rodríguez-Pose & Fratesi, 2004; Crescenzi, 2005; Crescenzi & Rodríguez-Pose, 2012). But why this is the case is still unclear.

One possible explanation posits that changes in accessibility deriving from new roads may benefit the economic core at the expenses of the periphery. This concept has been popularised in recent years by New Economic Geography (NEG) theories (Puga & Venables, 1997). A different possibility, which we explore in this paper, is that the returns of infrastructure investment are mediated by the quality of regional government institutions co-responsible for ensuring the selection and realization of specific projects. The local institutional environment in which investments are made will affect the scale and type of new infrastructure investments and, consequently, their economic returns. Poor institutions enhance the opportunities for private gain at the expense of a sound provision of public goods (Acemoglu & Dell, 2010). In weak government quality conditions new investment in transport infrastructure may respond more to political and individual interests than to economic and collective ones (Crain & Oakley, 1995; Henisz, 2002). Institutional failure is at the heart of a greater propensity to finance ‘flagship’ and large-scale transport projects (i.e. motorways, high-speed rail), more appealing to incumbent politicians seeking re-election (Rodríguez-Pose, 2000; Cantarelli et al., 2010), at the expense of less flashy ‘ordinary’ transport investments (i.e. secondary roads, freight railways). It may also lead to a more prominent role of political and business pressure groups, resulting in problems such as collusion at tender-stage, misrepresentation of costs and benefits and of the time needed for implementation (Kenny, 2007; Flyvbjerg, 2009; World Bank, 2011).

The role of institutions and of government quality as mediators of the returns of public policy – while increasingly acknowledged (e.g. Tanzi & Davoodi, 1997; Esfahani & Ramírez, 2003) – has seldom been proven empirically. To our knowledge, there are no analyses which have examined the triple link between quality of government, infrastructure investments, and economic growth for the European regions. We address this gap by analysing the influence of transport infrastructure on economic growth both independently and in interaction with specific institutional characteristics. Our main hypothesis is that investing in transport infrastructure in poor or inadequate local government institutional conditions can seriously undermine the returns of the investment.

We use the annual variation in the network of motorways and in all other regional roads as our proxy for transport infrastructure investment. Investing in these two infrastructure categories implies significantly different levels of visibility, costs, and potential economic returns. While additional investment in motorways requires a larger financial effort and often aims to improve inter-regional connectivity, investment in other roads tends to be substantially cheaper and generally targets local bottlenecks and the strengthening of internal mobility within a region. Similarly, investments in new infrastructure may be preferred to the maintenance of existing infrastructure. Hence, in areas with a weaker quality of government, where the interests of individual actors may prevail over those of society as a whole, motorways – with their greater political visibility and greater corruption opportunities – may be regarded as a more attractive option than secondary roads or road maintenance expenditure.

We test our hypotheses on a sample of 166 EU regions during the period 1995-2009. Our estimation method (panel fixed effects) controls for unobservable time-invariant regional features and time-specific common shocks, as well as for the key time-varying regional growth determinants, such as innovation capacity, human capital and industrial structure.

The results of the analysis provide little evidence of a positive correlation between regional investments in motorways and economic growth, even if associated with better regional government institutions. In contrast, variations in the endowment of other roads display a stronger connection with regional economic performance in regions with higher quality regional governments. Also the maintenance of transport infrastructure is positively associated with economic growth only in regions with sound government institutions.

2. Infrastructure, institutions and economic growth

Infrastructure and economic growth

A minimum level of public capital investment is essential for economic activity (Button et al., 1995). Infrastructure promotes local accessibility and leads to improvements in the provision of services, to reductions in production costs, to enhanced productivity (Biehl, 1991; Moreno et al., 1997), and to the relocation of economic activity, facilitating economic growth. However, once a necessary basic threshold of infrastructure provision is reached, the impact of additional public investment remains uncertain. A recent report claims that all OECD countries are already beyond that threshold and that additional road expansions may have limited effects on economic performance (OECD, 2009a). Timing is also crucial, as the returns to infrastructure investment tend to be positive when new roads are built, but the positive impact fades away for incremental expansions of existing transport connections (Fernald, 1999).

The notion of a positive linear effect of transport infrastructure investment on aggregate productivity (Aschauer, 1989; Munnell, 1990) has also been strongly challenged by subsequent economic research, both for the US (Holtz-Eakin & Schwartz 1995; Kelejian & Robertson, 1997) and Europe (Cappelen et al., 2003; Crescenzi & Rodríguez-Pose, 2012). In the case of Europe, single country analyses (Cadot et al., 1999; Stephan, 2000), as well as cross-country investigations (Cappelen et al., 2003; Crescenzi & Rodríguez-Pose, 2012) report much lower elasticities than those found by Aschauer (1989) or even insignificant coefficients.

The explanations as to why the returns of additional investments in infrastructure have not lived up to expectations vary. Some contributions have analysed the dynamic response over time of regional GDP to public spending in transport infrastructure. From this perspective, improvements in transport networks represent powerful growth stimuli only at specific moments, but have limited effects in other time periods. Leduc and Wilson (2013) demonstrated that motorway investment in US States had no impact on economic growth while road constructions were underway, an effect which became positive once the new infrastructure became operational. Other studies have shown, however, that most positive growth effects are short-lived. The connection between infrastructure and regional growth in Europe tends to vanish two or three years after it becomes available (Crescenzi & Rodríguez-Pose, 2008; OECD 2009b).

The differential impact of public capital on productivity, wages and employment has also been the centre of attention. According to Dalenberg & Partridge (1997), public capital serves as a household amenity that increases labour supply with no impact on productivity. In their view, the

weak productivity of US highways is explained by the fact that households may be willing to accept lower wages to live in places where infrastructure is more developed. In this case, the amenity effect may dominate the productivity effect, meaning that infrastructure investment has little or no effect on growth.

Diverse conditions across different types of regions may also affect the returns of infrastructure (Fujita & Thisse, 2002). In particular, NEG analyses have focused on the role of different types of roads. Puga and Venables (1997), Puga (2002) and Ottaviano (2008) have distinguished between the economic effect of long-distance inter-regional transport infrastructure, which affects overall ‘accessibility’ and provokes further economic concentration, and short-distance or intra-regional infrastructure, that generally facilitates the diffusion of public services and the formation of human capital within peripheral regions. Studies outside the NEG framework focusing on core-periphery differences in factor endowments have reached similar conclusions (Vickerman, 1995; Cappelen et al., 2003; Rodríguez-Pose and Fratesi, 2004).

Governance and infrastructure investment

One crucial factor behind the returns of transport infrastructure which has so far attracted limited attention in the empirical literature is linked to the institutional conditions in each territory. The system of incentives and constraints shaped by local institutions and the efficiency of the local political administration influence the total returns to investment in transport infrastructure (Crain & Oakley, 1995; Henisz, 2002; Acemoglu & Dell, 2010). Political and institutional factors may influence both infrastructure spending and its economic returns at every phase of the investment (Esfahani & Ramirez, 2003). From the planning and selection of transport projects to their implementation, the characteristics of the local governance system play an important role in determining future efficiency. The link between transport infrastructure investment and the planning system, the need for large budgets, the high number of actors involved, and the difficulty in applying effective control mechanisms make the transport sector particularly vulnerable to political interference (Wachs, 1989; Flyvbjerg, 2009; Cantarelli et al., 2010), corruption (Tanzi & Davoodi, 1997; 1998; Kenny, 2006), and collusion (World Bank, 2011). The quality of local institutions determines the risk of moral hazard and, consequently, the capacity of decisions on infrastructure investment to deliver.

In the following subsections, we develop the conceptual and theoretical arguments at the base of our hypothesis at each stage of the infrastructure building process and posit that the economic returns of transport infrastructure investments are deeply affected by the presence of deficient

governance. We integrate some significant case-studies drawn from the European context in the discussion.

Investment planning and project selection: political economy factors inflating transport investment

Inadequate political institutions may negatively affect the economic returns to transport infrastructure investment well before the money is actually spent. Governments are directly responsible for appropriate infrastructure planning and rigorous project selection, making transport infrastructure planning and financing fundamentally a political topic. In theory, decision-makers should base their decisions on rigorous cost-benefit considerations. However, decision-making on new transport investment in European countries is “generally politicized, rarely fully transparent, and there is little ex-post analysis on whether projects and policies meet expectations” (Short & Knopp, 2005: 363). Even when the investment is preceded by ex-ante impact studies, the secrecy which frequently surrounds forecasting methods does not guarantee the absence of deliberate cost-benefit misrepresentations (Wachs, 1989; Short & Knopp, 2005; Cantarelli et al., 2010). Incumbent planners may “purposely spin scenarios of success and gloss over the potential for failure” (Flyvbjerg, 2009: 350) of transport projects in order to strengthen their own political positions.

Infrastructure investment is very tangible and highly visible providing policy-makers with excellent opportunities for ribbon-cutting before elections with political considerations prevailing over solid economic valuation (Cadot et al., 2006). Vested political and economic interests can influence the activity of local administrations in weak institutional contexts, making the promotion of new large infrastructure projects preferable from a political perspective to investing in the maintenance of the old transport network or to the promotion of alternative, less ‘glitzy’ projects (Tanzi & Davoodi, 1997; Kenny, 2007). Special interests and pork-barrel politics can drive infrastructure investment decisions at the expense of social welfare and economic efficiency (Cadot et al., 1999; Kemmerling & Stephan, 2008). In addition, mega-projects are riskier, due to long planning horizons, and more susceptible to cost miscalculations (Flyvbjerg, 2009): collusion and clientelism may also play an important role in this context (Cadot et al., 2006).

Examples of political interest and/or weak local institutions leading to suboptimal infrastructure developments are plentiful. Many of those examples can be found in Spain. Substantial investments in motorways in the 1990s drove the catching-up process in transport infrastructure endowment. Yet, investment in infrastructure increased even further in the 2000s, when the road deficit relative to the countries in the core of Europe no longer existed (Bel, 2010). The wave of investment in motorways before the start of the crisis was mostly realised through toll road

concessions that set favorable conditions for private groups (Acerete et al., 2009). The Spanish entrepreneurial sector threw its considerable economic weight in order to inflate investments in new roads, investments which were seldom – if ever – preceded by accurate cost-benefit analyses and by the drafting of financial and economic long-term plans (Bel, 2010). The resulting roads often became ‘white elephants’ of questionable economic and public utility (Bel, 2010). Such is the case of the toll motorway connecting Madrid and Toledo (AP-41), inaugurated in 2006 with a forecasted traffic intensity of over 25,000 vehicles per day. The actual figures have been nowhere close,³⁵ as the new motorway has not been able to divert enough traffic away from its ‘competitor’, the pre-existing toll-free Madrid-Toledo motorway. The Spanish high-speed railway network can also be considered a rich source of ‘white elephants’ (Albalate & Bel, 2012).

Another highly controversial project is the ‘Vasco da Gama’ bridge in Lisbon (Portugal), which opened to traffic in 1998 and is the longest bridge in Europe. It is the second bridge over the river Tagus, built in theory to alleviate the highly congested ‘25 de Abril’ bridge. The project was financed using government grants, private resources, loans from the European Investment Bank and the Cohesion Fund, with the EU being the main contributor. The project was strongly promoted by the Ministry of Public Works of Portugal, supported by 17 municipal governments of the Lisbon metropolitan area and quickly approved by the European Commission, despite a dedicated commission identifying at least two other alternative and cheaper river crossings connecting more densely populated areas (Bukowski, 2004; Painvin, 2009). Partially as a result of its location the bridge failed to live up to expectations (Melo, 2000; Painvin, 2009). The estimated traffic of 132,000 daily vehicles never materialised. The Daily traffic across the bridge averaged only some 55,650 vehicles in 2015, and traffic has been declining since it peaked at about 67,500 vehicles in 2004 (for both statistics see INE, 2017). The political desire to build the longest bridge in Europe and the need to spend European funds quickly prevailed over the necessity to reduce congestion in the city by using a more suitable alternative location for the project.

Investment planning and project selection: lack of resources, corruption and collusion

Superfluous or wrongly planned infrastructure investment may also be the result of inadequate policy-making and scarce economic resources. In cases when the responsibility for investment planning is decentralised, regional and local authorities may lack sufficient financial leverage to implement investments with higher returns. If political decentralization is not matched by an adequate devolution of economic power, financial instability and coordination problems may

³⁵ According to official data by Spain’s Ministerio de Fomento (2017), the number of daily vehicles peaked at 2,800 in 2008. The number of users declined to a paltry 881 in 2016.

arise. In Italy, for example, the 2001 constitutional reform transferred a large share of responsibility for the programming, planning, and managing road development to the regions. However, Italian regional governments have never had sufficient financial resources to properly exercise this role (Casadio & Paccagnella, 2011). As a consequence, the regions have either been forced to further decentralize powers to the provinces or to create new *ad hoc* organizations for the management and realization of road investments (Marangoni & Marinelli, 2011).

Next to a lack of financing capacity, local corruption is also one of the main factors behind the inefficient planning of public capital spending. In competitive auctions economic efficiency is best ensured when infrastructure projects are contracted to the companies presenting the best bid. This process requires a great degree of transparency. However, the auctions' outcome is often perverted by corruption and collusion. In weak institutional environments bribery can lure government officials to select suboptimal bids or, in cases of limited contractors, collusion may be the outcome.

Several studies have documented the existence of cartels controlling construction bids in European countries. A 2002 enquiry unveiled frauds, unjustified subsidies and bribery of vast proportions from a state-corporate network monopolizing the construction sector in the Netherlands (Van der Heuvel, 2005). In Italy the responsibility for managing auctions³⁶ on highway and roads concessions belongs to the regions, with construction companies often lamenting a supposed lack of neutrality in the award of contracts. In the South of the country at least one third of projects are contracted to firms with close links to the awarding administration (Bentivogli et al., 2011). Corruption and collusion in the transport sector are severe in many Eastern European countries as well (Kenny, 2006). In Romania a cartel of firms used to raise the price of road construction tenders by up to 30 percent over their market equilibrium level (Oxford Business Group, 2004). Numerous cases of pre-defined tender prices have also emerged in Slovakia (OECD, 2006) and Poland (Cienski, 2013).

Project implementation: cost overruns and delays

Cost overruns and delays tend to be the norm in the implementation of transport infrastructure projects in weak institutional contexts. According to Flyvbjerg et al. (2005), an underestimation of the total costs of large-scale infrastructure projects happens nine out of ten times with cost overruns in road projects on average 20 percent above initial predictions. Political-economic factors are generally regarded as the main explanation for cost overruns (Cantarelli et al., 2010).

³⁶ The national level is responsible for a few projects of national relevance (*grandi opere*), while the regional level manages all other auctions.

In areas with weak institutions and governance systems, political and economic interest groups often voluntarily misrepresent the costs and benefits of a project in order to facilitate its approval.

Increases in the total costs of infrastructural projects may be also related to distortions taking place at the moment of their execution. Legal disputes – often resulting from clashes between local authorities and the company implementing the infrastructure – can cause severe delays. Finally, additional time and cost overruns can be originated by the incapacity of legal institutions (either national or local) to enforce the project's procurement contracts, and by the lack of appropriate bureaucratic structures monitoring the execution of works.

Such conditions are more prevalent in areas where rent-seeking and/or the presence of organised crime abound. These endemic situations may transform what initially appear to be feasible projects into ‘white elephants’, as was the case of the renovation of the Italian ‘A3’ motorway between Salerno and Reggio Calabria. Works began in 1997 and were only completed in 2016. Meddling by organised crime – attested by the National Anti-Mafia Commission – together with lengthy court disputes have made costs skyrocket, with the Italian State providing compensation of over 300 million Euros to the private contractors for ‘unpredicted costs’ (Turano, 2011).

Infrastructure investment in the periphery

Political meddling, delays, and unexpected cost overruns are frequently much more serious in the European periphery than in the core. As indicated by Charron et al. (2014), government quality in most regions of the European periphery is well below par. Many of the regions in the periphery of Europe have limited experience in project planning, monitoring and evaluation, along with greater problems of corruption, lack of transparency and accountability, inefficient rule of law and, last but not least, low government effectiveness. These conditions are perfect for the prevalence of political and/or individual criteria over economic and/or collective ones when designing, implementing, and exploiting infrastructure projects.

The impact of infrastructure projects in peripheral regions suffers as a result. Political instability, weak accountability, and ineffective governments limit the impact of infrastructure (Crain & Oakley, 1995; Henisz, 2002; Esfahani & Ramirez, 2003), whereas lobbying and corruption inflate expenditures in publicly funded projects (Tanzi & Davoodi, 1997; World Bank, 2011). This is particularly the case of large-scale transport projects that are politically appealing but have the effect of worsening the financial burden of a region, increasing the risk of a default. This risk becomes more serious if corruption is widespread. In these circumstances, the financing of debt

is more costly and public investment projects less productive (Ciocchini et al., 2003; Ahlin & Pang, 2008).

Institutional and government failures – more prevalent in peripheral areas – are therefore likely to emerge as barriers for the transformation of transport infrastructure investment into new economic activity and development. However, despite the salience of local institutions and government quality in determining how infrastructure shapes economic performance, only a limited number of empirical studies have attempted to assess the effect of institutions on the economic returns of infrastructure. Research by Tanzi and Davoodi (1997) and Esfahani and Ramirez (2003) uncover a positive role of institutional quality on economic growth, acting through the channel of more efficient and productive investments in infrastructure. These analyses are, nevertheless, conducted at a national level, with no focus on how the quality of regional government shapes the returns of transport infrastructure investments in the regions of Europe.

3. Model, data, and descriptive statistics

Model specification and data

The aim of the empirical analysis is to test whether the quality of regional government shapes the returns of infrastructure across the regions of Europe. Different typologies of transportation investment are considered. We distinguish between variations in the endowment of motorways and of other regional roads³⁷, assuming that this distinction would also reflect a set of structural differences in the investment based on political preferences for different types of roads, the financial effort required to implement them, as well as their potential association with economic growth. The influence of institutions on transport infrastructure is modelled through the inclusion of an interaction term between our two proxies for investment in roads and the regional quality of government. The model takes the following form:

$$\Delta \ln y_{i,t} = \alpha \ln y_{i,t-1} + \beta \Delta Infr_{i,t} + \gamma QoG_{i,t} + \delta(\Delta Infr \times QoG)_{i,t} + \eta X_{i,t} + \theta_i + \tau_t + \epsilon_{i,t} \quad (1)$$

³⁷ While in some EU countries national, not regional governments are responsible for the promotion of some types of transportation investments (e.g. motorways), local institutions may still indirectly influence national decisions by the central government about when, where, and how to invest in transport infrastructure. The capacity to invest in infrastructure depends very much on the level of decentralisation of each country, but the soft power to influence decision-makers is present everywhere and may indeed be more important than direct capacity to build different types of structure.

Where:

the dependent variable $\Delta \ln y_{i,t} = \ln y_{i,t} - \ln y_{i,t-1}$ is the annual change of the natural logarithm of GDP in region i (i.e. the logarithmic approximation of the annual regional growth rate). $y_{i,t-1}$ is the annual lagged level of regional GDP.

The main variables of interest in the model are the variation in the regional stock of transport infrastructure, the regional Quality of Government (QoG) index (Charron et al., 2011), and the interaction term between these two variables.

$X_{i,t}$ is a vector of independent variables as controls, θ_i are regions-specific unobservable fixed effects, τ_t are year dummies, and $\epsilon_{i,t}$ is the error term. $\alpha, \beta, \gamma, \delta, \eta$ are the parameters to be estimated.

Given the absence of comparable data on regional expenditure for transport projects across countries, we use the change in the regional endowment of road infrastructure as our proxy for infrastructure investment. The number of kilometres of roads normalised by thousand inhabitants is our indicator of infrastructure. Crescenzi and Rodríguez-Pose (2012) show that results of growth models assessing the effect of roads infrastructure remain substantially unaltered if alternative standardisations are employed – e.g. kilometres of road divided by regional GDP or by squared kilometres of land. The variable in first difference is assumed to reflect the regional variation in roads resulting from successfully completed new infrastructural investments³⁸.

Our variable accounts for all completed and fully functional infrastructure projects that can influence regional economic activity. It considers both publicly- and privately-funded improvements in transportation. However, being a measure of the *ex-post* outcome of the investment, it cannot account for time overruns in project construction or for financial waste from unfinished projects. More importantly, it does not capture all investments in road maintenance and improvement, which represent about 30 percent of total transport infrastructure investment in European countries during the 1995-2009 period (OECD, 2011). For this reason, an extension of our work considers a more complete model including a proxy for maintenance investment, only available, however, at the national level.

³⁸ Given that the focus is on investments, the models do not include the stock of infrastructure among controls. If the places that witnessed the greatest improvement in QoG over 1995-2009 were places that historically had low levels of infrastructure and are only now catching up, then the initial stock of infrastructure could be considered an omitted variable in our model, potentially biasing the coefficient of the QoG Index and of the interaction term. However, a lower level of infrastructure endowment at the beginning of the period does not seem to be associated with greater improvements in government institutions. The pairwise correlation coefficient between average QoG growth and infrastructure endowment in 1995 is negative and insignificant for motorways (-0.055) and positive for other roads (0.444).

In order to assess the role of local institutions on transport investment, we interact our infrastructure investment proxies with the Quality of Government (QoG) index, a survey-based indicator of government quality in European regions compiled by the Quality of Government Institute at the University of Gothenburg in 2009. The index was built on the basis of questionnaires gauging the quality and impartiality of public services and the perception of corruption by local citizens. Responses to the survey have been aggregated at the NUTS1 or NUTS2 level for the EU-27. In a later work, Charron et al. (2014) have extended the QoG index to a longer time-span by integrating it with the World Bank Governance Indicators (WBGI) (Kauffman et al., 2009), identifying in this way four different dimensions of government quality corresponding to the WBGI categories: control of corruption, government effectiveness, rule of law, and government accountability.

We make use of the classification by the European Statistical Office (Eurostat) of regional roads into ‘motorways’³⁹ – all dual carriageway roads – and ‘other roads’ – all other state, provincial, and communal roads. Motorways are more visible, costly to build, and normally connect urban centres across different regions. The development of local roads is much less politically glamorous and less likely to give rise to the same ‘hub-and-spoke’ effects as motorways. Both types of road investments may be influenced by the quality of regional and local governments. This influence can be exerted directly, if sub-national institutions are responsible to define the type of infrastructure to be constructed in their territory, or indirectly, if they condition decisions by the central or federal government about when, where, and how to invest in transport infrastructure. Due to the complexity of the multi-level decision making process for roadbuilding works at the level of the EU and the individual Member States, local institutions play a key role in the investment process.

The vector of controls $X_{i,t}$ includes a number of factors influencing economic growth. In line with the endogenous growth approach and, as customary in the scholarly literature, the model controls for innovation capacity, human capital, and labour market structure (OECD, 2009b; Crescenzi & Rodríguez-Pose, 2012; Parent & LeSage, 2012; Capello & Lenzi, 2014). Transport connectivity improvements determine the potential for a region to absorb and transfer new knowledge and ideas from/to other places. The capability of the regional economy to translate internal and external knowledge and innovation into economic growth, in turn, is deeply affected by the social and institutional conditions of the areas where economic activities take place (Cohen & Levinthal

³⁹ Eurostat defines a motorway as a “Road, specially designed and built for motor traffic, which does not serve properties bordering on it, and which: a) Is provided, except at special points or temporarily, with separate carriageways for traffic in two directions, separated from each other, either by a dividing strip not intended for traffic, or exceptionally by other means; b) Has no crossings at the same level with any road, railway or tramway track, or footpath; c) Is especially sign-posted as a motorway and is reserved for specific categories of road motor vehicles”.

1990; Fagerberg, 1994; Cooke et al., 1997). The composition of the labour force, the level of skills, and the quality of regional governments determine the capacity of regions to remain competitive over time by making the best possible use of the available inputs (Rodríguez-Pose & Crescenzi, 2008; Rodríguez-Pose & Di Cataldo, 2015). We account for the main characteristics of the regional socio-economic environment shaping regional competitiveness by including three different control variables: a) the natural logarithm of the number of patent applications per thousand of regional inhabitants, as a measure of innovation capacity; b) the natural logarithm of the percentage of employed people with tertiary education, as a proxy for human capital availability; and c) the share of employed people in the primary sector as a proxy for the upgrading of local skills.

In addition, transport infrastructure investment affects economic performance beyond the geographical boundaries within which it takes place (Cohen, 2010). When a reduction in transport costs helps connecting economic activities with new markets and boost trade new transport infrastructure generates positive spillovers. When new transport connections lead to a loss of productive resources due to the emigration of skilled labour, the spillover effects become negative. We control for spillovers from infrastructure investment in neighbouring regions with a spatial lag of the transport investment variable based on Euclidean distance.

All controls are extracted from the Eurostat Regio database for the period 1995-2009 (see Table A1 for the details and sources of the variables included in the analysis).

The study is performed on a sample of EU NUTS1 and NUTS2 regions determined by data availability. Having included in the model measures of regional government quality, we select for all countries the spatial scale with the highest political meaning and reflecting a real capacity to have an influence on infrastructure investment and maintenance decisions. We also consider the regional level with the greatest degree of autonomy for implementing infrastructure projects. This implies using NUTS1 regions for Germany, Belgium, and the United Kingdom and NUTS2 in the remaining countries: Austria, Czech Republic, France, Hungary, Italy, the Netherlands, Poland, Portugal, Romania, Spain, Sweden and Slovakia. The full sample covers 166 European regions. Data constraints (Greece, Denmark, Croatia, Bulgaria) or the absence of regional subdivisions at the NUTS2 level (Lithuania, Latvia, Estonia, Luxembourg, Malta, Cyprus), or lack of sub-national variation in the QoG Index (Finland, Ireland), prevent us from covering remaining EU countries.

Descriptive statistics

Table 1 presents the stock of kilometres of motorways and other roads in all countries in the sample at the beginning and at the end of the period of analysis. Spain and Portugal were the countries that witnessed the greatest expansion in their motorway network (Table 1). These two countries already enjoyed some of the most extended motorway network in Europe in 1995. Spain was second only to Austria for number of motorway kilometres per inhabitant. Between 1995 and 2009, Austria and Spain followed very different roadbuilding strategies: while Austria favoured the development of secondary roads, Spain invested in motorways. In 2009 Spain was the European country with the highest endowment of motorways per capita: 2.45 times the average of the countries in the sample. Portugal followed with 1.69 times above the average (Table 1). Other countries with significant investments in roadbuilding, such as France, followed a more mixed strategy, combining new investments in motorways and in secondary roads.

Overall, it is the European periphery where the bulk of the investment in motorways has taken place. Less developed regions have added around 1,400 kilometres more than regions of the EU core (Table 1). In more developed regions the transportation effort has been more geared towards secondary roads. Core regions have added more than 100,000 kilometres of secondary roads relative to peripheral regions during the period of analysis (Table 1).

Table 1
Stock of motorways and other roads at the beginning and at the end of the period – countries in sample

	Motorways					Other roads				
	kilometres			Per thousand inhabitants		kilometres			Per thousand inhabitants	
	1995	2009	Difference	1995	2009	1995	2009	Difference	1995	2009
Austria	1,589	1,697	108	0.224	0.236	105,193	108,509	3,316	12.61	13.41
Belgium	1,665	1,764	99	0.135	0.134	139,575	141,901	2,326	11.63	11.59 ^a
Czech Republic	361	730	369	0.032	0.068	55,243	54,990	-253	5.39	5.22
Germany	11,371	12,826	1,455	0.138	0.171	217,590	218,156	566	2.67	2.78
Spain	6,790	13,806	7,016	0.220	0.402	151,443	147,088	-4,355	5.18	4.71
France	8,275	11,163	2,888	0.158	0.212	948,963	1,031,114	82,151	21.50	21.67
Hungary	293	1,273	980	0.028	0.137	29,731	29,952 ^b	221	3.33	3.41 ^b
Italy	6,473	6,661	188	0.159	0.171	159,066	173,946	14,880	5.92	4.57
Netherlands	2,291	2,633	342	0.175	0.185	113,418	134,195	20,777	9.36 ^c	10.21
Poland	303	849	546	0.008	0.021	372,233	383,981	11,748	10.65	10.96
Portugal	671	2,705	2,034	0.100	0.278					
Romania	113	321	208	0.004	0.013	72,746	81,392	8,646	3.18	3.80
Sweden	1,279	1,885	606	0.122	0.169	96,713	96,598	-115	15.96	15.41
Slovakia	219	400	181	0.051	0.088	42,388	43,489	1,101	7.25 ^d	7.41
United Kingdom	3,422	3,674	252	0.058	0.059	407,628	416,002	8,374	7.83	7.60
All regions	44,375	59,682	15,307	0.119	0.164	2,590,193	2,962,697 ^e	372,504	9.72	10.01
Less developed regions	10,911	19,295	8,384	0.065	0.125	800,276	931,945 ^e	131,669	7.61	9.64
More developed regions	33,464	40,383	6,919	0.160	0.190	1,789,917	2,030,752	240,835	11.25	10.26

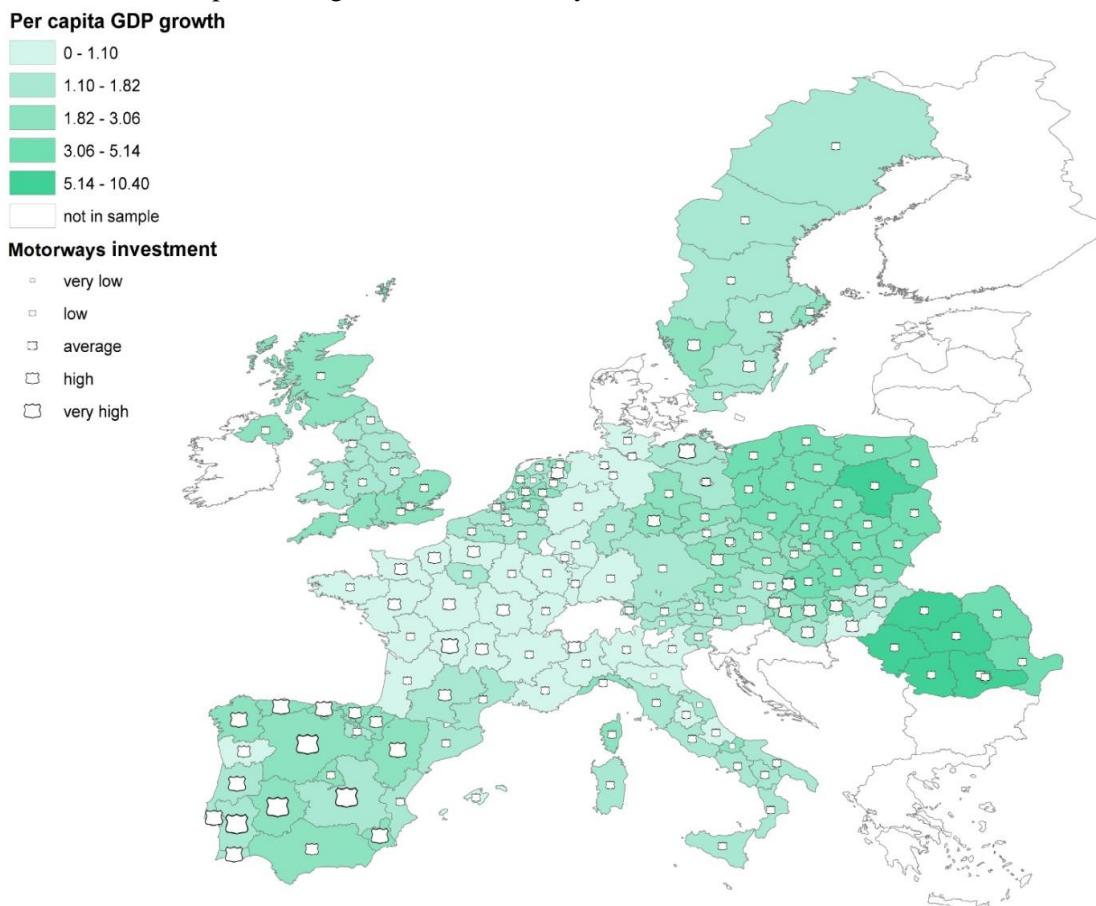
Notes: Less developed regions are all regions part of the 'Objective 1' program during 2000-2006; more developed regions are all regions not eligible for 'Objective 1' support; the values are sums in 'kilometres' columns and averages in 'per thousand inhabitants' columns. a / 2007 value. b / 2003 value. c / 1996 value. d / 1997 value. e / for Hungarian regions the sum is made using the 2003 value.

Source: own calculation with Eurostat and QoG Institute data.

Figures 1 and 2 combine data on transport infrastructure investment with regional economic performance during the period of analysis. Regions are classified according to their average per capita growth rate between 1995 and 2009 and their investment in motorways and other roads respectively. The figures confirm that countries in the Iberian Peninsula recorded the largest increases in motorways, with Hungary following suit. Other regions, such as Limousin in France, Mecklenburg-Vorpommern in Germany, or Småland and the Islands or West Sweden, both in Sweden, also witnessed considerable expansions in motorway endowment (Figure 1). The greatest improvements in secondary roads took place in the Netherlands, Sweden, Poland, Romania, central France, and central and southern Italy (Figure 2). The highest growth rates took place in Central and Eastern Europe and fundamentally in Poland and Romania. The lowest growth happened in France, northern Italy, and western Germany (Figures 1 and 2).

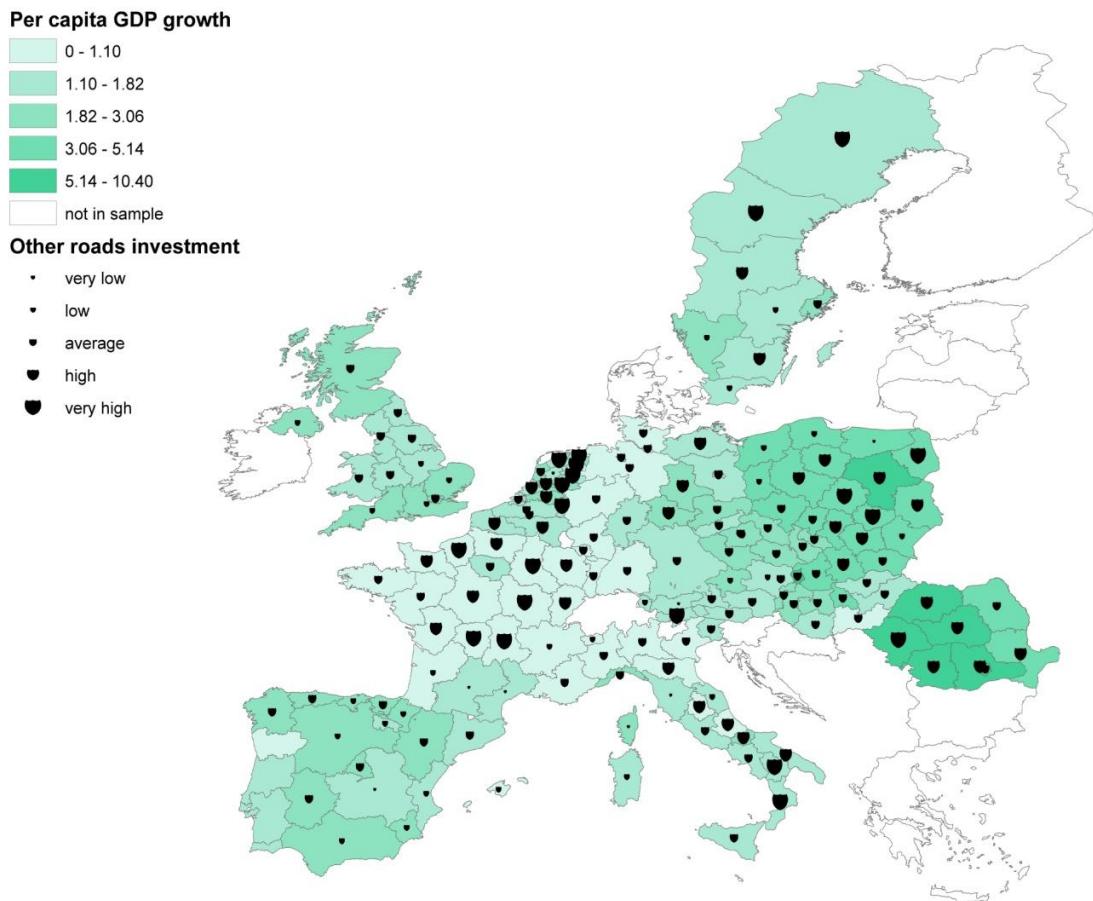
Figure 1

Per capita GDP growth and motorways investment in the EU, 1995-2009



Source: own elaboration with OECD and Eurostat data

Figure 2
Per capita GDP growth and other roads investment in the EU, 1995-2009



Source: own elaboration with OECD and Eurostat data.

4. Regression results

The empirical model specified in Equation (1) is estimated by means of fixed effects panel methods with the inclusion of time dummies. Clustered standard errors correct for possible problems of serial correlation and heteroscedasticity. The effect of spatial autocorrelation (i.e., the lack of independence among the error terms of neighbouring observations) is minimised by introducing ‘spatially lagged’ variables among the controls that explicitly take into consideration the interactions between neighbouring regions, thereby minimising their effect on the residuals. The Moran’s I test confirms the lack of spatial auto-correlation in the residuals. In the interpretation, we focus on the relative sign and significance of the key coefficients rather than trying to discuss specific point estimates.

Changes in motorway endowment as investment proxy are analysed first, with the results presented in Table 2. The first column refers to a baseline specification including initial GDP per

capita, a control for the regional population, region and time effects. In the following specification (column (2)), additional regressors are included to control for other key determinants of regional growth, i.e. the share of employment in the agricultural sector, a measure of regional innovative capacity (patent applications per thousand inhabitants), and a proxy for human capital endowment (the stock of highly educated individuals in the region). The model is completed with a spatially-lagged variable controlling for transport investments in neighbouring regions, obtained by weighting the infrastructure variable by means of a Euclidean distance matrix.

Infrastructure proxy: motorways

The baseline specification presented in Table 2 column (1) shows that both motorway investment and government quality are important drivers of regional growth. The significant and positive coefficient of infrastructure is in line with the neoclassical perspective emphasizing the centrality of public capital accumulation for explaining variations in aggregate productivity (Aschauer, 1989). However, when the model is completed with socioeconomic, educational, and innovation variables (column (2)) the coefficient of motorways investment sensibly reduces its magnitude and loses statistical significance. This is consistent with the hypothesis that development strategies centred on expenditure in new transport infrastructure may not be sufficient to stimulate the growth potential of every region (Vickerman, 1995).

The insignificant correlation between motorways investment and regional growth can be interpreted in different ways. If transport infrastructure is provided optimally in EU regions, the marginal returns of additional expenditures is equal to zero and new investment would have no effects on growth. Another potential explanation it is to assume that new motorway investment attracts individuals willing to accept lower wages to live closer to transport junctions (Dalenberg & Partridge, 1997). In the latter case, the wage decrease may offset any positive economic stimulus derived from the investment, hence determining a zero effect on total productivity. Alternatively, it may be that local development dynamics in some territories may depend less on the construction of new infrastructure and more on regional processes of knowledge generation, the presence of a highly-educated workforce, and socio-institutional conditions (Crescenzi, 2005; Crescenzi & Rodríguez-Pose, 2012). By contrast, the positive and significant coefficient of QoG is not altered by the inclusion of additional explanatory variables, meaning that the quality of regional institutions is strongly correlated to the economic success of European regions.

Table 2
Motorways investment, quality of government and regional growth

Dep. variable: Change of log GDP	Full Sample		Less Developed Regions	
	(1)	(2)	(3)	(4)
Lagged GDP	-0.0302*** (0.0103)	-0.0940*** (0.0130)	-0.0422*** (0.0121)	-0.123*** (0.0201)
Investment in motorways	0.126** (0.0613)	0.0847 (0.0525)	-0.0286 (0.0917)	-0.0478 (0.0773)
Quality of Government	0.0318*** (0.00500)	0.0346*** (0.00466)	0.0636*** (0.0107)	0.0603*** (0.00788)
(Investment in motorways) × (QoG)	-0.118 (0.0856)	-0.0663 (0.0739)	-0.184 (0.146)	-0.110 (0.103)
Spatial weight of investment in motorways		0.784*** (0.162)		0.409** (0.187)
Agricultural employment		-0.00285*** (0.000648)		-0.00292*** (0.000829)
Patent applications		0.00657*** (0.00171)		0.00748*** (0.00279)
Human capital		0.0158*** (0.00469)		0.0417*** (0.0102)
Regional population	-4.46e-05*** (1.21e-05)	-1.53e-05** (7.52e-06)	-3.83e-05* (2.06e-05)	1.14e-06 (1.12e-05)
Region dummies	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓
Observations	2,293	2,269	960	936
R ²	0.377	0.458	0.361	0.449
NUTS regions	166	166	70	70

Clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. QoG = Quality of Government Index.

Higher scores in the QoG index or its components (see Table A6 in the Appendix where estimates for the individual components of the index are reported) are, however, not associated with increases in the productivity of new motorways. In all specifications the coefficient of the interaction term is not statistically different from zero at the 10 percent significance level. Therefore, while a more effective, accountable and transparent regional government is pivotal in the promotion of successful development policies, it may not suffice for translating new investments in motorways into higher growth. The spatially-weighted variable displays a positive and significant coefficient, implying that being surrounded by regions investing in new motorways generates network externalities which affect local growth positively. However, the results suggest that only some areas may be able to reap the advantages arising from the expansion of the motorway network, while other European regions may see their productive resources being lured away by new investments in motorways.

Peripheral, isolated, and less economically advanced regions are most at risk of losing out from the potential agglomeration of economic activity linked to motorways. Hence, in order to gain a better understanding of how peripheral economies respond to changes in transportation endowment and government quality, we replicate the estimation of the model on a restricted sample of less developed regions – defined as those that were part of the ‘Objective 1’ of the EU

Structural Funds during the period 2000-2006. The less developed regions sample includes 70 NUTS 1 and 2 regions mainly from the Czech Republic, Hungary, Romania, Poland, Slovakia, as well as Eastern Germany, Southern Italy, Southern and Western Spain, Portugal, and Northern Sweden.

Columns (3) and (4) in Table 2 report the estimation results for the less developed sample. Restricting the sample to the regions receiving the bulk of EU Structural Funds can suggest whether financial resources for the promotion of territorial Cohesion among EU regions have been allocated efficiently. For many years, the highest share of EU regional development funds was allotted to transport infrastructure (Rodríguez-Pose & Fratesi, 2004). However the belief that growth in peripheral regions is best fostered through investments in ‘hard’ transport infrastructure connecting isolated and remote areas with the European economic hubs is not supported by our empirical results. New investments in motorways in lagging regions have not been associated with higher levels of growth, as indicated by the negative and insignificant coefficient (column (3), Table 2). In addition, the negative and insignificant interaction term between new motorway investment and government quality highlights that higher investment in motorways is not significantly associated with regional growth, even if promoted by a relatively more efficient regional government.

Consistent with the hypothesis that lagging areas need to strengthen local socio-institutional development pre-conditions in order to stimulate their competitive advantages, column (4) in Table 2 indicates that social and structural factors – including human capital assets, innovation capabilities, and local government quality – are far more accurate predictors of regional growth than investments in motorways. All of these variables display a higher correlation with growth, indicating their importance in regions that, because of their peripherality, tend to be relatively less endowed with a skilled labour force, have a lower innovative potential,⁴⁰ and lack a well-functioning institutional system of governance.

Infrastructure proxy: other roads

We now re-estimate the model with the annual change in kilometres of other roads as our infrastructure proxy. As before, we reproduce the estimation first on the full sample of regions (columns (1) and (2), Table 3) and then on the smaller sample of less developed regions (columns

⁴⁰ These results suggest that growth-enhancing factors in lagging regions differ between Europe and the US. In contrast to the results for less developed European regions, the economic dynamism of US lagging areas seems to rely less than that of European regions on elements, such as the proportion of patent applications and the share of high-skilled employment (Stephens et al., 2013).

(3) and (4), Table 3). The number of observations is reduced to 161 and 66 respectively, due to data availability issues for Portuguese regions. The presentation of the estimation output follows the structure of Tables 2 and is reported in Table 3, while results for the individual components of the QoG index are reported in Table A7 in the Appendix.

In the full sample – and, as was the case for motorway development – when we exclude control variables, infrastructure investments are positively and significantly correlated with economic growth (column (1), Table 3). This effect is, however, not robust to the inclusion of additional growth determinants in the model, providing no statistical evidence that an upgrade in the network of state, regional, and local roads may independently act as an engine for growth (column (2), Table 3). Conversely, institutional quality is confirmed as a robust growth predictor.

Table 3
Other roads investment, quality of government and regional growth

Dep. variable: Change of log GDP	Full Sample		Less Developed Regions	
	(1)	(2)	(3)	(4)
Lagged GDP	-0.0252** (0.0101)	-0.0901*** (0.0140)	-0.0473*** (0.0138)	-0.129*** (0.0218)
Investment in other roads	0.00102** (0.000487)	0.000607 (0.000476)	0.00136 (0.00768)	0.000401 (0.000497)
Quality of Government	0.0235*** (0.00484)	0.0246*** (0.00436)	0.0628*** (0.0109)	0.0595*** (0.00801)
(Investment in other roads) × (QoG)	0.00157* (0.000829)	0.00234*** (0.000873)	0.00268** (0.0128)	0.00352*** (0.00118)
Spatial weight of investment in other roads		0.00366** (0.00155)		0.00299 (0.00204)
Agricultural employment		-0.00352*** (0.000626)		-0.00339*** (0.000834)
Patent applications		0.00534*** (0.00180)		0.00753*** (0.00276)
Human capital		0.0136*** (0.00512)		0.0420*** (0.0134)
Regional population	-4.46e-05*** (1.21e-05)	-1.53e-05** (7.52e-06)	-3.56e-05* (1.78e-05)	5.04e-06 (8.77e-06)
Region dummies	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓
Observations	2,158	2,134	889	876
R ²	0.387	0.472	0.383	0.472
NUTS regions	161	161	66	66

Clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. QoG = Quality of Government Index.

As mentioned above, the direct effect of new ‘other road’ infrastructure may not be captured by the data because of how the investment variable is constructed. Another hypothesis, however, is that investments have been successful in some regions, but have had only a limited effect on the aggregate productivity of others. If this is the case, the coefficient of the investment variable may

suggest that the resources governments allocated to productivity-enhancing projects were partly offset by interventions that ended up being wasteful and economically inefficient. As widely discussed in section 2, self-interested public officials may take investment decisions that do not represent socially and economically optimising goals. A sound institutional environment where policy-makers are competent and averse to moral hazard behaviours sets the necessary conditions for transport projects to achieve economic success. The positive and statistically significant interaction term in all specifications of Table 3 suggests that investments in roads other than motorways, if associated with higher quality of government institutions, have a positive correlation with the economic performance of European regions.⁴¹ This confirms that the economic returns from transport investments are conditional on a number of institutional factors including the transparency of the local administrations, a government's political and financial autonomy, the effectiveness of the judicial system, and the risk of corruption.

Our results show that the quality of regional governments may have an influence on the profitability of investments in other roads, but play little role in making motorways investments more productive. It may also be the case that regions with lower government quality and weaker institutions may prefer or – whenever they are not directly responsible for the funding – demand motorways as a more flamboyant, visible, and electorally-rewarding investment than secondary roads. In either case, the outcome is the same: no influence on economic growth. By contrast, regions with better government quality that put greater effort on the overall road network are rewarded by higher levels of growth.

Motorways also represent an important opportunity cost in development terms. Because of their cost, an emphasis in motorways tends to leave limited resources for other types of interventions. The upgrading of local roads, reinforcing the internal connectedness of a region, is generally cheaper and allows greater room for alternative (or complementary) interventions. Hence, the development of transport projects that are embedded in the local economic fabric and contribute to mobilize people, goods, and knowledge may truly bring about economic stimuli for all types of economies. When comparing the coefficients of the interaction term in Table 3, the positive effect of a mutual variation in other roads investments and government quality is higher for the sub-sample of less developed regions. This is certainly due to the higher importance of institutions for the economic development of lagging areas than in the core of Europe. These results point to the growth potential of well-targeted investments in secondary roads, which often tend to be

⁴¹ A different interpretation of the insignificant coefficient of investment in other roads may be that, at the margin, additional expenditures in secondary roads produce no effect on total output because the level of transport infrastructure in EU regions is already optimal. If this is the case, the positive and significant coefficient of the interaction term may imply that marginal returns are higher in regions with stronger governance because increases in the quality of government determine a more-than-proportional increase in total output. In other words, when investments in other roads are pursued in the framework of supportive institutions, they benefit from increasing returns to scale.

disregarded by subnational governments, especially in those peripheral regions of Europe where the quality of government is well below the average.

The control variables maintain the sign and significance reported in the previous version of the model. The coefficients for patent applications and a highly-educated labour force in the less developed regions subset (column (4), Table 3) is higher than the one observed in the full sample, showing that innovative capacity and a good endowment of human capital are more crucial for economic growth in the periphery than in the core of Europe. Quality of government in the periphery of Europe is a far more accurate predictor of regional economic growth than investments in motorways.

Maintenance investment

So far the analysis has considered only the effect of new finished road infrastructure projects on growth. However, a large share (about 30 percent) of total infrastructure investment has been devoted to maintenance and improvements of existing transport networks. The proportion of expenditures for maintenance varies significantly across European countries. Areas where investment decisions have been highly politicised have had a preference for new infrastructure over maintenance spending, due to the higher political returns of newly created roads.

In this section we re-estimate the model including a control for investment in maintenance. In absence of data at the regional level, we resort to the OECD database, providing national-level statistics of annual expenditures for transport infrastructure maintenance subdivided by transport type. We consider two types of expenditures, total transport infrastructure and road maintenance,⁴² normalised by national GDP. As before, we interact the maintenance investment variables with the Quality of Government index, in order to test if the effect of maintenance spending on regional growth varies depending on the local quality of government.

The results of the extended model are presented in Table 4. Panel A (columns (1)-(4)) reports the estimates with the inclusion of total infrastructure maintenance, while Panel B (columns (5)-(8)) focuses on road maintenance. The coefficient of maintenance investment is always negative and, in the case of total transport infrastructure, statistically significant. Although this result may at first seem counter-intuitive, it may be related to the balance between the resources allocated to maintenance relative to new investments. Economists looking at the impact of these two types of investment on growth have argued that a minimum level of maintenance is required in order to

⁴² These two variables are available for all countries in the sample, with exception of the Netherlands, Germany, and Spain in the case of total infrastructure maintenance, and Germany and Spain, in the case of road maintenance.

display positive growth effects. Rioja (2003) has estimated that for Latin American countries maintenance investments in public infrastructure below 1 percent of GDP would have a negative effect on GDP change. In our case, the average investment in total transport is 0.64 percent of GDP for the full sample, and 0.79 percent of GDP in less developed regions (Table A2). Hence, this result may imply that maintenance investment in all EU regions is still below a minimum critical value.

Table 4
Maintenance investment

Dep. variable: Change of log GDP	Panel A Total transport infrastructure maintenance				Panel B Road maintenance			
	Motorways		Other roads		Motorways		Other roads	
	FS (1)	LDR (2)	FS (3)	LDR (4)	FS (5)	LDR (6)	FS (7)	LDR (8)
Lagged GDP	-0.0983*** (0.0172)	-0.152*** (0.0211)	-0.0824*** (0.0182)	-0.152*** (0.0234)	-0.0851*** (0.0160)	-0.119*** (0.0268)	-0.0770*** (0.0175)	-0.125*** (0.0297)
Investment in motorways	0.114 (0.0722)	-0.0415 (0.110)			0.0873 (0.0756)	-0.126 (0.128)		
Investment in other roads			0.000593 (0.000465)	0.000430 (0.000486)			0.000623 (0.000473)	0.000486 (0.000490)
Quality of Government	0.0200*** (0.00548)	0.0478*** (0.00905)	0.0148*** (0.00561)	0.0537*** (0.00940)	0.0319*** (0.00553)	0.0613*** (0.00894)	0.0228*** (0.00580)	0.0624*** (0.00984)
(Investment in motorways) × (QoG)	-0.0804 (0.0952)	-0.144 (0.108)			-0.103 (0.0847)	-0.102 (0.119)		
(Investment in other roads) × (QoG)			0.00193*** (0.000703)	0.00353*** (0.00112)			0.00210** (0.000833)	0.00344*** (0.00114)
Spatial weight of investment in motorways	0.962*** (0.268)	0.602** (0.298)			0.900*** (0.252)	0.571* (0.311)		
Spatial weight of investment in other roads			0.00136 (0.00153)	-1.31e-06 (0.00212)			0.00230 (0.00154)	-1.29e-06 (0.00215)
Transport infrastructure maintenance	-0.00521** (0.00234)	-0.00881*** (0.00272)	-0.00405* (0.00240)	-0.00845*** (0.00290)				
(Transport infrastructure maintenance) × (QoG)	0.0176*** (0.00414)	0.0166*** (0.00411)	0.0129*** (0.00405)	0.0130*** (0.00414)				
Road maintenance					-0.00484 (0.00567)	-0.00119 (0.0119)	-0.00181 (0.00571)	-0.00239 (0.0126)
(Road maintenance) × (QoG)					0.00821 (0.00628)	0.00239 (0.0114)	0.00588 (0.00657)	-0.000769 (0.0111)
Other controls	✓	✓	✓	✓	✓	✓	✓	✓
Region dummies	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,637	710	1,514	650	1,793	710	1,670	650
R ²	0.443	0.429	0.443	0.438	0.420	0.395	0.428	0.413
NUTS regions	122	55	117	51	134	55	129	51

Clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; FS = full sample; LDR = less developed regions.
Controls: agricultural employment, patent applications, human capital, regional population. QoG = Quality of Government Index.

A different interpretation is that the investment has limited effect on productivity, because a proportion of the allocated resources is not effectively spent for infrastructure maintenance, but rather captured by interest groups through corruption or collusion mechanisms. This hypothesis is supported by the fact that the interaction term between government quality and maintenance expenditures is positive and significant for total transport infrastructure, but insignificant for road

investment (Table 4, column (8)). The significant interaction term between government quality and total transport maintenance holds both for the full sample and the sample of less developed regions, as well as for motorways and for other roads investment. This means that investing in the maintenance of the overall transport network (total transport maintenance) has more beneficial effects on economic performance, the higher the government quality of the region in which the investment is made. All other coefficients are in line with the ones reported in the previous tables.

Robustness checks

In this section we test the robustness of our estimation results. We consider a number of factors that may affect our estimates: the time-span employed in the empirical analysis, the specification of the model, the persistence of institutions, and the endogeneity of our key variables. The results of the robustness tests are displayed in Appendix A5.

Changes in time-span. The literature on the relationship between infrastructure and growth has produced different results depending on the different time-spans considered. Our model has been tested on the 1995-2009 time period, but the results may not hold for different periods. We therefore test the robustness of our estimates to a change in time span by excluding the first four and last four years. Table A5.1 in the Appendix shows the results of the main model for the 1995-2005 and 1999-2009 periods. The results of the analysis are confirmed for both sub-periods. Quality of government is a significant factor behind economic growth and infrastructure investment in other roads is associated with regional GDP growth only in interaction with the QoG index – this result being stronger in less developed regions. The coefficient of the interaction term is larger in magnitude for the 1995-2005 period, probably due to the fact that the marginal returns of the investment are higher when the road network is less developed (Fernald, 1999).

Changes in specification. The model specified in Equation (1) is a dynamic specification where the lagged level of GDP enters as a regressor. This allows to test for convergence and to control for the initial conditions of the regions. Here we present the estimates of a more parsimonious version of the model, excluding the $\ln y_{i,t-1}$ variable. Panel A in Table A5.2 shows that while the magnitude of the coefficient of some variables changes marginally, the main results are confirmed. Infrastructure investment alone is not significantly linked with regional GDP change; investment in secondary roads is more strongly linked to economic growth in regions with better government quality.

Panel A of Table A5.2 demonstrates that our results are robust to the exclusion of some regressors. Panel B of Table A5.2 presents a more complete version of the model in Equation (1), with the

inclusion of a new control variable. Models connecting transport infrastructure with economic growth typically rely on Cobb-Douglas production functions including private capital as one factor of production. Our original model does not control for private investment because data for this variable at the regional level is available only from 2000. Adding gross fixed capital formation as a proxy for the stock of private capital does not significantly alter the results (Table A5.2). One difference is that the coefficient of other roads investment is now positive and significant at 5 percent level.⁴³ This variable's connection with economic growth becomes stronger if interacted with government quality.

Persistence of institutions. Institutions change slowly over time (Guiso et al., 2016), and indeed the average annual change in the QoG index used in our dataset is low.

In order to allow for a higher variation in regional government institutions, we perform two robustness estimates. First, the analysis is replicated by averaging all variables across 3-year periods. In such a way, the 1995-2009 dataset is collapsed into five periods only. This reduces the number of observations considerably, but allows to obtain a QoG index having a -0.048 average value for period-by-period change, as opposed to -0.014 in the annual dataset. The results of the robustness test, displayed in the first two columns of Table A5.3, confirm the main findings of the model. As a second test, we collapse the dataset into a cross-section, by averaging all key variables across the 14 years of our dataset (1995-2009). As shown in the third and fourth columns of Table A5.3, the main results remain again unchanged.

Endogeneity. The estimated effect of transport infrastructure and government quality on economic growth may be imprecise or biased if the direction of causality is running in the opposite way from that assumed in our model: i.e. if infrastructure investment and the quality of institutional structures are the consequences, not the causes, of the economic performance of EU regions.

A vast body of literature has attempted to account for the potential endogeneity of infrastructure capital and institutional conditions by means of instrumental variables. Some studies have addressed endogeneity using time-lags as instruments with Generalised Methods of Moments (GMM) estimation techniques (Calderón & Servén, 2004; Crescenzi & Rodríguez-Pose, 2012), while others have employed instruments based on historical factors correlated with the endogenous variables but exogenous to current economic conditions (Acemoglu et al., 2001; Tabellini, 2010 for institutions; Duranton & Turner 2011; 2012, for transport infrastructure).

⁴³ This difference with respect to previous results is not driven by the inclusion of private capital, but by the change in time-span (2000-2009). Estimating the model for this period without private capital produces similar coefficients and standard errors for the variable of other roads investment.

Our model includes two variables of interest which may be endogenous to economic growth, as well as the interaction term between them, making any identification strategy based on ‘external’ instruments complicated to apply. Moreover, data on historical variables for European regions is not readily available. Hence, in order to minimize endogeneity issues we resort to a dynamic panel analysis through a GMM-system model.⁴⁴ The GMM produces estimates in line with the results in Tables 2 and 4 (Table A5.4). The quality of regional governments remains a significant driver of growth and the interaction term between other roads and government quality is positive and significantly associated with regional economic performance, although only at the 10 percent level. Unlike the fixed effects results, the coefficient of infrastructure investment is not statistically significant, if the control variables are excluded from the model.

This econometric approach is, however, unlikely to fully correct for the endogeneity issues of our model. As government quality is strongly path-dependent, time-lags do not represent valid sources of exogenous variation. Reverse causality, measurement errors and omitted variable remain an issue potentially biasing the results. For this reason, we cannot make any claim regarding the causality of the relationships observed. Hence, our results must be considered as a descriptive analysis of the complex set of relationships between transport infrastructure investment, government quality, and economic growth discussed in the introductory section of this paper.

5. Conclusions

This paper has investigated the importance of government quality for the economic returns of transport infrastructure investments in the European regions. We assumed that government institutions played a strong conditioning role on the effectiveness of public investments in road infrastructure and that government quality would also affect decisions and the returns of different types of roads: motorways vs. ordinary roads.

The analysis, performed using these two different proxies for infrastructure investment and by interacting them with measures of institutional quality, unveils a very weak or insignificant direct correlation between economic growth and regional investments in either motorways or other

⁴⁴ We choose a GMM-system over a GMM-difference model because it better accounts for the high persistence over time of the variables (Roodman, 2009). To make the number of instruments lower than the number of groups, we only use the second-order time lags as instruments and limit the regressors to the key variables of interest. As this implies excluding population –no longer controlling for ‘per capita’ effects – we replace the dependent variable with per capita GDP change. The GMM model is estimated for the full sample only because restricting the sample to less developed regions would imply having more instruments than regions.

roads, but a strong and highly significant connection with regional economic performance if other roads investment is interacted with government quality. The results hold for all different measures of government quality in our dataset. These findings suggest that, as hypothesised, positive rates of returns from infrastructure investment are mediated by the presence of adequate government institutions. Only certain types of transport infrastructure investment are associated with higher growth across the regions of Europe. In particular, improvements in secondary road network in sound government quality conditions are linked to higher growth. By contrast, the highly popular motorway development schemes which have been at the centre of development strategies mainly in the periphery of Europe – and in particular in Portugal and Spain – are not associated with the expected economic outcomes, even if promoted by credible, competent and transparent local governments (which is not always the case). Government institutions also help translating investments in maintenance of transport infrastructure into economic growth. Maintenance investment alone is weakly associated to economic performance, and this association may even turn negative, if conducted in environments where corruption and collusion are rife. In all cases, government quality on its own or after controlling for human capital endowments and innovation has been more strongly linked to economic growth than transport infrastructure investment.

These results can be partly ascribed to the differences in the two typologies of road infrastructure considered in our study. The category of other roads includes local and regional roads, whose construction tends to weigh less on public finances if compared to motorways expenditures and is often made to enhance within-region rather than between-region connectivity. This distinction is relevant especially for peripheral areas located far away from the main urban centres and with fewer economic resources at their disposal. Their lower visibility and potential electoral dividends also make this type of investment more likely to respond to real needs and cost-benefit considerations. The glitzier large-scale motorway projects are more visible and generally yield greater electoral returns, but are costlier and may take away vital resources from other key infrastructure interventions or other development axes which could generate greater economic returns.

When discussing the potential policy insights from these results, it is crucial to bear in mind some caveats. First, data constraints limit the possibility of drawing any causal conclusions from the analysis: time-varying omitted variables and reverse causality may still affect our estimates. Second, the time span covered is relatively limited, making it impossible to capture long-term growth trends. Third, our proxies for infrastructure investments are necessarily constrained by data availability: changes in road length of motorways and other roads, as well as national maintenance expenditures can be captured, but we cannot account for broader network effects (linked for example with the interactions between roads and railways or airports), traffic creation, and diversion effects.

Having acknowledged these limitations, our findings still offer relevant insights for economic development policies in Europe. First, the results of the analysis contribute to the increasing number of studies recognizing improvements of local institutions as a necessary prerequisite for efficient public spending, in general, and infrastructure investment, in particular (Acemoglu & Dell, 2010; Rodríguez-Pose & Di Cataldo, 2015; Rodríguez-Pose & Garcilazo, 2015). As Esfahani and Ramírez (2003) put it, “achieving better [economic] outcomes requires institutional and organizational reforms that are more fundamental than simply designing infrastructure projects and spending money on them” (Esfahani & Ramírez, 2003: 471). The re-shaping of institutional structures is a challenging task for policy-makers, as reforms will have to be designed specifically for the environment in which they are to be applied. In any case, our results indicate that ‘institution-building’ needs to be put at the top of the development agenda, if other types of development interventions – and, fundamentally, transport infrastructure interventions – are to become more effective.

A potential way to limit distortions in public investment decisions determined by political interests, pork-barrel politics, or corruption may be to set stricter rules for project evaluation and provide technical guidance to local governments lacking the administrative capacity to select the most profitable projects. Ex-ante and ex-post evaluations, monitoring analyses and appraisals – despite increasing legislation in this respect – are not yet a consolidated practice in all European regions. Highly objective evaluation techniques are unappealing for local politicians regularly trying to exert their influence over the investment’s decisions (Short and Knopp, 2005). Regions with weak government institutions require a more thorough following of their transport projects over the full cycle and a greater awareness of project specificities. As argued by a recent US Transportation Research Board (TRB) report, a key capability of infrastructure monitoring agencies is to be able to distinguish between the short-term and the long-term benefits of transport projects. This allows setting timeliness and maintenance-of-effort requirements according to the type of goal to be achieved. Short-term and long-term targets may be assigned specific implementation rules, but a uniform evaluation framework is recommended for each project (TRB, 2014). In the EU enforcing effective evaluation frameworks should require greater levels of enforcement by the European institutions awarding financial resources for infrastructure interventions. One way to do so would be to truly condition the disbursement of EU funds for infrastructure investment to the application of technical regulations for project evaluations.

Other policy implications of our analysis concern the type of transport investment more advisable for peripheral regions. Our empirical results challenge the vision, already disputed in the literature (e.g. Puga, 2002), that one way to foster economic convergence in the EU is to link peripheral locations with the economic heart of the continent through the establishment of a core network of costly long-distance corridors of transport infrastructure. Conversely, our evidence supports the

idea that, considering improvements in government quality, economically backward regions should strengthen regional roads in order to facilitate the creation of linkages between key local economic actors. In lagging areas, investing only in long-distance connections may provide incentives for the main economic assets of the region (being them skilled individuals or successful businesses) to re-locate elsewhere. Efforts to improve institutional conditions and promote local accessibility should be accompanied by initiatives targeting other key development drivers, such as education or innovation.

Overall, these policy indications are coherent with the ongoing reform of EU Cohesion Policy, increasingly prone to recognize different institutional capacities as drivers of persistent disparities and as major hindrances for regional convergence in Europe (Barca et al., 2012). Our findings indicate that considering place-based institutions as a key determinant of regional development may be the way forward to ensure effective development support, as long as it implies setting up consistent measures to condition the provision of additional funds on the proof of efficient spending from regional government authorities. Our results also suggest the need to pause and rethink about the interest and viability of many of the transportation policies financed with EU Structural Funds. Under the 2007-2013 budget period, almost half of EU Cohesion expenditures for transport infrastructure development were devoted to the realization of the Trans-European Transport Network (TEN-T), a planned set of road, rail, air, and maritime infrastructure investments that are intended to develop continuous North-South and East-West corridors in the continent. Despite a decline in infrastructure investment, transport infrastructure still attracts a considerable percentage of the almost €352 billion of Cohesion Policy for the period 2014-2020. A very large share of these funds has been or will be spent in lagging areas of Europe, precisely those where our analysis suggests that, unless there are significant improvements in government quality, the association of these funds with economic growth is likely to be limited. A coherent shift to a place-based approach to regional development should induce a thorough rethink of how new transport infrastructure investments can best contribute to future economic development across the regions of the EU.

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Appendix

A1 Variables description

Table A1.1
Description and source of variables

Variable	Source	Definition and notes
Change of log GDP	OECD Statistics	First difference of the natural logarithm of regional GDP in current euros, 1995-2009. Data for Romanian regions obtained from Eurostat.
Lagged GDP	OECD Statistics	Natural logarithm of regional GDP lagged by one year.
Investment in motorways	Eurostat	First difference of the number of kms of motorways, standardised by thousand regional inhabitants.
Investment in other roads	Eurostat	First difference of the number of kms of regional roads not classified as motorways, standardised by thousand regional inhabitants, 1995-2009. Missing values for all Portuguese regions.
Transport infrastructure maintenance	OECD Statistics	Spending on preservation of the existing transport network and maintenance expenditure financed by public administrations. Data at the national level, 1995-2009. Current euros as percentage of national GDP. Maintenance expenditures for road, rail, inland waterways, maritime ports and airports. Missing values for the Netherlands, Germany and Spain.
Road maintenance	OECD Statistics	Investment and maintenance expenditures for roads as percentage of GDP. Data at the national level, 1995-2009. Current euros as percentage of national GDP. Missing values for Germany and Spain.
Quality of Government (QoG)	Own calculation with QoG Institute data and World Bank Governance Indicators	EU Quality of Government (QoG) index elaborated by the University of Gothenburg, a survey-based index constructed around three main pillars: quality of education, public health care and law enforcement; impartiality in education, public health and legal protection; level of corruption in education, health care and the legal system. This index has been extended over time adopting the World Bank Governance Indicators developed by Kauffmann et al. (2009). See Charron et al. (2014) for a detailed explanation on how the index was constructed.
Control of Corruption	Own calculation with QoG Institute data and World Bank Governance Indicators	Section of the QoG combined index based on the calculated score from the answers of its inhabitants to the following questions: 'Corruption is prevalent in my area's local public school system.' (0-10); 'Corruption is prevalent in the public healthcare system in my area.' (0-10); 'In the past 12 months have you or anyone living in your household paid a bribe in any form to: health or medical services?' (y/n); 'In your opinion, how often do you think other citizens in your area use bribery to obtain public services?' (0-10)

Rule of Law	Own calculation with QoG Institute data and World Bank Governance Indicators	Section of the QoG combined index based on the calculated score from the answers of its inhabitants to the following questions: 'how would you rate the quality of the police force in your area?' (0-10); 'The police force gives special advantages to certain people in my area.' (0-10); 'All citizens are treated equally by the police force in my area' (1-4); 'Corruption is prevalent in the police force in my area' (0-10).
Government Effectiveness	Own calculation with QoG Institute data and World Bank Governance Indicators	Section of the QoG combined index based on the calculated score from the answers of its inhabitants to the following questions: 'how would you rate the quality of public education in your area?' (0-10); 'how would you rate the quality of the public healthcare system in your area?' (0-10); 'Certain people are given special advantages in the public education system in my area' (0-10); 'Certain people are given special advantages in the public healthcare system in my area.' (0-10); 'All citizens are treated equally in the public education system in my area.' (1-4); 'All citizens are treated equally in the public healthcare system in my area.' (1-4).
Government Accountability	Own calculation with QoG Institute data and World Bank Governance Indicators	Section of the QoG combined index based on the calculated score from the answers of its inhabitants to the following questions: 'In your opinion, if corruption by a public employee or politician were to occur in your area, how likely is it that such corruption would be exposed by the local mass media?' (0-10); 'Please respond to the following: Elections in my area are honest and clean from corruption.' (0-10).
Spatial weight of investment in motorways/other roads	Own calculation with Eurostat	Spatially weighted average of first difference of transport infrastructure endowment in neighbouring regions, calculated with an Euclidean distance matrix setting the threshold at the minimum distance for each region to have at least one neighbour.
Agricultural employment	Eurostat	Share of regional employment in NACE categories A (Agriculture, forestry and fishing) and B (Mining and quarrying).
Patent applications	Eurostat	Natural logarithm of the number of applications filled for patents of all types per thousand of inhabitants.
Human capital	Eurostat	Natural logarithm of the percentage of employed people (aged 25-64) with completed higher education (ISCED-97 levels 5 and 6).
Regional population	Eurostat	Thousands of residents in the region.
Gross fixed capital formation	Eurostat	Resident producers' acquisitions, less disposals, of fixed tangible or intangible assets. Hundred million euros of national currency (current prices). Available 2000-2009.

A2 Descriptive statistics

Table A2.1
Descriptive statistics

Variable	All regions			Less developed regions		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Regional GDP	2490	67062	86939	1050	34572	36196
Kms of motorways	2421	321	387	1012	219	374
Kms of other roads	2321	19273	17695	966	14785	9523
Motorways per thousand inhabitants	2459	0.142	0.134	1030	0.093	0.127
Other roads per thousand inhabitants	2321	9.555	8.273	966	8.285	6.586
Change in motorways per thousand inhabitants (investment in motorways)	2293	0.0033	0.012	960	0.005	0.014
Change in other roads per thousand inhabitants (investment in other roads)	2150	0.013	0.272	893	0.029	0.218
Transport infrastructure maintenance	1811	0.644	0.530	809	0.794	0.591
Road maintenance	1967	0.351	0.267	809	0.460	0.263
Quality of Government Index ^a	2490	0.169	0.960	1050	-0.420	1.017
Control of Corruption	2490	0.128	0.924	1050	-0.445	0.908
Rule of Law	2490	0.169	0.938	1050	-0.376	0.982
Government Effectiveness	2489	0.196	1.035	1050	-0.406	1.134
Government Accountability	2489	0.125	0.951	1050	-0.410	1.049
Spatial weight of investment in motorways	2324	0.0033	0.0054	980	0.0042	0.0065
Spatial weight of investment in other roads	2312	0.068	0.43	968	0.123	0.613
Agricultural employment	2490	7.807	9.20	1050	13.11	11.92
Patent applications	2490	70.27	93.57	1050	16.76	33.33
Human capital	2454	21.83	9.06	1018	18.06	7.86
Regional population	2490	2639	2470	1050	2248	1533
Gross fixed capital formation	1562	117.67	148.56	682	59.91	71.18

a / The Quality of Government Index is measured relative to the EU mean in 2010 = 0. The mean of 0.169 is due to the fact that not all Member States are included in the sample – countries for which there are no sub-national difference in QoG (e.g. Finland, Ireland, Baltic countries) are not considered in the analysis.

A3 Robustness checks

Table A3.1
Robustness checks – change of time-span

Dep. variable: Change of log GDP	Panel A				Panel B			
	Motorways		Other roads		Motorways		Other roads	
	FS (1)	LDR (2)	FS (3)	LDR (4)	FS (5)	LDR (6)	FS (7)	LDR (8)
Lagged GDP	-0.164*** (0.0181)	-0.213*** (0.0256)	-0.162*** (0.0205)	-0.217*** (0.0277)	-0.101*** (0.0190)	-0.141*** (0.0301)	-0.0977*** (0.0183)	-0.143*** (0.0295)
Investment in motorways	0.127** (0.0606)	0.0435 (0.105)			0.0362 (0.0525)	-0.0994 (0.0733)		
Investment in other roads			0.00124 (0.000883)	0.00182 (0.00172)			0.000745 (0.000464)	0.000840 (0.000508)
Quality of Government	0.0366*** (0.00667)	0.0487*** (0.0134)	0.0254*** (0.00576)	0.0483*** (0.0127)	0.0266*** (0.00472)	0.0597*** (0.00787)	0.0263*** (0.00470)	0.0630*** (0.00798)
(Investment in motorways) × (QoG)	-0.113 (0.0874)	-0.185 (0.134)			-0.0775 (0.0781)	-0.123 (0.108)		
(Investment in other roads) × (QoG)			0.00796*** (0.00295)	0.0124* (0.00695)			0.00208*** (0.000782)	0.00365*** (0.00108)
Spatial weight of investment in motorways	0.627*** (0.155)	0.453** (0.192)			0.510*** (0.165)	0.163 (0.231)		
Spatial weight of investment in other roads			0.00641*** (0.00168)	0.00426* (0.00222)			0.00346** (0.00151)	0.00296 (0.00200)
Agricultural employment	-0.00298*** (0.000954)	-0.00334*** (0.00124)	-0.00383*** (0.000838)	-0.00377*** (0.00116)	-0.00441*** (0.000736)	-0.00445*** (0.00101)	-0.00437*** (0.000723)	-0.00445*** (0.00102)
Patent applications	0.00506*** (0.00178)	0.00290 (0.00328)	0.00324* (0.00165)	0.00263 (0.00279)	0.00799*** (0.00246)	0.0106*** (0.00326)	0.00943*** (0.00245)	0.0122*** (0.00322)
Human capital	0.0186*** (0.00452)	0.0371*** (0.0102)	0.0157*** (0.00497)	0.0359*** (0.0134)	0.0109 (0.00841)	0.0481*** (0.0147)	0.00960 (0.00849)	0.0467*** (0.0152)
Regional population	-2.17e-05* (1.24e-05)	-1.31e-05 (2.52e-05)	-1.71e-05 (1.19e-05)	6.74e-07 (2.26e-05)	-1.91e-05** (7.67e-06)	1.33e-06 (1.06e-05)	-1.80e-05** (7.64e-06)	9.22e-06 (9.05e-06)
Region dummies	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,625	672	1,496	612	1,798	750	1,754	726
R ²	0.218	0.235	0.242	0.264	0.505	0.494	0.506	0.508
NUTS regions	166	70	161	66	166	70	161	66

Clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Notes: FS = full sample; LDR = less developed regions.

Table A3.2
Robustness checks – change of specification

Dep. variable: Change of log GDP	Panel A				Panel B			
	Motorways		Other roads		Motorways		Other roads	
	FS (1)	LDR (2)	FS (3)	LDR (4)	FS (5)	LDR (6)	FS (7)	LDR (8)
Lagged GDP					-0.142*** (0.0218)	-0.200*** (0.0307)	-0.140*** (0.0213)	-0.203*** (0.0298)
Investment in motorways	0.0616 (0.0564)	-0.0721 (0.0785)			0.0275 (0.0527)	-0.0570 (0.0750)		
Investment in other roads			0.000492 (0.000520)	0.000325 (0.000545)			0.00105** (0.000448)	0.00115** (0.000503)
Quality of Government	0.0276*** (0.00336)	0.0414*** (0.00559)	0.0191*** (0.00323)	0.0394*** (0.00537)	0.0308*** (0.00516)	0.0672*** (0.0113)	0.0310*** (0.00514)	0.0712*** (0.0114)
(Investment in motorways) × (QoG)	-0.0606 (0.0773)	-0.100 (0.103)			-0.0772 (0.0769)	-0.0615 (0.114)		
(Investment in other roads) × (QoG)			0.00227** (0.000887)	0.00358*** (0.00106)			0.00231*** (0.000831)	0.00401*** (0.00122)
Spatial weight of investment in motorways	0.677*** (0.148)	0.454** (0.188)			0.434** (0.171)	0.0876 (0.240)		
Spatial weight of investment in other roads			0.00421** (0.00168)	0.00415* (0.00217)			0.00264* (0.00154)	0.00194 (0.00196)
Agricultural employment	-0.00122*** (0.000357)	-0.000962** (0.000427)	-0.00187*** (0.000319)	-0.00139*** (0.000440)	-0.00468*** (0.000924)	-0.00445*** (0.00115)	-0.00466*** (0.000906)	-0.00445*** (0.00113)
Patent applications	0.00358** (0.00166)	0.00372 (0.00289)	0.00214 (0.00180)	0.00352 (0.00306)	0.00753*** (0.00271)	0.0121*** (0.00351)	0.00893*** (0.00267)	0.0136*** (0.00344)
Human capital	0.0103** (0.00416)	0.0196** (0.00759)	0.00704 (0.00450)	0.0158 (0.00953)	0.0135 (0.00990)	0.0435** (0.0176)	0.0135 (0.0101)	0.0428** (0.0182)
Regional population	-2.29e-05*** (6.05e-06)	-1.69e-05* (9.57e-06)	-2.59e-05*** (6.04e-06)	-1.33e-05* (7.13e-06)	-3.66e-05*** (1.19e-05)	-0.000110** (4.96e-05)	-3.28e-05*** (1.20e-05)	-9.98e-05** (4.88e-05)
Gross fixed capital formation					7.59e-05** (3.66e-05)	0.000481** (0.000205)	6.99e-05* (3.71e-05)	0.000471** (0.000203)
Region dummies	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2,269	936	2,134	876	1,535	662	1,498	642
R ²	0.429	0.404	0.445	0.421	0.527	0.521	0.527	0.536
NUTS regions	166	70	161	66	166	70	161	66

Clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. FS = full sample; LDR = less developed regions.

Table A3.3
Robustness checks – three-year averages and cross-section dataset

Dep. variable: Change of log GDP	Variables averaged over 3-year periods		Cross-section dataset	
	(1)	(2)	(3)	(4)
Lagged GDP	-0.0332*** (0.0125)	-0.0292** (0.0135)		
Investment in motorways	0.178 (0.122)		-0.213 (0.201)	
Investment in other roads		0.00162 (0.00279)		-0.0180 (0.0123)
Quality of Government	0.0388*** (0.00486)	0.0186*** (0.00429)	0.00489* (0.00295)	0.00430 (0.00308)
(Investment in motorways) × (QoG)	-0.144 (0.155)		-0.0988 (0.263)	
(Investment in other roads) × (QoG)		0.00690*** (0.00205)		0.0159** (0.00746)
Spatial weight of investment in motorways	1.111*** (0.319)		0.622*** (0.221)	
Spatial weight of investment in other roads		0.00854*** (0.00296)		0.0240*** (0.00714)
Agricultural employment	-0.00248*** (0.000749)	-0.00366*** (0.000761)	-0.000124 (0.000122)	-0.000118 (0.000120)
Patent applications	0.00362* (0.00210)	-0.000399 (0.00211)	-0.00112 (0.00090)	-0.00113 (0.00086)
Human capital	0.0153*** (0.00514)	0.00955* (0.00544)	0.0113*** (0.00333)	0.0129*** (0.00396)
Regional population	-2.31e-05*** (7.59e-06)	-2.81e-05*** (7.20e-06)	-3.13e-07 (3.17e-07)	-2.13e-07 (3.23e-07)
Region dummies	✓	✓		
Year dummies	✓	✓		
Observations	815	769	166	161
R ²	0.410	0.436	0.492	0.553
NUTS regions	166	161	166	161

Clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table A3.4
Robustness checks – GMM estimates

Dep. variable: Change of log per capita GDP	GMM-system (2 nd order lags as instruments)	
	(1)	(2)
Lagged per capita GDP	-0.0305*** (0.00499)	-0.0494*** (0.00757)
Investment in motorways	-0.0192 (0.138)	
Investment in other roads		-0.00452 (0.00328)
Quality of Government	0.00612** (0.00310)	0.00888** (0.00429)
(Investment in motorways) × (QoG)	-0.420 (0.262)	
(Investment in other roads) × (QoG)		0.0122* (0.00724)
Spatial weight of investment in motorways	0.518* (0.273)	
Spatial weight of investment in other roads		0.0235*** (0.00672)
Year dummies	✓	✓
Observations	2,289	2,158
NUTS regions	166	161
Instruments	136	140
AR (2) test (p-value)	0.85 (0.393)	0.36 (0.719)

Clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Drivers of employment and social inclusion in the regions of the European Union

Marco Di Cataldo & Andrés Rodríguez-Pose

Abstract

The European Union promotes development strategies aimed at producing growth with “a strong emphasis on job creation and poverty reduction”. However, whether the economic conditions in place in EU regions are ideal for the generation of high- and low-skilled employment and labour market inclusion is unclear. This paper assesses how the key factors behind EU growth strategies – infrastructure, human capital, innovation, quality of government – condition employment generation and labour market exclusion in European regions. The findings indicate that the dynamics of employment and social exclusion vary depending on the conditions in place in a region. While higher innovation and education contribute to overall employment generation in some regional contexts, low-skilled employment grows the most in regions with a better quality of government. Regional public institutions, together with the endowment of human capital, emerge as the main factors for the reduction of labour market exclusion – particularly in the less developed regions – and the promotion of inclusive employment growth across Europe.

Keywords: social exclusion, employment, skills, regions, Europe.

JEL Classification: R23, J64, O52.

Published in *Regional Studies*.

1. Introduction

The European Union is undertaking an effort to counterbalance the effect of the crisis on unemployment by trying to get people back into work. Employment generation is targeted by strategies such as Europe 2020, aimed at producing inclusive economic growth with “a strong emphasis on job creation and poverty reduction” (European Commission, 2010). However, concerns remain about the ‘inclusiveness’ of these measures.

The challenge for the promotion of ‘inclusive’ or ‘equitable’ growth and cohesion in EU labour markets is double: competition from emerging markets and skilled-biased technological development. These challenges, it is claimed, raise the demand for skilled workers, while threatening the wages and jobs of the unskilled (Atkinson, 2009; 2013) and pose a serious risk for the creation of a more inclusive society. The situation has worsened with the current economic and financial crisis, which has fundamentally hit workers with few formal qualifications and reverted a two-decade-long decline in people at risk of poverty or social exclusion⁴⁵ in the EU (European Commission, 2013). According to recent estimates, in 2013 more than 120 million people (1 out of every 4 EU inhabitants) were at risk of poverty and social exclusion (European Commission, 2014a).

Strategies such as Europe 2020 have been designed to counter these trends and promote employment by focusing in particular on those in highest need. However, how these policies can lead to inclusive labour markets is still unclear (Bilbao-Osorio et al., 2014). It is uncertain what types of jobs will be generated, what are the optimal conditions for creating more jobs, and who will benefit or lose out from any potential job creation.

The aim of this paper is to investigate the relationship between economic factors and regional labour market outcomes by assessing how the elements on which the EU has invested – and plans to invest – the most affect employment generation and social inclusion in European regions. We focus on the four different axes regarded as key constituents of economic growth: human capital, research and innovation, infrastructure endowment, and the quality of public institutions.⁴⁶

Each of these axes represents a basic component of the framework in which labour investments take place. A growing body of literature has studied their potential impact on labour market

⁴⁵ Social exclusion is a broad concept involving factors that may leave specific groups in society vulnerable. These include unemployment, lack of access to education, to childcare and to healthcare facilities, inadequate living conditions, and scarce social participation. In this study we focus particularly on labour market exclusion.

⁴⁶ For each of these elements, a large body of empirical research has examined their effect on economic growth in the EU regional context. See e.g. Rodríguez-Pose & Vilalta-Bufí (2005), OECD (2009) for human capital; Fagerberg et al. (1997), Bottazzi & Peri (2003), Crescenzi & Rodríguez-Pose (2011) for innovation; Moreno et al. (1997), Crescenzi & Rodríguez-Pose (2012) for infrastructure; and Crescenzi et al. (2016) for institutions.

outcomes, yet much less research has concentrated on their contribution to employment generation by skill-type and to social inclusion in the EU regional context. This paper tests the extent to which each development axis has been associated to employment generation and social inclusion in EU regions between 1999 and 2010. The analysis distinguishes employment by skill level, sub-dividing regions by level of economic development. The aim is to identify the conditions that exacerbate or reduce labour market disparities in different economic contexts. Additional light is shed on the dynamics of social exclusion by using long-term unemployment as a proxy for labour market marginalisation while testing for the presence of a long-run effect of economic endowments on labour conditions.

The findings of the analysis stress that the economic factors behind employment growth are not always the same as those conditioning the evolution of social exclusion. As a consequence, targeting job creation and social inclusion goals requires different policy options depending on the specific needs of regions. While in the better-off EU regions innovation capacity contributes to employment growth, the presence of a highly-educated population drives employment in the less developed areas. The key result of the analysis is that the quality of regional government emerges as a fundamental element for the creation of employment for workers with limited skills, particularly in the periphery of Europe. Both human capital and government quality facilitate labour market inclusion: regions with a more qualified workforce and better public institutions have significantly reduced the share of long-term unemployment. The endowment of transport infrastructure is, at best, insignificant for generating regional employment and reducing labour market disparities.

2. Social inclusion and the Europe 2020 strategy

The Europe 2020 growth and jobs strategy was launched in 2010. For the first time a development strategy adopted by the EU incorporates social inclusion objectives as headline targets, alongside innovation, education, and environmental goals. Through Europe 2020, the EU expects to reduce the population at risk of poverty and social exclusion by at least 20 million (Social Protection Committee, 2011). Investing to make the European society more equitable and inclusive is part of broader vision aimed at ensuring economic recovery and social stability in the Continent for the years to come.

Social exclusion is a broad concept involving all factors that may leave social groups isolated⁴⁷ (European Commission, 2004). In this study, we focus on labour market exclusion, that is, the

⁴⁷ Social exclusion is defined as: “a process whereby certain individuals are pushed to the edge of society and prevented from participating fully by virtue of their poverty, or lack of basic competencies and lifelong learning opportunities, or

persistence of large numbers of people excluded from work. One of the indicators used by the EU to calculate people at risk of labour market exclusion is the long-term unemployment (Atkinson et al., 2002). We refer to this variable in our empirical analysis as proxy for social exclusion.

In order to attain Europe 2020 objectives on social inclusion, the EU has set up a “European Platform against poverty and social exclusion”, including a number of financial instruments. The most important are the European Social Fund (ESF) – of which 20% will be earmarked to fighting poverty and social exclusion –, the EU Programme for Employment and Social Solidarity (PROGRESS), and the European Globalisation and Adjustment Fund (EGF) (European Commission, 2011).

Despite all these initiatives, recent trends on social exclusion in the EU have been far from encouraging (European Commission, 2014a). Moreover, the financial instruments targeting social inclusion often operate with limited resources for the task at hand. For 2014 and 2015 only 7% of all finances allocated to Europe 2020 flagship initiatives have been devoted to the European Platform against poverty (European Commission, 2014b). A report assessing the progress towards the achievement of Europe 2020 social inclusion objectives has certified that in many Member States social inclusion issues are not given appropriate attention, and “a balanced approach to the Europe 2020 agenda, where the poverty and social exclusion target and the objective of inclusive growth should achieve the same amount of attention as the other objectives of Europe 2020, has still to be achieved” (Frazier & Marlier, 2013: 11).

If the direct EU measures to address social exclusion have so far not delivered the expected outcomes, this may be due either to a lack of sufficient finances devoted to this scope, or to a lack of capacity to manage resources adequately. Our analysis then aims to verify what type of regions have been most successful in creating employment and stemming long-term unemployment.

3. Growth factors, employment, and social inclusion

The development factors leading to economic growth have been theorised as affecting employment generation and social inclusion as well. In particular, four factors regarded as essential for economic growth – transport infrastructure, innovation, human capital, and government quality – have been related by the literature to employment/social conditions. This paper focuses on these four factors over the 1999-2010 period. The link between each of these

as a result of discrimination. This distances them from job, income and education opportunities as well as social and community networks and activities” (European Commission, 2004: 8).

factors and employment generation and social exclusion, as referred to by the theoretical and empirical literature, is presented below.

Transport infrastructure

There is a growing body of literature making the connection between transport accessibility and changes in the labour pool and in the demand for labour (Seitz & Licht, 1995; Dalenberg & Partridge, 1995; Cohen & Paul, 2004; Jiwattanakulpaisarn et al., 2010). The construction, operation and maintenance of transport infrastructure is also used as a means to create employment (OECD, 2002). Transport infrastructure is considered capable of attracting private investment and generating jobs, through increases in the demand for labour. However, private investment may take place even in absence of transport improvements and higher transport accessibility may displace other economic activities (Venables et al., 2014). Moreover, if improved transport conditions determine increases in firm output in unchanged market-demand conditions, cheaper transport inputs may lead firms to a substitution effect away from the use of labour (Lakshmanan et al., 2001; Vickerman, 2007). Therefore, the evidence on the link between infrastructure and employment remains ambiguous.

Transport is also seen as essential in determining social outcomes (Banister & Hall, 1981). Individuals facing transport-related constraints, such as limited mobility, inaccessibility to goods and services and ‘lock-out’ from planning and decision-making processes may end up socially excluded (Lucas, 2012). However, transport disadvantage does not always lead to social exclusion and areas with good transport may have pockets of socially excluded individuals (Kenyon et al., 2002; Currie & Delbosc, 2010; Lucas, 2012). Similarly, low levels of accessibility may correspond to high social inclusion (Preston & Raje, 2007). Whether improvements in transport increase or reduce social exclusion depends on how changes in the transport system affect the generalised costs of travel for those at risk. In general, if transport services are far away from where the socially excluded live, the costs (i.e. the psychologically weighted sum of travel times) increase and the probability of participation in society of vulnerable groups is reduced (Schönfelder & Axhausen, 2003).

Innovation

The effect of technological development on employment growth and social inclusion is equally controversial. A long-standing debate has addressed the labour implications of innovation. Economic theory generally predicts that the short-term effect of new technologies is a reduction of employment. In the medium/long-run, however, the market would counterbalance the effect,

producing increases in labour demand. This mechanism of compensation, however, is subject to a set of conditions that must be in place for it to work (e.g. Vivarelli, 2014). The picture is further complicated by the ‘skill-biased technological change’ hypothesis (Griliches, 1979), which stresses that the introduction of new technologies favours the creation of high-skilled employment. Hence, in presence of skill-biased innovation, unskilled unemployment increases.

The empirical evidence on the link between innovation and employment is mixed. Most analyses support a positive impact of innovation on employment generation (e.g. Van Reenen, 1997; Greenan & Guellec, 2000; Bogliacino et al., 2011). The skill-biased technological change concept also goes in this direction (Berman et al., 1994; Machin & Van Reenen, 1998), although some research suggests a more complex relationship, depending on the level of skills available in a territory (e.g. Piva & Vivarelli, 2002; Autor et al., 2003). Evidence from developing countries indicates that the presence of institutional barriers makes employment creation from technological development less likely to occur (Vivarelli, 2014).

Technological development and innovation can also solve social problems and favour pro-poor employment, but this link is far from automatic (Cozzens et al., 2007; Alzugaray et al., 2012). The development of knowledge economies has at times implied income and social inequalities, with more technologically advanced regions and more qualified workers advantaged at the expense of poorer areas and less skilled individuals. Lee and Rodríguez-Pose (2013), for instance, find that innovation capacity leads to higher labour market inequalities. Only if research and innovation are adequately tailored to the needs of end-users, such as disadvantaged local communities and marginalised workers, their impact on social cohesion can become positive (Cozzens et al., 2007).

Human capital

Different views also exist on whether employment and social exclusion are influenced by human capital and education. The dominant view is that the stock of human capital has both direct and indirect effects on employment. The direct effects stem from the greater employability of workers with higher human capital in markets that demand skills, as in the European case. The indirect effects are related to the positive externalities human capital generates. Highly-educated individuals attract other human capital (Berry & Glaeser, 2005) and this external effect produces an increase in employment, especially in areas endowed with higher shares of highly-skilled (Glaeser et al., 1995; Simon, 1998).

Education also fosters participation in the labour market and social mobility for the poorest in society. Winters (2013) finds that human capital concentration determines higher employment, through increases in labour market participation. This is particularly true for less-skilled workers.

Additional external effects of higher education rates are decreases in criminal activity (Lochner & Moretti, 2004) and increases in civic participation (Milligan et al., 2004) and quality of life (Shapiro, 2006). All of these externalities facilitate labour market inclusion.

By contrast, opponents of the human capital model believe that labour market participation and individual earnings depend more on the personal ability and less on educational attainments (see Sparkes, 1999).

Government quality

Finally, social exclusion and employment outcomes are influenced by institutional quality. Strengthening institutional and administrative capacity, reducing the administrative burden, and improving the quality of legislation can have beneficial effects on labour demand, wages, and employment (Knack, 1999).

Well-functioning institutions are regarded as a precondition for the promotion of effective social development policies, in line with Europe 2020 goals (European Commission, 2015). Lack of accountability and corruption distort resource allocation, incentivising investment in capital-intensive projects at the expense of social expenditure (Gupta et al., 2002). Good governance additionally contributes to social welfare in cases where governments are more trustworthy, impartial, and less corrupt (Rothstein et al., 2012). Government quality is also positively related to welfare spending (Rothstein et al., 2012) and helps reduce income inequalities (Knack, 1999). There may also be an indirect effect of government quality on labour market participation, through access to sanitation and health care or schooling. The socially excluded have less access to public services and good government may facilitate a more equal delivery of such services (Lewis, 2006).

While most empirical studies on the role of institutions are performed at the national level, social spending increasingly depends on regional governments and their quality (Deacon et al., 2007). The key role of regional and local government institutions for limiting social exclusion has been theoretically postulated – sub-national governments are essential to uncover local bottlenecks perpetuating social exclusion and design bottom-up policies accordingly (Barca et al., 2012) – but no empirical evidence has yet attempted to confirm it.

4. Research on employment generation and social inclusion in EU regions

The dynamics of employment and unemployment in Europe have been analysed in a large number of studies. Less research, however, has been carried out at the regional level. Regions are nevertheless important, both because in the multi-level governance framework of the EU labour market policy has traditionally been decentralised (Scarpetta, 1996) and because an increasing share of economic resources are devoted to generating employment in regions of Europe, through Cohesion Policy interventions, European and national employment schemes, and other European, national, and local policies.

The main interest of research on employment in EU regions has been to test convergence theories and assess how change in economic structure and sectoral specialisation affects regional employment (e.g. Martin & Tyler, 2000; Marelli, 2004), or to link unemployment to increasing regional polarisation (Martin & Tyler, 2000; Overman & Puga, 2002; Cosci & Sabato, 2007). The determinants of long-term unemployment in European regions have, by contrast, attracted much less attention (e.g. Bornhorst & Commander, 2006; Perugini & Signorelli, 2007). There is no research making a connection between unemployment and existing economic development conditions of the kind analysed in this paper. Similarly, there is no evidence about how labour market determinants affect employment at different levels of skill composition: high-skilled vs. low-skilled employment. Consequently, we know little about how vulnerable workers with low levels of education and training are conditioned by structural economic and labour market factors. Despite a growing interest on the study of social cohesion in the EU (e.g. Atkinson et al., 2002; Atkinson, 2009), the analysis of which policy measures and which conditions are more effective for the promotion of inclusive regional employment remains underexplored.

Our work examines how the four different development axes associated with European regional interventions affect employment promotion in EU regions and contribute to social inclusion/exclusion, long-term unemployment, and to changes in labour market disparities. In order to test the effect of growth determinants on labour market outcomes, we develop empirical models of employment and long-term unemployment change, including traditional labour market determinants as controls. The most often used set of explanatory factors for explaining change in employment concerns regional industrial structure (e.g. Martin and Tyler, 2000). Other works have explained differences in employment growth intensity by looking at labour market governance and institutions (Dunford, 1995; Nickell & Layard, 1999; Perugini & Signorelli, 2007; Huber, 2013), such as differences in unionisation rates and unemployment benefits. These factors are however generally set nationally (Nickell et al., 2005). The existing literature has also

devoted great attention to Okun's (1970) law: i.e. the relationship between the change in employment/unemployment and GDP growth. Okun considered the direction of causality as running from (un)employment to economic growth, however most estimates of the Okun coefficient look at the inverse relationship (Prachowny, 1993). Finally, some empirical models (e.g. Perugini & Signorelli, 2007) are completed by other variables describing the structure of the regional labour market (labour market flexibility, proportion of employees).

5. Employment, unemployment, and social exclusion: key facts

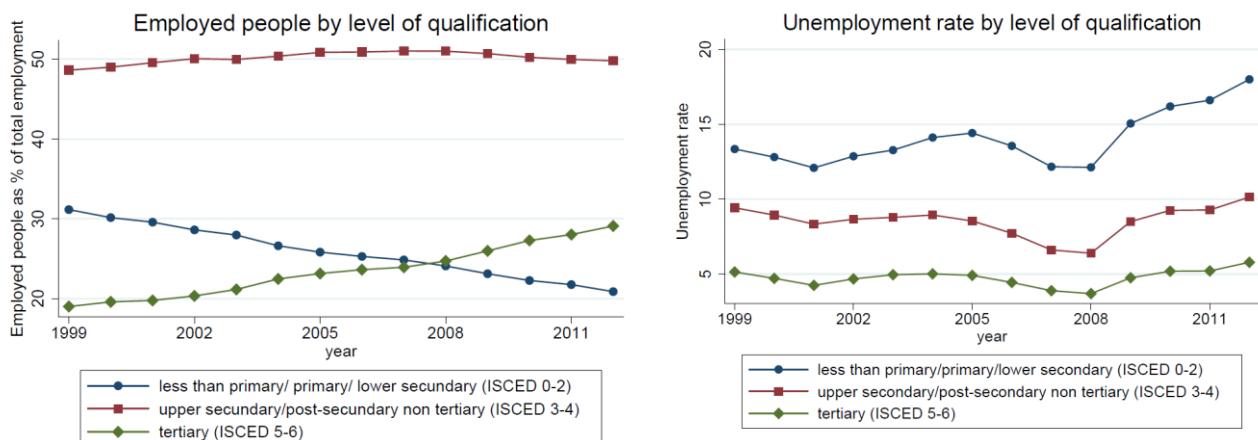
Over the past 15 years the composition of EU employment has changed significantly. One of the most striking changes has occurred in the share of employed people with high- versus low-skills. As shown in the left-hand graph of Figure 1, in 1999 less than two in ten workers held a higher education degree. By 2012 the proportion had increased by 50%, to about three in ten.⁴⁸ Low-skilled employment has followed an opposing trend: starting from a relatively high value in 1999 (over 30% of the total workforce holding less than primary/lower secondary level of education degree), in 2012 only 20% of those in employment had left school without formal qualifications. Overall, employment in the EU has followed a strong upskilling process.

However, the change in the composition of employment has been associated with an important variation in unemployment by skills-type (European Commission, 2013). Unemployment for medium-skilled and high-skilled changed only marginally from 1999 onwards. Jobs for the low-skilled, by contrast, have declined, causing unemployment rates for this group to shoot up from 12% (2001) to 18% (2012) (right-hand graph, Figure 1). Simultaneously, the percentage of long-term unemployed as share of total unemployment remained stable until 2006, dropped to its lowest level in 2009⁴⁹ and then started to rise until 2012 (Appendix A1).

⁴⁸ In this paper we use the definitions of levels of education adopted by the EU Labour Force Survey (LFS), which are based on UNESCO's International Standard Classification of Education (ISCED).

⁴⁹ While the share of unemployed being long-term unemployed reached the lowest level in 2009, the long-term unemployment rate, as a result of the crisis, grew considerably in that very year. Hence, the long-term unemployment rate reflects to a greater extent the immediate shock of the crisis than the share of unemployed being long-term unemployed. Since 2009, however, both variables have co-evolved in a similar way, rising moderately between 2009 and 2012. Both indicators are correlated at 75% during the period of analysis. Because of the one-off shock provoked by the crisis in the long-term unemployment rate, we have preferred to use the share of unemployed being long-term unemployed as an indicator that is less affected by the immediate short-term shock linked to the beginning of the crisis. In any case, in order to assess the robustness of the results, we resort to the long-term unemployment rate as an alternative to the share of unemployed being long-term unemployed in the GMM analysis presented in Table 4.

Figure 1
Percentage of employed and unemployment rate by level of qualification in the EU



Source: Authors' own elaboration with Eurostat data.

Figure 2 illustrates the geographical distribution of long-term unemployment⁵⁰ in EU regions. The highest long-term unemployment is found in Southern Italy, Eastern Germany, and Eastern Europe, particularly in Slovakia. While all regions of the Mezzogiorno (Southern Italy) and many regions of Germany managed to reduce the proportion of long-term unemployed between 1999 and 2012, in Eastern Europe only some regions of Poland, Romania, and Hungary, have seen long-term unemployment decrease. The share of the long-term unemployed has risen in Northern Italy, Northeastern France, Ireland, Central and Eastern Spain, and the UK. The crisis has aggravated the long-lasting skills mismatch by expanding the pool of highly educated workers driven towards less skilled jobs, consequently displacing the low-skilled into long-term unemployment⁵¹ (Livanos & Núñez, 2012).

Long-term and low-skilled unemployed represent those at a higher risk of marginalisation and persistent exclusion. Low-skilled workers are more likely to become long-term unemployed when losing their jobs (European Commission, 2013) and long periods of inactivity lead to skill loss (Pissarides, 1992; Ljungqvist & Sargent, 1998). Therefore, the recent growth in long-term unemployment is related to the increase in low-skilled unemployment. Especially since the beginning of the crisis, the share of people at risk of poverty and social exclusion has continued to rise, making European targets on poverty and social exclusion difficult to meet (European

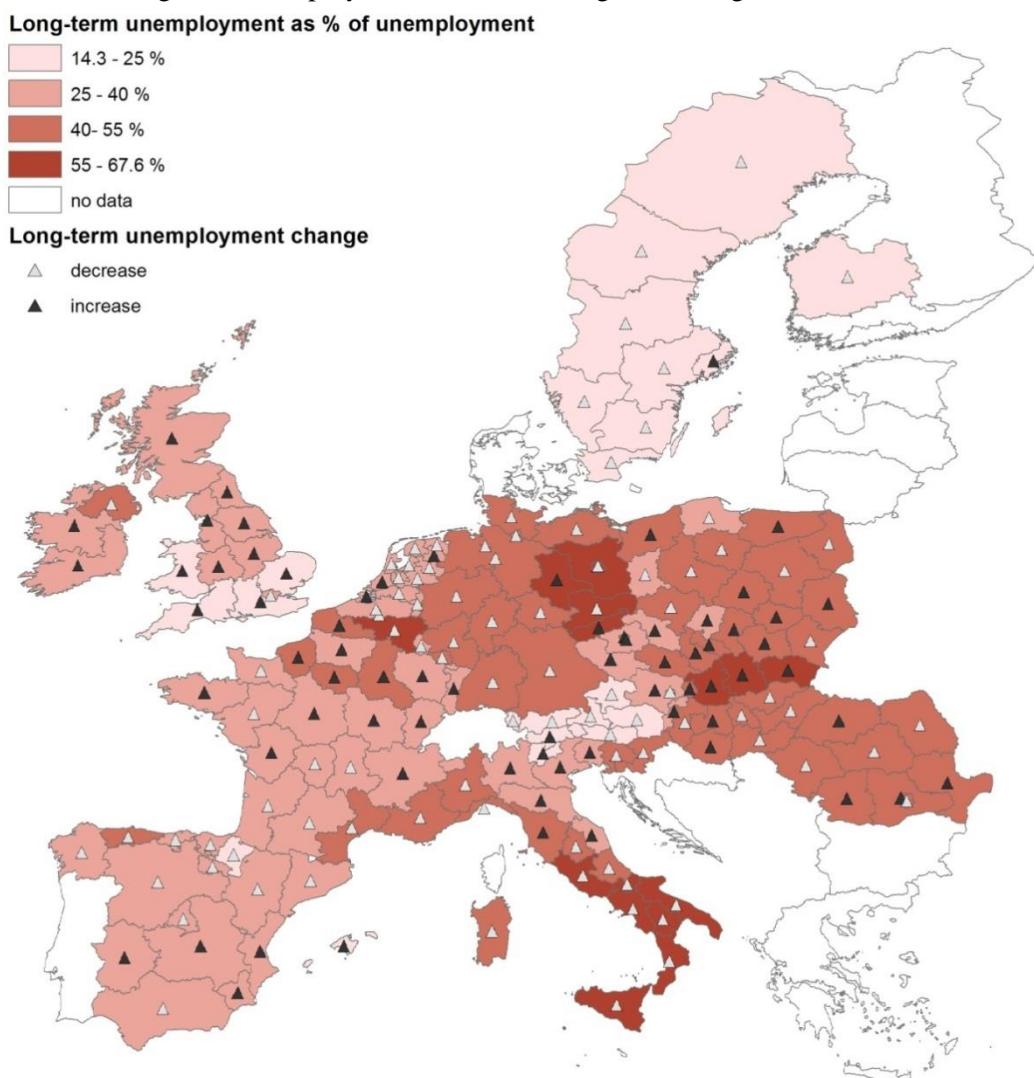
⁵⁰ Long-term unemployed are defined by Eurostat as those individuals unemployed for 12 months or more. Unemployment refers to the population of jobseekers aged 15 to 74 who are available to start work within the next two weeks and who have actively sought employment at some time during the last four weeks.

⁵¹ When the labour market adjusts to negative shocks by pushing skilled people towards lower level occupations, this progressively leads to a concentration of unemployment among the least qualified groups (Reder, 1964). This involuntary exclusion from employment is of persistent nature, and highly spatially concentrated. A recovery in the labour demand may be insufficient to fully revert the process, making labour market policy intervention necessary (Gordon, 2006).

Commission, 2013; Frazier & Marlier, 2013). Similar trajectories are visible in other areas, such as jobless households and the proportion of people facing material deprivation (Social Protection Committee, 2013). Put together, these trends suggest increases in the number of people requiring welfare support. The challenge for the EU thus goes beyond bringing unemployment back to the pre-crisis levels, and includes unwinding the cumulative social effects determined by the rise in long-term unemployment. In order to identify what policies are needed to revert these trends and to recognise the areas at a higher risk, it is necessary to first understand what are the factors behind change in social exclusion in Europe.

Figure 2

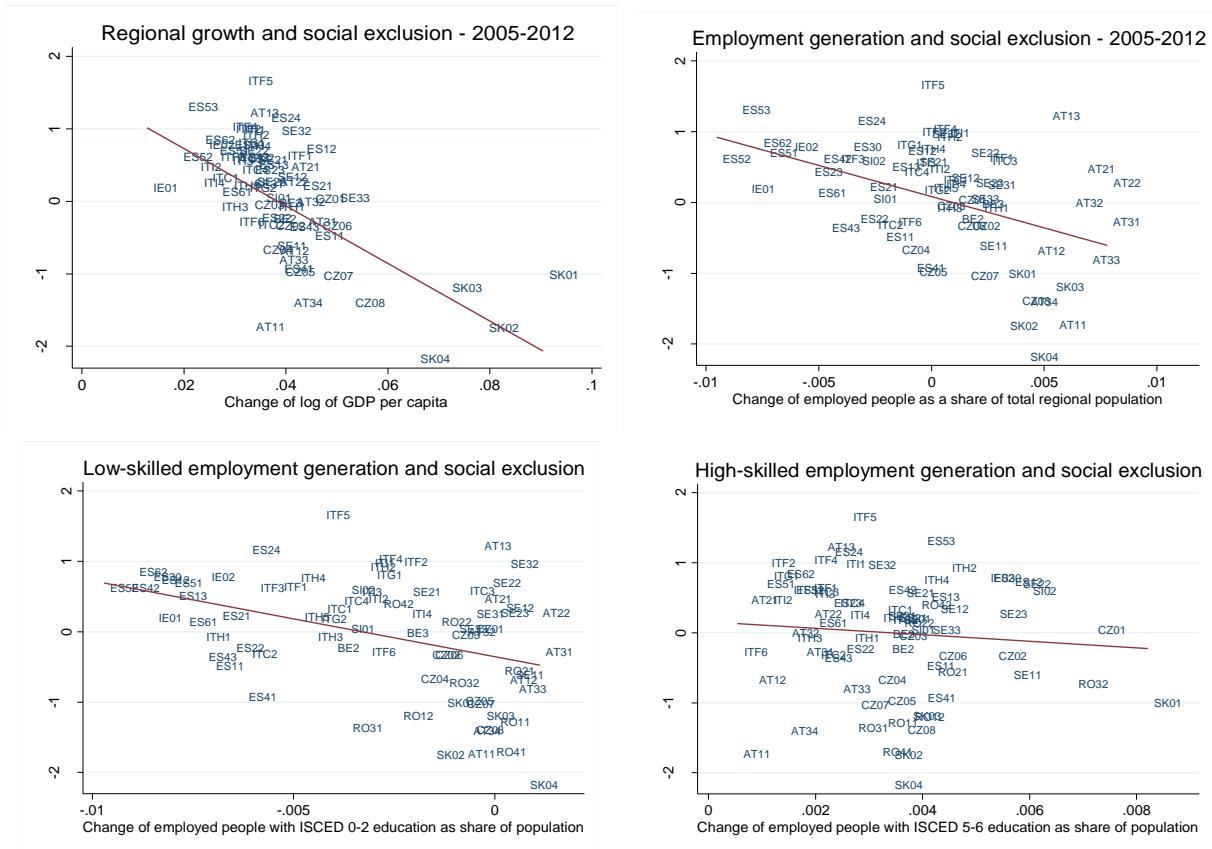
Long term-unemployment level and change in EU regions, 1999-2012



Source: own elaboration with Eurostat data.

A first descriptive picture is derived from plotting the regional data on people at risk of poverty or social exclusion from Eurostat Regio, available from 2005 to 2012 for a limited number of EU regions (Figure 3).⁵²

Figure 3
Scatterplot correlations: economic growth and social exclusion;
employment by skill-level and social exclusion



Source: authors' own elaboration with Eurostat data.

The top quadrants of Figure 3 show that economic growth and employment creation are associated with a reduction in social exclusion during this period. De-composing employment growth into high-skilled and low-skilled adds nuance to the social exclusion picture. The relationship between changes in low-skilled employment and in social exclusion is negative and significant, suggesting that employment conditions for the poorest have improved in regions witnessing the lowest reduction in low-skilled employment (Figure 3, bottom left quadrant). Increases in high-skilled employment, instead, are not associated with a reduction in people at risk of poverty or social exclusion (Figure 3, bottom right quadrant). We investigate more thoroughly the determinants of change in social exclusion in the next section.

⁵² The variable is available at the regional level only for Austria, Belgium, Czech Republic, Italy, Ireland, Spain, Romania, Sweden, and Slovakia.

6. Models and data

This section aims to identify the local endowments (human capital, innovation, infrastructure, quality of government) contributing to the generation of employment, high-skilled employment, low-skilled employment, and to the reduction of long-term unemployment. The models allow assessing the employment/unemployment long-term performance of different EU regions on the basis of specific economic characteristics.

Two versions of the models are estimated. The first employs classic panel techniques – fixed effects and random effects – while the second is structured as a dynamic panel AR(1) model, minimising endogeneity issues by employing Generalised Method of Moments (GMM) techniques.

The models, for region i at time t , are as follows:

$$\Delta L_{i,t} = \beta \text{ growth factors}_{i,t} + \gamma \Delta \log GDP p/c_{i,t} + \delta X_{i,t} + \varphi_i + \tau_t + \varepsilon_{i,t} \quad (1)$$

$$\Delta LTU_{i,t} = \beta \text{ growth factors}_{i,t} + \gamma \Delta \log GDP p/c_{i,t} + \delta X_{i,t} + \varphi_i + \tau_t + \varepsilon_{i,t} \quad (2)$$

And:

$$\Delta L_{i,t} = \alpha L_{i,t-1} + \beta \text{ growth factors}_{i,t} + \gamma \Delta \log GDP p/c_{i,t} + \delta X_{i,t} + \varphi_i + \tau_t + \varepsilon_{i,t} \quad (3)$$

$$\Delta LTU_{i,t} = \alpha LTU_{i,t-1} + \beta \text{ growth factors}_{i,t} + \gamma \Delta \log GDP p/c_{i,t} + \delta X_{i,t} + \varphi_i + \tau_t + \varepsilon_{i,t} \quad (4)$$

Where:

$\Delta L_{i,t}$ is divided into $\Delta tL_{i,t}$, $\Delta hsL_{i,t}$ and $\Delta lsL_{i,t}$, meaning that, in total, four dependent variables are considered.

$\Delta tL_{i,t}$ is the annual change in employment as a share of regional population, a proxy for total employment generation.

$\Delta hsL_{i,t}$ and $\Delta lsL_{i,t}$ are respectively: the annual change of those in employment with tertiary level of education (ISCED 5-6) as a share of the regional population, a proxy for the generation of jobs for workers with high qualifications; and the annual change of those employed with less than primary/lower secondary level of education (ISCED 0-2), as a share of the regional population, a proxy for the variation low-skilled employment.⁵³ An increase in low-skilled employment is assumed to correspond to a more inclusive labour market and to a decrease in the proportion of the regional population facing poverty or social exclusion;

⁵³ An alternative version of these variables standardise them by economically active population rather than by total residents. Adopting this different standardisation does not significantly alter the estimation results.

$\Delta LTU_{i,t}$ is the annual change of long-term unemployment. As discussed above, a long period of unemployment often results in the marginalisation of workers and in skills loss and demotivation. The longer the duration of unemployment, the greater the risk of social exclusion, understood as the inability to afford material goods, services and housing, combined with the reduction of social contacts (European Commission, 2010). Long-term unemployment is used by the EU as one of its basic indicator of labour market exclusion (Atkinson et al., 2002). However, this indicator suffers a profound one-off shock in 2009 as a result of the crisis which is likely to affect the viability of the econometric analysis. We therefore resort to the use of long-term unemployment as a percentage of total unemployment – the ‘incidence’ of long-term unemployment, according to the European Commission (2014a) – as our main long-term unemployment proxy. We test the robustness of the results by using the long-term unemployment rate as an alternative dependent variable in the GMM models.

$L_{i,t-1}$ and $LTU_{i,t-1}$ are the lagged levels of employment and long-term unemployment, respectively.

The four growth determinants are measured as follows:

Human capital: percentage of total students in higher education (ISCED levels 5-6). This variable differs from the usual educational attainment proxy for human capital – the proportion of employed people holding university degrees (Nehru et al., 1993) – which cannot be used, as it is the dependent variable in one of the models. The drawback of using university students is that not all graduates will contribute to increase the stock of highly-qualified employable individuals in a region, as graduates are highly mobile (Docquier and Marfouk, 2006). Human capital proxies based on school enrolment (ratio between individuals of school age and students enrolled in educational institutions) are widely used in national level analyses (e.g. Barro, 1991). We therefore assume that a strong correlation exists between the capacity of a region to attract university students and the accumulation of talented individuals.

Innovation capacity: patent applications per million inhabitants in the region, available until 2010. Patents are an imperfect proxy for innovative performance (Griliches, 1990), as not all inventions are patented and patenting propensity differs across sectors. Nonetheless, for want of better alternatives, this is the most frequently used variable (Acs et al., 2002), including the majority of studies assessing innovation performance at the regional level in the EU (e.g. Bottazzi & Peri, 2003).

Transport infrastructure: kilometres of roads per squared kilometre. This is a widespread measure of transport infrastructure density⁵⁴ (e.g. Crescenzi & Rodríguez-Pose, 2012; Del Bo & Florio,

⁵⁴ Using a different normalisation, e.g. kilometres of roads divided by thousand inhabitants, leaves our econometric results essentially unaltered (regression results available upon request).

2012). This variable is chosen over other available transport proxies (km of motorways only or of railways) because it gives a better representation of the transport network in a region.

Quality of government institutions: EU Quality of Government (QoG) Index, calculated as a combination of the Regional QoG index developed by the QoG Institute of the University of Gothenburg and the World Bank Global Governance Indicators (WBGI). This variable was produced by Charron et al. (2014) by extending the Regional QoG over time. Due to the way in which it is calculated, this variable indicates the capacity of regions to equally provide key public services to all citizens. The index has already been employed as a proxy for regional institutions in the literature (e.g. Rodríguez-Pose & Di Cataldo, 2015; Rodríguez-Pose & Garcilazo, 2015).

The model is completed by a set of control variables selected on the basis of existing empirical works analysing employment and unemployment determinants.

First, we account for Okun's law and for the economic cycle by controlling for the natural logarithm of the annual change of regional per capita GDP. A positive correlation with employment generation and a negative association with long-term unemployment change are expected.

$X_{i,t}$ represents a vector of labour market variables. To control for labour market institutions, the model includes union density, available at the national level. While there are a variety of views about how unions shape labour market outcomes, the dominant position suggests that stronger unions are associated with higher wages for the unskilled (Faini, 1999; Koeniger et al., 2007) and with higher unemployment (Nickell, 1997). Following the majority of analyses looking at the evolution of employment in EU regions, the models control for industrial structure (e.g. Martin & Tyler, 2000; Marelli et al., 2012), by including the share of employment in agriculture and fisheries and industry.⁵⁵ Finally, models on regional unemployment normally consider a number of characteristics of the labour force structure. Perugini and Signorelli (2007) include the share of employees and part-time workers – the latter as a proxy for labour flexibility. The percentage of unemployed in long-term unemployment is included as a control in models 1 and 3.

The Variance Inflation Factor (VIF) test for collinearity is reported in Appendix A5.

φ_i and τ_t represent region and time dummies, respectively.

All dependent and independent variables and their sources are presented in Appendix A2. The variables' descriptive statistics and the correlation among the variables of interest are displayed in Appendix A3 and A4, respectively.

⁵⁵ Eurostat provides data on regional employment in the primary, secondary, and tertiary sector. The three variables are collinear when included simultaneously in the model. We therefore choose primary and secondary sector employment (excluding services) for reasons of data availability.

The analysis considers all EU regions for which data are available and comprises a panel of 168 NUTS1 and NUTS2 regions⁵⁶ from 18 countries for the 1999-2010 period.

For all regressions, standard errors are clustered at NUTS level (NUTS1 or NUTS2 depending on the geographical level at which variables are measured).

7. Estimation results – employment generation

The first three models focus on employment generation. In these models the four growth determinants – human capital, innovation, infrastructure, and government quality – are linked to annual change in employment to identify what drives job creation in EU regions. The increase of high-skilled employment has different social implications with respect to changes in low-skilled employment. While the former is a process following the structural transformation of the EU labour market, the latter is closely connected with social inclusion trends. For this reason, the results of the model assessing the effect of growth factors on low-skilled employment are interpreted as an indication of how labour market inclusion may be affected by the specific conditions of a region.

The results of model (1) are displayed in Tables 1, 2, 3. We begin with a parsimonious specification including change in per capita GDP as the only control variable and excluding region dummies in a random effects (RE) model (columns (1), (5), (9)). The fixed effects (FE) version of this specification is shown in columns (2), (6), (10), where we test for systematic differences between the two models with a Hausman test. Columns (3), (7), (11) report the results with labour market controls. For the latter specifications, the Hausman test reports a systematic difference in the variables' coefficients and we only report the preferred fixed effects results. Finally, the results of the GMM⁵⁷ version of the model are depicted in columns (4), (8), (12). In all GMM estimations, first-order lags are excluded as instruments. The Hansen test for over-identifying restrictions reports a p-value indicating that instruments as a group are exogenous.

⁵⁶ In our choice of geographical level for regions, we follow Crescenzi & Rodriguez-Pose (2012) and Crescenzi et al. (2016) in selecting the regional units by country which are more meaningful in terms of institutional and governance features. This implies NUTS2 regions for Austria, Czech Republic, Finland, France, Hungary, Ireland, Italy, the Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, and Sweden. NUTS1 are used for Belgium, Germany, and the UK.

⁵⁷ We opt for GMM-system (Arellano & Bover, 1995; Blundell & Bond, 1998) over GMM-difference because the lagged levels of our variables are likely to be weak instruments for first-differences of endogenous variables. Instruments are collapsed in order to avoid issues of instrument 'proliferation' (Roodman, 2009). As the Arellano-Bond autoregressive test reports first-order lags as endogenous, they are excluded as instruments. Alternative versions of GMM estimations demonstrate that the results are not sensitive to the introduction of further restrictions on the set of instruments used, for example by excluding lower-order time lags (regression tables available upon request).

In the case of change in total employment, the first specification shows that employment rose in regions with a higher stock of human capital and good government institutions. Transport infrastructure endowment is negatively and marginally significantly correlated with employment growth. The inclusion of fixed effects does not alter the significance of human capital, while innovative capacity becomes positive and significant, and government quality is no longer significant. These results remain unchanged when labour market controls are included. Therefore, the main findings of this model are that a larger share of highly-educated population and a strengthened innovative capacity have favoured employment generation in EU regions, a result that can be explained by the upskilling process in the composition of employment.

Table 1
Employment change and growth determinants

Dep. Variable:	Change in employment			
	RE (1)	FE (2)	FE (3)	GMM (4)
Human capital	0.000135*** (4.44e-05)	0.000950*** (0.000233)	0.00103*** (0.000244)	0.000939** (0.000368)
Innovation	-2.97e-06 (2.29e-06)	3.04e-05** (1.34e-05)	3.08e-05** (1.24e-05)	3.02e-05* (1.73e-05)
Transport infrastructure	-0.000222* (0.000127)	-0.00278 (0.00190)	-0.00308 (0.00217)	-0.00187 (0.00174)
Government quality	0.000772*** (0.000177)	0.00206* (0.00126)	0.000539 (0.00132)	0.00102 (0.00107)
Change of log of per capita GDP	0.0218** (0.0104)	0.0425*** (0.0109)	0.0775*** (0.0136)	0.0796*** (0.0211)
Union density			2.83e-05 (0.000248)	0.000134 (0.000155)
Share of employees			-0.00760 (0.0244)	0.0314 (0.0289)
Share of part-time workers			-0.0165 (0.0252)	0.0366 (0.0256)
Share of unemployed people being long term unemployed			8.26e-05* (4.68e-05)	-0.000140** (6.53e-05)
Share of people employed in the primary sector			-0.0189 (0.0416)	-0.0243 (0.0378)
Share of people employed in the industry sector			0.0186 (0.0261)	0.0690* (0.0394)
Lagged employment change				-0.195*** (0.0429)
Year dummies	✓	✓	✓	✓
Region dummies		✓	✓	
Observations	1,742	1,742	1,593	1,593
R-squared	0.189	0.201	0.466	
EU regions	168	168	157	157
Hausman FE/RE ($p>\chi^2$)		55.1 (0.000)	34.4 (0.044)	
Instruments				151
AR(1) test (p-value)				-7.56 (0.000)
AR(2) test (p-value)				-1.19 (0.235)
AR(3) test (p-value)				-0.56 (0.575)
AR(4) test (p-value)				-0.05 (0.962)
Hansen test (p-value)				147.2 (0.096)

Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Collapsed instruments in GMM estimations. Second-order and higher order lags used as instruments.

Regarding our control variables, an increase in per capita GDP is positively correlated with employment generation, in line with Okun's law. The only significant labour market variables are the share of people in manufacturing (positively associated with employment creation in the GMM estimate) and the share of unemployed being long-term unemployed, taking the expected negative coefficient in the GMM model.⁵⁸

In sum, the more successful regions in job generation are those accumulating more qualified individuals and with greater innovation potential. This result is consistent with the fact that in the European 'knowledge economy' the 'winners' have been regions investing in skills and making a better use of the available human resources to maintain the competitiveness of their production structure and their local labour market.

Switching to the variation of those in employment holding higher education degrees as the dependent variable (Table 2), the first specification (column (5)) indicates that high-skilled employment has grown more in regions with a skilled workforce and with more efficient public institutions. However, government quality is no longer significant in the fixed effects estimation. The sign and significance of human capital is, by contrast, robust to the inclusion of all controls. High-skilled employment increased more in regions with a highly-educated population. This provides evidence that EU regions feature self-reinforcing spatial concentrations of human capital, i.e. high-skilled jobs increase where skills are already clustered. The inclusion of region dummies uncovers a negative effect on high-skilled employment growth in regions where transport infrastructure is more developed.⁵⁹ However, the coefficient is insignificant in the GMM model. Innovation capacity, marginally significant in the RE model, turns positive but insignificant with region fixed effects. Regarding the controls, a larger share of long-term unemployed has a negative effect on high-skilled jobs creation (column (7)), while the only labour market variable remaining significant across specifications is manufacturing employment.

⁵⁸ Models (1) and (3) are also estimated using the long-term unemployment rate as control variable instead of the share of unemployed being long-term unemployed. All the main results remain unchanged. The long-term unemployment rate is negative and significantly correlated with employment growth. These regression results are available upon request.

⁵⁹ This result may be explained by the fact that better road connections may represent an opportunity for skilled workers to move away from relatively less competitive regions towards more dynamic areas. Although estimates in Table A6.1 show that the coefficient of transport infrastructure is negative and significant among core, not peripheral regions, a further sub-division of regions among different income levels demonstrates that the negative coefficient is mainly driven by regions with intermediate income, while in the richest EU regions a better transportation contributes positively to the dynamics of high-skilled jobs.

Table 2
High-skilled employment change and growth determinants

Dep. Variable:	Change in high-skilled employment			
	RE (5)	FE (6)	FE (7)	GMM (8)
Human capital	0.000118*** (2.19e-05)	0.000347** (0.000137)	0.000567*** (9.94e-05)	0.000517*** (0.000185)
Innovation	-3.88e-06* (1.98e-06)	1.24e-05 (1.10e-05)	6.39e-06 (8.34e-06)	2.47e-05** (1.11e-05)
Transport infrastructure	0.000135 (0.000111)	-0.00321*** (0.000744)	-0.00325*** (0.000993)	-0.000813 (0.00123)
Government quality	0.000278*** (7.47e-05)	0.000553 (0.000404)	0.000173 (0.000512)	0.000227 (0.000717)
Change of log of per capita GDP	0.0112*** (0.00377)	0.00985** (0.00458)	0.0216*** (0.00590)	0.0355*** (0.0115)
Union density			-0.000119 (9.29e-05)	-3.69e-05 (9.58e-05)
Share of employees			0.0125 (0.0132)	0.00321 (0.0225)
Share of part-time workers			0.00681 (0.0101)	-0.0142 (0.0138)
Share of unemployed people being long-term unemployed			-1.81e-05 (2.44e-05)	-0.000108** (4.57e-05)
Share of people employed in the primary sector			-0.0319** (0.0160)	-0.0161 (0.0254)
Share of people employed in the industry sector			-0.0471*** (0.0110)	-0.101*** (0.0249)
Lagged high-skilled employment				-0.0627 (0.0521)
Year dummies	✓	✓	✓	✓
Region dummies		✓	✓	
Observations	1,720	1,720	1,593	1,593
R-squared	0.037	0.044	0.074	
EU regions	166	166	157	157
Hausman FE/RE ($p>\chi^2$)		13.3 (0.582)	41.3 (0.005)	
Instruments				141
AR(1) test (p-value)				-7.51 (0.000)
AR(2) test (p-value)				-0.93 (0.352)
AR(3) test (p-value)				-0.67 (0.503)
AR(4) test (p-value)				-1.08 (0.281)
Hansen test (p-value)				129.2 (0.208)

Note: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Collapsed instruments in GMM estimations. Second-order and higher order lags used as instruments.

In the third version of model (1), the dependent variable is change in low-skilled employment (Table 3). Regions experiencing more significant increases (or less pronounced decreases) in employment of less-qualified workers are those with poverty and social exclusion problems.

The relationship between local factors and low-skilled employment generation differs from the specifications describing the dynamics of total employment and high-skilled employment. Unlike in previous versions of the model, the positive and significant coefficient of government quality is robust to the inclusion of all control variables and to changes in estimation method (Table 3, columns (10)-(12)). Regions with higher government quality have more successfully tackled declines in employment for the low-skilled.

Table 3
Low-skilled employment change and growth determinants

Dep. Variable:	Change in low-skilled employment			
	RE (9)	FE (10)	FE (11)	GMM (12)
Human capital	7.13e-05*** (2.35e-05)	0.000350*** (0.000105)	0.000154 (0.000113)	1.91e-05 (0.000136)
Innovation	1.37e-06 (1.53e-06)	2.12e-06 (8.66e-06)	6.90e-06 (8.51e-06)	-3.96e-08 (9.51e-06)
Transport infrastructure	2.50e-05 (7.19e-05)	-3.60e-06 (0.00123)	-0.000142 (0.00113)	-0.000214 (0.000717)
Government quality	0.000327*** (0.000118)	0.00224*** (0.000517)	0.00152** (0.000597)	0.00122** (0.000520)
Change of log of per capita GDP	0.00666 (0.00619)	0.0166*** (0.00636)	0.0360*** (0.00694)	0.0529*** (0.0123)
Union density			-1.73e-05 (9.90e-05)	-0.000111* (6.53e-05)
Share of employees			-0.0318* (0.0170)	-0.0612*** (0.0153)
Share of part-time workers			-0.0157 (0.0121)	0.0141 (0.0110)
Share of unemployed people being long-term unemployed			-3.19e-05 (2.56e-05)	2.91e-05 (3.78e-05)
Share of people employed in the primary sector			0.0465** (0.0221)	-0.0590*** (0.0200)
Share of people employed in the industry sector			0.0377*** (0.0137)	0.00356 (0.0173)
Lagged low-skilled employment				-0.0538*** (0.0132)
Year dummies	✓	✓	✓	✓
Region dummies		✓	✓	
Observations	1,742	1,742	1,593	1,593
R-squared	0.072	0.083	0.129	
EU regions	168	168	157	157
Hausman FE/RE ($p>\chi^2$)		32.7 (0.005)	51.3 (0.000)	
Instruments				141
AR(1) test (p-value)				-7.59 (0.000)
AR(2) test (p-value)				-1.01 (0.312)
AR(3) test (p-value)				0.85 (0.395)
AR(4) test (p-value)				-0.07 (0.948)
Hansen test (p-value)				130.8 (0.181)

Note: Robust standard errors in parenthesis; *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Collapsed instruments in GMM estimations. Second-order and higher order lags used as instruments.

Of the other economic growth determinants, only human capital displays a significant coefficient, which becomes insignificant in the GMM model. Of the control variables, regional GDP growth is positive and significant in all specifications, while a higher share of workers is negatively associated with low-skilled employment generation. New jobs for the low-skilled have been created in regions with higher shares of industrial employment, indicating that the association between manufacturing employment and job creation of column (3) in Table 1, mainly relates to low-skilled jobs. Agricultural employment is associated with lower high-skilled employment change in the GMM estimation. The coefficient of union density is negative and significant in column (12), meaning that a strong presence of trade unions is not enough to stem the low-skilled job haemorrhage. An increase in high-skilled employment is connected with a decrease in low-

skilled employment. The labour market upskilling process works at the expense of individuals with fewer opportunities to adapt to new professions, who are pushed out of employment by overqualified workers.

The results of the analysis also confirm a strong relationship linking government quality and corruption with inequality (Mauro, 1998; Gupta et al., 2002; Rothstein, 2011). Efficient public institutions may provide greater support for disadvantaged workers, by, for example, setting up effective labour market re-insertion schemes targeting those in highest need, delivering effective public policies and services to all citizens, or curbing corruption.

Employment generation in core and peripheral regions

Do the results vary depending on the level of development of EU regions? To address this question, we sub-divide the full sample into core and peripheral regions according to the European Commission classification for the 2007-2013 Cohesion Policy programming period. Peripheral regions are those with a per capita GDP below 75% of the EU average and receiving larger shares of Structural Funds. Core regions are all remaining regions. The three versions of models (1) and (3) are estimated for the sub-samples of core and peripheral regions both with FE and GMM methods.⁶⁰

The results are presented in Appendix A6 (Table A6.1). Columns (1) to (4) refer to the model analysing the determinants of total employment generation. The estimates indicate that the key finding of Table 1 – human capital endowment as a driver of employment growth – applies particularly to less developed regions, while in richer regions employment has grown the most in more technologically advanced and innovative areas. The positive correlation between the stock of highly qualified individuals and high-skilled employment generation of Table 2 is principally driven by the most developed regions. The human capital coefficient in columns (5) and (6) (core regions) of Table A6.1 is positive and significant and displays a larger magnitude relative to columns (7) and (8) (peripheral regions). Government quality also has a different effect on low-skilled employment generation in core and less developed regions. The positive effect of government institutions on the creation of jobs for the less skilled is mainly driven by the less developed subset (columns (11) and (12), Table A6.1), rather than by core regions (columns (9) and (10)). While the coefficient of government institutions is positive across all specifications, its magnitude and significance are higher in less developed regions. Hence, higher regional

⁶⁰ As this empirical test is performed on reduced samples, in order to keep the number of instruments in the GMM model close to the number of groups (Roodman, 2009), only second to sixth-order lags in the estimations for core regions and second to fifth-order lags in the estimations for peripheral regions are considered.

government quality makes a difference for the promotion of labour market inclusion particularly in poorer areas, where the welfare system and social infrastructures are generally less developed and efficient.

8. Estimation results - social exclusion

Models (2) and (4) describe the relationship between different growth determinants and the evolution of long-term unemployment over the 1999-2010 period. Long-term unemployment is recognised by the European Commission as an indicator of labour market exclusion. Some countries have even set long-term unemployment targets in order to comply with the Europe 2020 social inclusion objective.⁶¹ Therefore, the results of these models can be seen as a description of the dynamics of social exclusion in EU regions.

The results are shown in Table 4. The model is estimated with the change in the share of unemployed being long-term unemployed as dependent variables and RE, FE and GMM methodologies. To test the robustness of the results, the GMM model is replicated with the change in the long-term unemployment rate as dependent variable (column (6)).

In all different specifications and with both long-term unemployment proxies, human capital and government quality display significant and negative coefficients. Long-term unemployment has reduced in regions with a more educated population, possibly because of the employability of skilled workers. The finding confirms that, as suggested by the European Commission (2013), education is a major factor for avoiding long-term unemployment and limiting social exclusion. High government quality is also associated with lower long-term unemployment, further supporting the main results of the model with low-skilled employment as dependent variable. Regions with effective and accountable governments, where the provision of public services such as health care and education is of better quality, have been more able to establish measures to control long-term unemployment and social exclusion than regions with a weaker government quality.

Reverting the persistent unemployment trends in Europe thus requires targeted measures to reform local labour markets, developed by effective government institutions. These may include labour supply (i.e. improving the employability of those out of work; promoting the upward

⁶¹ Germany has committed to a reduction in long-term unemployment of 320,000 individuals; Sweden has pledged to reduce long-term unemployment and long-term sick leave by 14% (http://ec.europa.eu/europe2020/pdf/targets_en.pdf).

mobility for those in employment) and demand-side measures (e.g. equal opportunity policies; encouraging social integration) (Gordon, 2006).

Long-term unemployment and social exclusion are not affected by the extensiveness of regional transport networks, while the GMM model with long-term unemployment rate as dependent variable displays a positive and significant association between innovation capacity and long-term unemployment change. Labour market exclusion has grown the most in regions with more developed innovation structures. The positive correlation between patents and social exclusion supports the idea that technological development affects most the less qualified workers, acting as a driver of labour market inequalities in Europe (Lee and Rodríguez-Pose, 2013).

Turning to the control variables, as predicted by Okun's law, there is a negative relationship between GDP growth and long-term unemployment. Long-term unemployment decreases as regional output increases and appears conditioned by the regional industrial structure. It has grown more in rural regions and less in manufacturing regions. However, the negative coefficient of industrial employment turns insignificant in the GMM models. Similarly, the positive link between the share of employees and long-term unemployment is no longer evident when endogeneity is minimised with the GMM. The specifications including change in high-skilled and low-skilled employment as regressors show that they both are connected with long-term unemployment reduction.

Table 4
Long-term unemployment change and growth determinants

Dep. Variable:	Change in unemployed people being long-term unemployed				Change in long-term unemployment rate GMM (6)
	RE (1)	FE (2)	FE (4)	GMM (5)	
Human capital	-0.0943*** (0.0183)	-0.636*** (0.0800)	-0.550*** (0.0987)	-0.824*** (0.200)	-0.188*** (0.0506)
Innovation	0.00130 (0.000951)	0.00585 (0.00507)	0.00106 (0.00557)	0.00140 (0.0115)	0.00526** (0.00236)
Transport infrastructure	0.0315 (0.0376)	0.000802 (1.306)	0.379 (1.382)	1.092 (1.305)	0.336 (0.228)
Government quality	-0.116** (0.0587)	-1.497*** (0.391)	-0.933** (0.444)	-1.175** (0.618)	-0.264** (0.126)
Change of log of per capita GDP	-13.70*** (3.818)	-14.84*** (4.822)	-17.28*** (5.879)	-37.10*** (10.47)	-4.477*** (1.574)
Union density			-0.0159 (0.0951)	0.101 (0.0762)	0.0173 (0.0133)
Share of employees		29.75** (13.76)		9.611 (29.01)	-4.086 (4.580)
Share of part-time workers			7.430 (9.636)	31.35 (20.60)	0.242 (3.911)
Share of people employed in the primary sector			75.44*** (18.71)	86.48*** (27.01)	10.81** (4.565)
Share of people employed in the industry sector			-27.41** (11.94)	22.91 (27.10)	0.0606 (5.684)
Lagged unemployed people being LTU				-0.188*** (0.0479)	
Lagged LTU rate					-0.192*** (0.0342)
Year dummies	✓	✓	✓	✓	✓
Region dummies		✓	✓		
Observations	1,686	1,686	1,588	1,588	1,538
R-squared	0.189	0.218	0.219		
EU regions	164	164	156	156	151
Hausman FE/RE ($p>\chi^2$)		65.6 (0.000)	83.2 (0.000)		
Instruments				140	140
AR(1) test (p-value)				-8.28 (0.000)	-5.70 (0.000)
AR(2) test (p-value)				3.16 (0.002)	1.02 (0.309)
AR(3) test (p-value)				-1.06 (0.287)	-0.53 (0.594)
AR(4) test (p-value)				0.44 (0.658)	-0.64 (0.524)
Hansen test (p-value)				130.2 (0.174)	132.5 (0.141)

Note: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Collapsed instruments in GMM estimations. Second-order and higher order lags used as instruments.

9. Conclusions and policy implications

In the coming years the EU will spend vast resources to revamp its economy and generate job opportunities in its depressed labour market. The funds will be invested in the hope of developing not just more competitive, but also more inclusive economies. In this paper we have examined the extent to which the pillars of the new growth strategies have indeed contributed to past employment generation and social inclusion in European regions. We identified four types of economic factors (infrastructure, human capital, innovation, government quality) and tested whether they are linked to regional employment growth, labour market disparities, and social exclusion.

Over the past 15 years, the EU workforce has become both more specialised and more prone to risks of labour market exclusion. Our empirical findings suggest that the two elements that have been associated with faster employment growth are a relatively higher endowment of highly-skilled workers, mostly in less developed regions, and a stronger regional innovative performance, particularly in more advanced regions. Human capital has been at the heart of new job creation for the most skilled. A better capacity to absorb new workers, however, has not necessarily implied a decrease in the number of disadvantaged workers. The proportion of individuals in poverty or at risk of social exclusion has increased sharply since 2009. More inclusive societies will thus require the promotion of better opportunities for the low-skilled and the long-term unemployed.

In this respect, the results of the analysis indicate that better and more efficient governments, able to provide high quality public services to all citizens, have helped reducing labour market marginalisation and stemmed the loss of low-skilled jobs. This is particularly true for the less developed regions of Europe, generally characterised by lower economic capacity and government quality. Unlike short-term unemployed and highly educated workers, whose job opportunities are less affected by recessions (Oreopoulos et al., 2012), low-skilled workers face a strong risk of permanent exclusion. Other things equal, a more favourable institutional environment can make the difference in ensuring that public policies facilitate job-market re-entry.

The empirical analysis also demonstrates that a good human capital base is vital to reduce long-term unemployment, and hence social exclusion. Upward mobility schemes or the matching of educational achievement to local job requirements can help in this respect (Nativel, 2002; Gordon, 2006). In order to better match labour supply and demand, education and training programmes should reflect the need for skills to a greater extent than they do now (Cedefop, 2015). Strengthening networks between schools and universities, on the one hand,

and the business environment, on the other, would contribute to addressing the skill mismatch. These interventions should be combined with measures targeting specifically those out of work (Gordon, 2006), such as employability programmes or policy initiatives generating new jobs for which the low-skilled have a comparative advantage. Conversely, investment strategies centred on technological development (e.g. R&D spending), by favouring the creation of high-skilled jobs, may exacerbate the employment divide between the most equipped workers and those with fewer qualifications.

More broadly, EU regions need to define comprehensive labour market strategies involving the largest possible number of stakeholders and dealing with wide-ranging issues, including the upskilling of the unemployed and socially excluded, the creation of vocational training programmes, and addressing skill mismatch problems (Cedefop, 2015). This general set of recommendations should be adapted to the needs and priorities of each specific context.

While some of these measures are already included in EU programmes targeting employment and social exclusion, the financial resources allocated to this target may require revision to tackle low-skilled unemployment and social exclusion more effectively (Frazier & Marlier, 2013).

This study has demonstrated that not all areas of regional intervention affect labour market conditions in the same way. The generation of employment and the process of labour upskilling depend on different economic factors than the dynamics of long-term unemployment and social inclusion. The regional endowment of human capital is a positive element for growth, employment promotion and social inclusion, but it is unlikely that education investments alone will suffice to fulfil the inclusion objectives of the Europe 2020 strategy. Especially in disadvantaged regions, characterised by weak governments and higher corruption, education policies should be coupled with institutional reforms, as improvements in governance are essential to put the socially excluded back in the employment track. The presence of adequate government institutions is a prerequisite for the success of any labour market policy.

Interventions in this direction may help the regions worst affected by the economic crisis to adapt to the changes underway in the European labour market. The EU is facing the complex challenges of recovering from the worst recession in almost a century, while reaffirming its pivotal position in the global economy. While the most qualified workers may be sufficiently equipped to compete globally, the low-skilled are those whose employment opportunities are most threatened. The formulation of policies sensitive to the needs of the weakest workers would help to ensure the participation in the labour market of those in the workforce facing the higher risk of marginalisation, lightening the burden on the European welfare systems, and reducing economic and social disparities in Europe.

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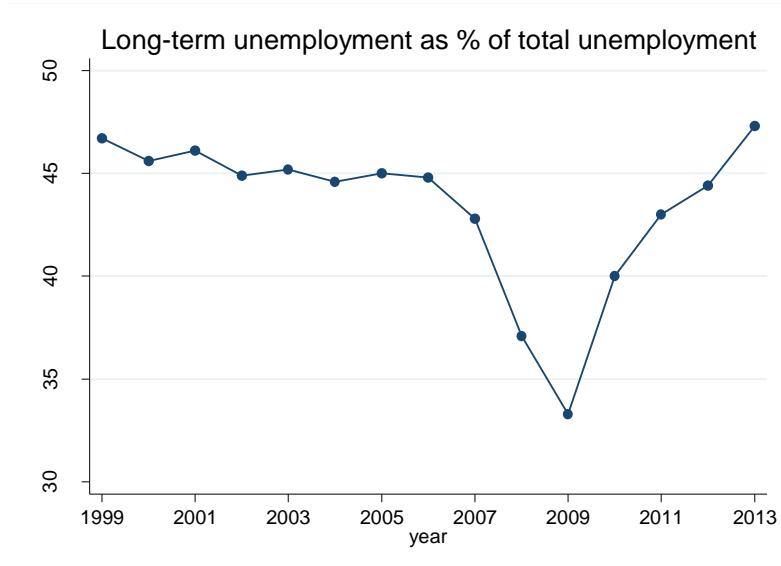
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Appendix

A1 Long-term unemployment trend in the EU

Figure A1.1
Evolution of long-term unemployment in the EU, 1999-2013



A2 Variables description

Table A2.1
Description of the variables

Variable	Source	Definition
<i>Dependent variables</i>		
Change in employment	Eurostat - LFS	Annual change of total employed people (aged 15 or over) divided by total regional population.
Change in high-skilled employment	Eurostat - LFS	Annual change of the percentage of employed people (aged 15 or over) with completed higher education (first and second stage of tertiary education - ISCED-97 levels 5 and 6) divided by total regional population.
Change in low-skilled employment	Eurostat - LFS	Annual change of the percentage of employed people (aged 15 or over) with less than primary, primary and lower secondary level of education (ISCED-97 levels 0, 1 and 2) divided by total regional population.
Change in unemployed people being long-term unemployed	Eurostat - LFS	Annual change of long-term unemployment (12 months or more) as percentage of total unemployment.
Change in long-term unemployment rate	Eurostat - LFS	Annual change of long-term unemployment (12 months or more) divided by economically active population.
<i>Growth determinants</i>		
Human capital	Eurostat	Students at ISCED-97 levels 5-6 as percentage of all pupils and students aged 15-24 at regional level.
Innovation	Eurostat	Patent applications to the EPO per million of regional inhabitants.
Transport infrastructure	Eurostat	Kilometres of motor-roads divided by squared kilometres of regional land.
Government quality	QoG Institute - WBGI	Regional Quality of Government (QoG) Index elaborated by the QoG Institute at the University of Gothenburg, a survey-based index constructed around three main pillars: quality of education, public health care and law enforcement; impartiality in education, public health and legal protection; level of corruption in education, health care and the legal system. The index has been combined with the World Bank Governance Indicators (Charron et al., 2014).
<i>Control for Okun's law</i>		
Change of ln per capita GDP	OECD	Annual change of natural logarithm of regional Gross Domestic Product divided by regional population.
<i>Labour market controls</i>		
Union density	OECD - ILOSTAT	Trade union density, calculated as the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. National level variable, all regions of a country are assigned the same value.
Share of employees	Eurostat - LFS	Number of employees divided by total regional employment.
Share of part-time workers	Eurostat - LFS	Number of part-time workers divided by total regional employment.
Share of people employed in the primary sector	Eurostat - LFS	Number of people employed in NACE categories A (Agriculture, forestry and fishing) and B (Mining and quarrying) divided by total regional population.
Share of people employed in the industry sector	Eurostat - LFS	Number of people employed in NACE categories C (Manufacturing), D (Electricity, gas, steam and air conditioning supply), E (Construction) and F (Water supply; sewerage, waste management and remediation activities) divided by total regional population.

A3 Descriptive statistics

Table A3.1
Descriptive statistics

Variable	Observations	Mean	Std. Dev.
<i>Dependent variables</i>			
Change in employment	1890	0.0018	0.013
Change in high-skilled employment	1898	0.0035	0.007
Change in low-skilled employment	1898	-0.0029	0.008
Change in unemployed being LTU	1821	-0.397	6.27
Change in LTU rate	1764	0.058	1.08
<i>Lagged dependent variables</i>			
Lagged employment	1898	0.429	0.057
Lagged high-skilled employment	1898	0.096	0.041
Lagged low-skilled employment	1898	0.115	0.068
Lagged unemployed being LTU	1827	39.04	14.06
Lagged LTU rate	1772	3.862	3.187
<i>Growth determinants</i>			
Human capital (share of university students)	1950	15.46	6.568
Innovation (patent applications per million inhabitants)	2092	69.93	94.41
Transport infrastructure (roads per squared km)	1956	1.373	1.474
Government quality ^a (QoG Index)	2088	6.992	1.989
<i>Okun's law</i>			
Change of ln per capita GDP	1898	0.044	0.047
<i>Labour market controls</i>			
Union density	1966	25.416	15.663
Share of employees	2064	0.822	0.086
Share of part-time workers	2063	0.167	0.106
Long-term unemployment as share of unemployment	1992	38.95	13.81
Share of people employed in the primary sector	2064	0.071	0.086
Share of people employed in the industry sector	2062	0.281	0.073

Note: Quality of Government Index standardised between 0 (lowest-quality institutions) and 1 (highest-quality institutions).

A4 Correlation matrix

Table A4.1
Correlation matrix

	$\Delta tL_{i,t}$	$\Delta hsL_{i,t}$	$\Delta lsL_{i,t}$	$\Delta U \text{ being } LTU_{i,t}$	$\Delta LTU \text{ rate}_{i,t}$	$\Delta \log GDP \text{ p/c } i,t$	$HK_{i,t}$	$Innovation_{i,t}$	$Infra_{i,t}$	$QoG_{i,t}$
$\Delta tL_{i,t}$	1									
$\Delta hsL_{i,t}$	0.308*	1								
$\Delta lsL_{i,t}$	0.501*	-0.135*	1							
$\Delta U \text{ being } LTU_{i,t}$	-0.184*	-0.082*	-0.106*	1						
$\Delta LTU \text{ rate}_{i,t}$	-0.454*	-0.121*	-0.237*	0.643*	1					
$\Delta \log GDP \text{ p/c } i,t$	0.225*	0.067*	0.115*	-0.050*	-0.025*	1				
$HK_{i,t}$	0.016	0.104*	0.027	-0.082*	-0.073*	0.055*	1			
$Innovation_{i,t}$	0.034	-0.021	0.056*	-0.002	0.015	-0.115*	0.031	1		
$Infra_{i,t}$	-0.011	0.036	0.021	0.003	0.026	-0.075*	0.056*	0.147*	1	
$QoG_{i,t}$	0.085*	0.016	0.060*	-0.006	-0.042	-0.222*	0.252*	0.478*	0.172*	1

Note: * $p < 0.05$

A5 Test for multicollinearity

Table A5.1
Variance Inflation Factor (VIF) tests

Variable	VIF	1/VIF
Change in high-skilled employment	1.12	0.89
Change in low-skilled employment	1.17	0.85
Change of log of per capita GDP	2.02	0.49
Union density	1.31	0.76
Share of employees	2.75	0.36
Share of part-time workers	2.89	0.35
Share of unemployed people being long-term unemployed	1.6	0.63
Share of people employed in the primary sector	2.15	0.47
Share of people employed in the industry sector	1.82	0.55
Government quality	3.33	0.30
Human capital	1.38	0.72
Innovation	1.59	0.63
Transport infrastructure	1.33	0.75
year		
2001	2.12	0.47
2002	2.23	0.45
2003	2.35	0.43
2004	2.2	0.45
2005	2.23	0.45
2006	2.21	0.45
2007	2.24	0.45
2008	2.4	0.42
2009	3.08	0.32
2010	2.27	0.44
Mean VIF	2.08	

A6 Employment generation by skill-type, core and peripheral regions

Table A6.1
Employment generation in core and peripheral regions

Dep. Variable:	Change in employment				Change in high-skilled employment				Change in low-skilled employment			
	Core		Periphery		Core		Periphery		Core		Periphery	
	FE (1)	GMM (2)	FE (3)	GMM (4)	FE (5)	GMM (6)	FE (7)	GMM (8)	FE (9)	GMM (10)	FE (11)	GMM (12)
Human capital	-9.13e-05 (0.000177)	0.000518 (0.000422)	0.00117*** (0.000384)	0.00104* (0.000563)	0.000588*** (0.000143)	0.000586** (0.000286)	0.000347* (0.000177)	0.000151 (0.000216)	0.000119 (0.000148)	-4.34e-05 (0.000281)	0.000266 (0.000201)	-0.000173 (0.000300)
Innovation	2.23e-05** (9.84e-06)	4.38e-05** (1.88e-05)	-0.000101 (6.17e-05)	-5.84e-05 (7.57e-05)	4.79e-06 (8.53e-06)	9.23e-06 (1.19e-05)	3.99e-05 (3.91e-05)	7.68e-05 (5.21e-05)	5.33e-06 (7.90e-06)	1.31e-05 (1.15e-05)	1.60e-05 (3.36e-05)	-3.87e-05 (3.90e-05)
Transport infrastructure	-2.69e-05 (0.00193)	-0.00162 (0.00251)	-0.0461** (0.0186)	-0.00347 (0.00591)	-0.00375*** (0.00129)	-0.00180 (0.00237)	-0.00132 (0.00679)	0.000960 (0.00194)	-0.00187 (0.00124)	-0.000884 (0.00160)	0.00684 (0.00888)	-0.000825 (0.00183)
Government quality	-7.70e-05 (0.00122)	0.00102 (0.00131)	0.00487** (0.00231)	0.00176 (0.00128)	0.000317 (0.000656)	0.000104 (0.00105)	-0.000398 (0.00114)	-0.000436 (0.000841)	0.000953 (0.000763)	2.42e-07 (0.000764)	0.00331** (0.00130)	0.00209*** (0.000702)
Change of log of per capita GDP	0.00998 (0.0105)	-0.0351 (0.0326)	0.0555*** (0.0143)	0.0932*** (0.0343)	0.0254*** (0.00904)	0.0741*** (0.0226)	0.0285*** (0.00766)	0.0338** (0.0163)	0.0411*** (0.00984)	0.0737*** (0.0222)	0.0305*** (0.00883)	0.00454 (0.0146)
Lagged employment		-0.254*** (0.0765)		-0.131*** (0.0480)								
Lagged high-skilled employment						-0.0513 (0.0470)			-0.107** (0.0444)			
Lagged low-skilled employment										-0.0997*** (0.0334)		-0.0292 (0.0204)
Labour market controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Region dummies	✓		✓		✓		✓		✓		✓	
Observations	1,106	1,106	476	476	1,106	1,106	476	476	1,106	1,106	476	476
R-squared	0.482		0.532		0.120		0.145		0.174		0.185	
EU regions	106	106	50	50	106	106	50	50	106	106	50	50
Instruments			89		76		83		71		83	
AR(1) test (p-value)		-5.65 (0.000)		-4.00 (0.000)		-6.64 (0.000)		-4.42 (0.000)		-6.89 (0.000)		-3.79 (0.000)
AR(2) test (p-value)		-1.54 (0.124)		-1.82 (0.068)		-1.28 (0.199)		-1.03 (0.304)		-0.74 (0.462)		-2.43 (0.015)
AR(3) test (p-value)		-0.69 (0.487)		0.89 (0.375)		1.04 (0.299)		0.37 (0.710)		0.66 (0.507)		1.02 (0.306)
AR(4) test (p-value)		0.00 (0.997)		-0.04 (0.966)		-1.28 (0.202)		-0.32 (0.749)		-0.52 (0.601)		0.39 (0.695)
Hansen test (p-value)		85.6 (0.037)		40.3 (0.860)		71.1 (0.135)		22.5 (0.999)		57.4 (0.531)		21.8 (0.999)

Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Collapsed instruments in GMM estimations. Second to sixth order lags used as instruments in columns (2), (6), (10); second to sixth order lags used as instruments in columns (4), (8), (12).

Organised crime, captured politicians, and the allocation of public resources

Marco Di Cataldo & Nicola Mastrorocco

Abstract

What is the impact of organised crime on the public finances of local governments? This paper studies the consequences of collusion between members of criminal organisations and politicians in Italy. The ‘capturing’ of local government’s decision-making from organised crime is identified by exploiting a national law that allows the dissolution of municipal governments upon evidence of mafia ‘infiltration’, i.e. the collusion between public officials and members of organised crime. Newly-collected data on local public finances allow to investigate the consequences of this collusion on the spending decisions and the fiscal efficiency of local governments over the 1998–2013 period. Differences-in-differences estimates reveal that infiltrations significantly affect the proportion of resources allocated to key components of local capital expenditure. Municipal governments controlled by the mafia invest more for construction, and less for law enforcement. In addition, infiltrated governments collect fewer taxes for waste and garbage. The analysis also uncovers key elements of local elections associated with mafia-government collusions. In particular, regression discontinuity estimates show that infiltration is more likely to occur in governments controlled by right-wing parties.

Keywords: organised crime, local public finances, collusion, government captures, Italy.

JEL Classification: K42; H72; D72.

1. Introduction

Organised crime is detrimental to the functioning of any democratic or economic system (Gambetta, 1993). Its presence produces institutional failures with the potential to influence key aspects of the legal economic activity, undermining the long run development of every society (Shleifer and Vishny, 1993; Pinotti, 2015). The strength of mafia groups, as well as their influence on the legal economy, relies on the diffused external complicity, i.e. an increasing close relationship between organised crime groups and public officials such as national or local politicians and public administrators (Dickie, 2005). Thanks to the development of such networks, organised crime has become highly pervasive and fully integrated into the everyday socio-economic and political life of many countries in the world (Leonardi, 1995; Trigilia, 2001; Allum and Siebert, 2003).

Yet, understanding the extent to which these dynamics condition the choices and activities of policy-makers is far from easy. What impact does the collusion between members of criminal organisations and politicians have on local public finances? In this paper, we tackle this question by investigating a particular aspect of organised crime activity: its ‘infiltration’ within local governments. Such infiltration occurs when criminal groups manage to ‘capture’ local politicians who in turn manipulate policy decisions in their favour. We study the case of Italy, country home to the first form of organised crime, by using a unique yearly municipal-level dataset for the three Italian regions where organised crime is most widespread and rooted: Calabria, Campania and Sicily.⁶²

In order to measure the presence of organised crime, we exploit the staggered enforcement of national law 164/1991, which allows for the dissolution of a municipal government upon evidence of collusion between elected officials and criminal organisations. The enforcement of this law within a given municipality at a specific point in time represents a sudden shock to both the local political establishment and the organised crime group, given that its occurrence and timing is solely determined at the national level and kept secret until its implementation.

More specifically, we exploit the enforcement of this policy to identify and compare municipal governments with and without infiltration before and after such infiltration occurs. Differences-in-differences estimates reveal that the influence of organised crime on local governments does

⁶² A focus on southern regions rather than on Italy as a whole has the advantage of restricting the sample to a relatively homogenous area in terms of unobservable elements such as culture or social capital, traditionally considered as highly diversified across this country (Putnam, 1993, Leonardi, 1995).

not affect the total level of public spending of municipalities, but does have consequences both for the allocation of public resources and the collection of fiscal revenues. In particular, infiltrated local governments modify capital expenditures in sectors that are strategic to the interests of organised crime. According to our estimates, infiltration leads to an increase in the share of total investments in construction and waste management, and to a decrease in the annual share of investment in police force. Moreover, infiltrated municipalities exhibit a lower ability to collect waste and garbage taxes. An extensive set of robustness tests confirm these findings.

Our estimates could pick up some non-mafia related effects (e.g. low quality of politicians, unstable governments) or be determined by political characteristics of the municipal elections correlated with infiltrations. To address this issue, we perform a series of further tests, ensuring that our results are driven by mafia collusion and not by any of these potentially unobserved components. We identify a set of political characteristics of municipal elections with which the infiltration is correlated. Although descriptive, this exercise is noteworthy in that it uncovers a relationship between infiltrations and elections where there is just one candidate running for office, the mayor is running for her second and last term, and the right-wing party wins the election. Using our differences-in-differences setting, we show that none of these factors have an impact on public spending or on revenues collection.

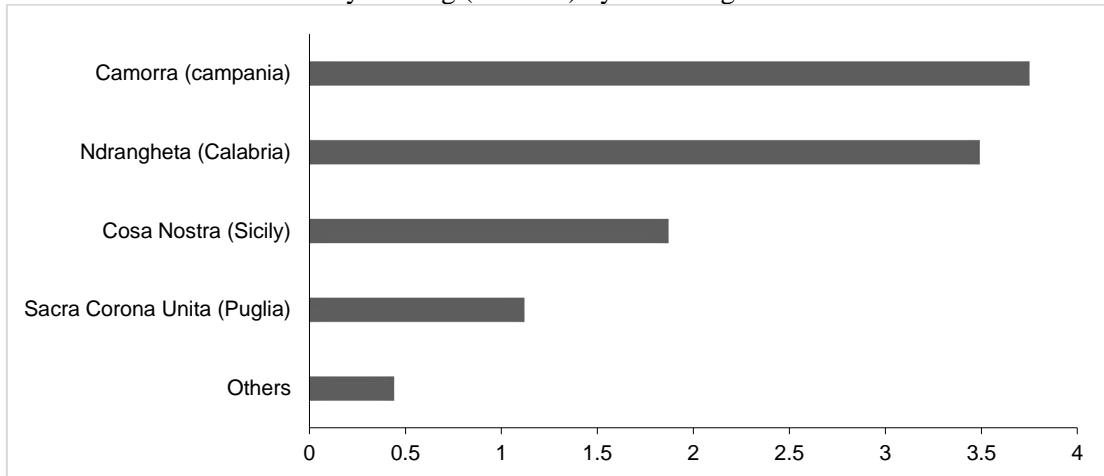
In the final part of the paper, we focus on the systematic correlation between collusion and elections won by right-wing parties, implementing a regression discontinuity design based on close elections. Our results show that the probability of infiltration increases when the right-wing party barely wins an election. However, closely elected right-wing governments are not systematically related to variations in public spending during infiltration periods. These results further corroborate our main hypothesis that the observed variations in public finances are due to collusion between organised crime and politicians as opposed to any other unobserved factors.

The rest of the paper is organised as follows: section 2 provides the background, reviews the relevant literature, and describes the contribution of our work; section 3 focuses on the institutional setting used as a basis for the difference-in-differences analysis and discusses our identification strategy; section 4 discusses the data; section 5 presents the main results; section 6 reports a set of robustness tests; section 7 extends the analysis by studying the relationship between infiltration and political factors and in particular the relationship between right-wing parties and infiltration; section 8 concludes.

2. Background and review of the literature

According to recent estimates, the total combined annual revenue of the Italian mafias is €10.7 billion, with the *Camorra* and the *'Ndrangheta* being the most profitable organisations (Figure 1). The main sources of revenue are illegal activities such as drug trafficking, extortions and corruption. These activities generate a turnover approximately equal to 1.6% of the Italian GDP.

Figure 1
Yearly earning (bn EUR) by mafia organisation

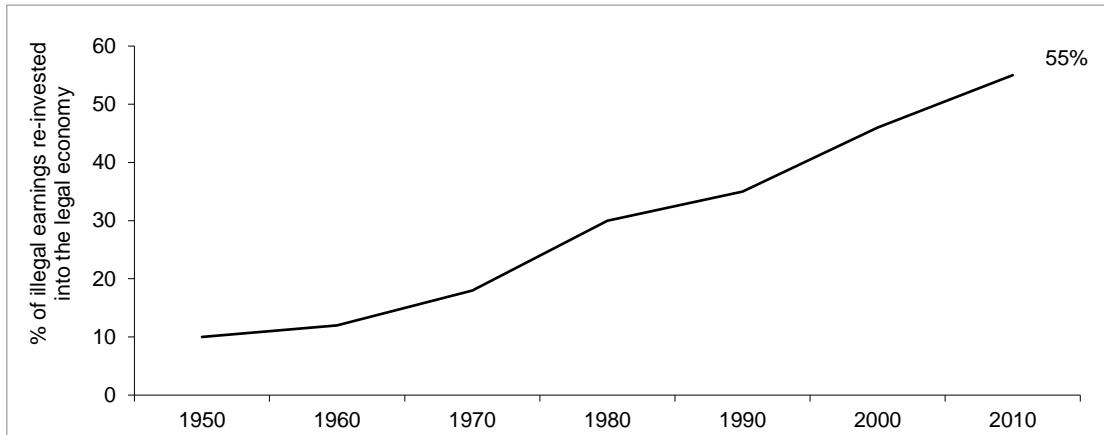


Source: authors' own elaboration using Transcrime (2013) data.

Since the 1970s, organised crime groups have become increasingly sophisticated and their business model has shifted from one based on extortion to one based on entrepreneurship (Gambetta, 1993; Lupo, 2004). The nature of the relationship between the mafia and the State has also changed. Rather than representing an enemy to fight, the government has instead become an opportunity to exploit. As Figure 2 shows, the result of this shift has been that a significant portion of the massive liquidity generated by illegal activities has been re-invested into the legal economy.

Figure 2

Percentage of illegal profits of Italian mafias re-invested into the legal economy



Source: Transcrime and Geo L.O.C. of the Financial Guard

A very high share of criminal organisations' profits thus come from public investments. Indeed, public finances are seen in the literature as potentially being severely affected by corruption and political collusion, both of which are practices commonly employed by the mafia. There is a substantial body of evidence emphasizing how these government failures impact the cost-effectiveness of public investments (Shleifer and Vishny, 1993; Mauro, 1997; Tanzi and Davoodi, 1997; Cadot et al., 2006; Crescenzi et al., 2016) as well as the specific spending sectors in which governments decide to invest (Mauro, 1998; Ehrlich and Lui, 1999; Gupta et al., 2001; Rajkumar and Swaroop, 2008). However, no empirical evidence exists on whether and how government expenditures are conditioned by government captures being perpetrated specifically by criminal organisations.

This topic has been overlooked also by the applied economics literature studying the effects of organised crime. Evidence has been produced to show that the mafia affects economic performance (Pinotti, 2015), firms' productivity (Ganau and Rodriguez-Pose, 2017), foreign direct investments (Daniele and Marani, 2011) and the quality of governance (Allum and Siebert, 2003; Pinotti and Stanig, 2017). A strand of this literature has examined the impact of mafia-government linkages on political and electoral outcomes, finding that criminal organisations sell votes to the party expected to win the elections (De Feo and De Luca, 2013), and that violence is strategically used to influence elections and get captured politicians elected (Alesina et al., 2016). Buonanno et al. (2016) find a systematic correlation between the strength of *Cosa Nostra* and the proportion of votes for the main Italian conservative party.

However, despite the growing scholarly interest in studying the consequences of mafia activities, the degree to which organised crime influences the allocation of public resources is unclear,

because empirical research investigating the rent-seeking behaviour of the mafia is almost non-existent. Notable exceptions are the works of Barone and Narciso (2015), arguing that the presence of organised crime affects the distribution of national public funds to firms⁶³, and of Olivieri and Sberna (2014), asserting that pre-electoral mafia violence inflates local public expenditures. However, none of these works focus on the impact of criminal infiltrations within local governments. Our paper contributes to the literature by performing the first empirical analysis on the effects of collusions between organised crime and local politicians.

Our study adopts a novel method to measure mafia activities. The large majority of the above-mentioned works have identified the presence and intensity of the mafia by employing proxies such as the number of mafia-related crimes, murders, and violent attacks (Alesina et al., 2016; Daniele and Marani, 2011; Olivieri and Sberna, 2014; Barone and Narciso, 2015), historical or geological indicators (Bandiera, 2003; Buonanno et al., 2015; Buonanno et al., 2016; Dimico et al., 2017; De Feo and De Luca, 2017), or artificial constructs for counterfactual analysis (Pinotti, 2015). These measures aim to calculate the impact of organised crime in a broad sense, encompassing the whole range of possible actions perpetrated by such criminal groups. They do not, however, take into consideration the fact that organised crime in Italy has evolved over time, progressively reducing the use of violence and becoming increasingly integrated within the boundaries of democratic society (Cantone, 2010). While in conflict with the State, criminal organisations do not wish to displace the latter but rather to ‘infiltrate’ it, co-existing with it through the creation of a network based on mutual interests. Criminal organisations use violence only as a last resort when previous strategies have failed. Hence, the use of violence may reveal the extent, but not the real strength, of organised crime.

The consequences of criminal activities that do not employ violence have yet to be empirically identified. By focusing on collusion between organised crime and politicians, we aim to shed light on this more silent but equally dangerous phenomenon, studying the strategy of mafia groups in capturing government resources. The national law we use to identify ‘infiltrations’ (law 164/1991) has previously been employed in the empirical literature (Acconia et al., 2014; Daniele and Geys, 2015, 2016; Galletta, 2016)⁶⁴. Our approach differs, however, from previous studies in that we

⁶³ Barone and Narciso (2015) analyse the role of organised crime in the allocation of national public subsidies to businesses in Sicily. Their results show that organised crime positively affects both the probability of obtaining funding and the amount of public funds received.

⁶⁴ Acconia et al. (2014) exploit temporary contraction in public investment occurring in post-dissolution periods to obtain estimates of the fiscal multiplier for Italian provinces. Daniele and Geys (2015; 2016) provide an assessment of the impact of the 1991 law on different post-dissolution outcomes, such as elected politicians' levels of education and turnout at local elections. Galletta (2016) empirically investigates the presence of spillover effects resulting from the strengthening of law 164/1991.

aim to estimate the impact of organised crime infiltrations within local governments rather than evaluate the effect of the law. More specifically, our focus is on the period *before* the enforcement of the law, i.e. *before* the dissolution of mafia-infiltrated municipalities took place.

3. Empirical strategy

Law 164/1991: dissolution of municipal governments for mafia infiltration

The rise in mafia infiltrations within the local administrations throughout the 1980s led the Italian central government to introduce a set of tougher anti-mafia measures in the early 1990s. In order to contrast the cases of collusion between local politicians and members of organised crime, a new law has been introduced in 1991, imposing the dissolution of a city council on evidence of ‘mafia infiltration’ into the local government⁶⁵ (D.L. 31/05/1991 n.164). According to law 164/1991, the national government can decree the dissolution of a municipal government “*when evidence emerges regarding direct or indirect links between members of the local government and criminal organisations [...] jeopardising the free determination of electoral bodies and the good functioning of municipal administrations*”⁶⁶.

The dissolution of a local government requires a number of steps. First, a proposal for dissolution must be put forth by the provincial prefect, who has been informed by either the magistrates or the police of the risk of infiltration of a municipal government. The prefect then establishes a commission composed by the vice-prefect and officials of different law enforcement bodies (*Polizia dello Stato, Carabinieri* and *Guardia di Finanza*). The commission investigates over the activity of the government for a period between three and six months and produces a report, which is sent by the prefect to the Ministry of Interior. Any proposal for dissolution signed by the Minister must be approved by the cabinet of the National Government (Council of Ministers) and the President of the Republic before being implemented. Municipalities having their government

⁶⁵ Some of the most common reasons for dissolving local governments using law 194/1991 have been: administrators or bureaucrats having affinity/kinships with mafia members or recurrent criminal records; construction permits awarded illegitimately due to bid rigging; severe cases of infringement of building regulations; absence of rigorous controls over the execution of public works; significant flaws in tax collection; cases of clientelism; illegal elections.

⁶⁶ <http://www.gazzettaufficiale.biz/atti/2001/20010223/01A10530.htm>

dissolved are those where mafia infiltration has been attested by the Italian judicial system and confirmed by multiple political institutions. Importantly, infiltrated municipalities are unaware that they are under investigation, as the process of dissolution is kept fully secret until its implementation. Once the investigation is concluded, both the members of the criminal organisation and the local politicians are arrested.

Upon the removal of the infiltrated local administration, the central government appoints three non-elected, external commissioners, ruling the municipality for a period of 12 to 24 months and typically committed to make significant cuts to financial flows into public investment projects (Acconcia et al., 2014). After the end of the transition period, regular elections are held.

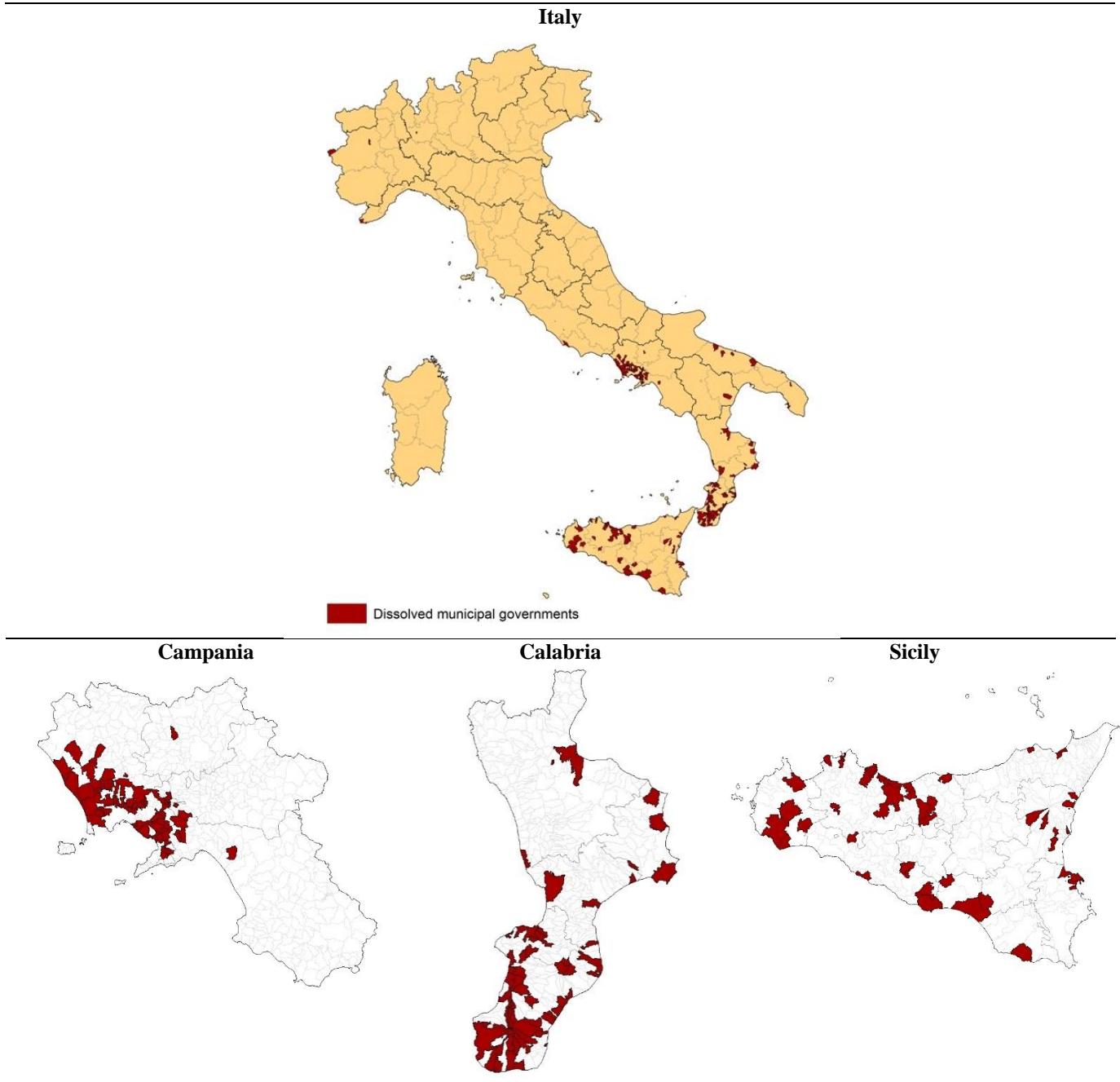
According to law 164/1991, infiltration occurs when organised crime captures local politicians in order to manipulate policy decisions in their favour. This criminal strategy can be perpetrated in different ways. It can, for example, occur directly, as in the case of Pompei (in the province of Naples) where “*the speaker of the municipal council has been identified as the main link between the local administration and the local mafia boss, who has also been arrested in the same investigation*”⁶⁷. Alternatively, it can occur through the contamination of the electoral competition. This was the case in Plati’ (in the province of Reggio Calabria), where “*the party winning the electoral competition benefitted from electoral favours from the local mafia group, who was able to divert a large number of votes and aimed to maintain political control of the territory*”⁶⁸. Finally, infiltration can occur simply through the use of threats and intimidations. To this regard, Africo (in the province of Reggio Calabria) was dissolved because “*the policy decisions of the municipal council were not made freely and without bias because local politicians were repeatedly intimidated and threatened by criminal organisations*”⁶⁹.

⁶⁷ Official Gazette (*Gazzetta Ufficiale*) – Decree of the President of the Republic no. 133 of June 2001: <http://www.gazzettaufficiale.biz/atti/2001/20010223/01A10530.htm>

⁶⁸ Official Gazette (*Gazzetta Ufficiale*) – Decree of the President of the Republic no. 119 of Marzo 2012: <http://www.gazzettaufficiale.biz/atti/2012/20120093/12A04237.htm>

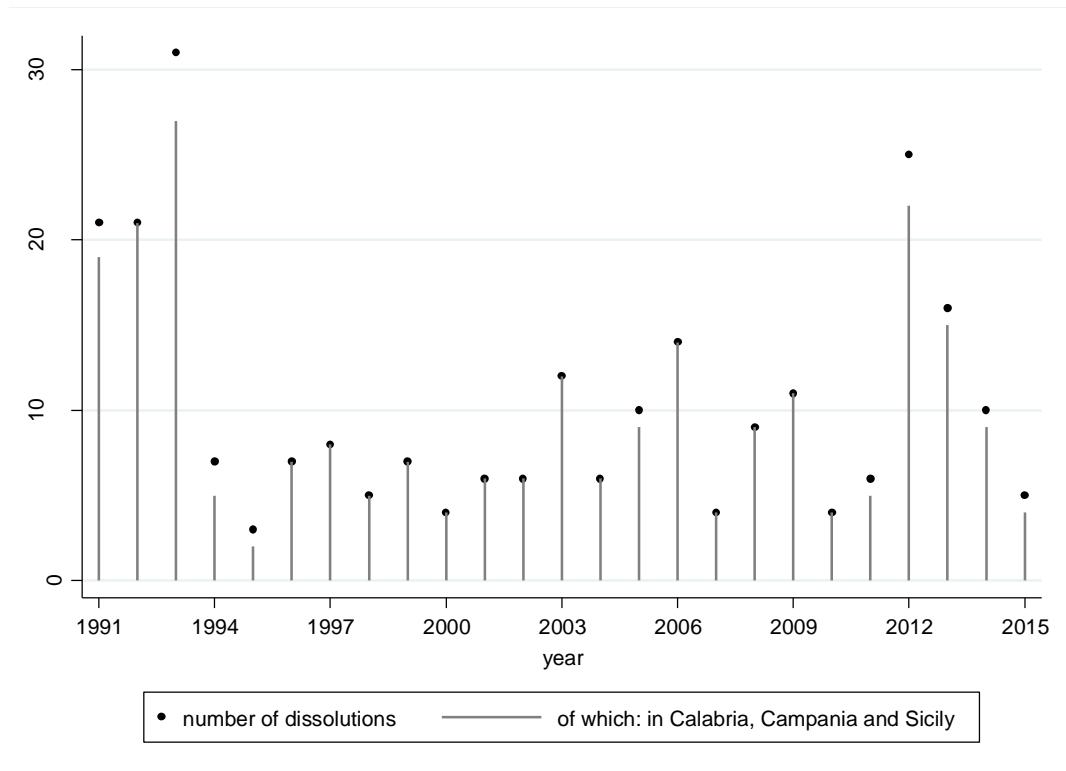
⁶⁹ Official Gazette (*Gazzetta Ufficiale*) – Decree of the President of the Republic: <http://www.gazzettaufficiale.biz/atti/2014/20140194/14A06583.htm>

Figure 3
Geographical location of government dissolutions for mafia infiltration



Source: Italian Ministry of Interior – maps are authors' own elaboration.

Figure 4
Number of dissolved municipal governments for mafia infiltration



Source: Italian Ministry of Interior.

As shown in Figure 3, the large majority (and in some years all) of dissolutions have occurred in the three regions subject of our study. Figure 4 illustrates the number of dissolved municipal governments for mafia infiltration from the introduction of the law until 2015. In total, there have been 258 cases of detected mafia infiltration into local governments over this period.

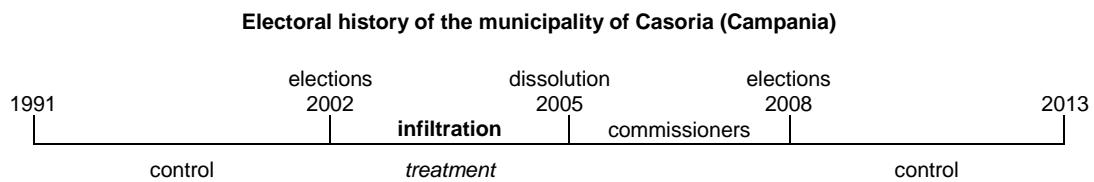
That said, within these three regions, the geographical distribution of dissolution varies significantly. As shown in figure 3, detected cases of mafia infiltration tend to be clustered in several specific areas within these regions. In Campania, the large majority of dissolutions occurred in the north-west, particularly in the provinces of Caserta and Naples – the area where the *Camorra* is traditionally strongest. Similarly, in the region of Calabria most detected infiltrations were located in the south, in the provinces of Reggio Calabria and Vibo Valentia, where the '*Ndrangheta*' is known to be centred. Finally, while dissolutions in Sicily are more widespread, the majority are concentrated in the province of Palermo, the heart of *Cosa Nostra*.

Identification Strategy

We rely on law 164/1991 to identify cases of mafia infiltration within local governments of the municipalities in our sample regions. Our identification strategy is based on a difference-in-differences (DiD) setting and exploits the time and geographical variation of dissolutions over time. The impact of criminal infiltrations is estimated by comparing municipal governments with and without infiltration before and after such infiltration is ended by the national government. We use the dissolution of a municipal government to identify our treatment period. For example, as shown in figure 5, the municipality of Casoria, in the province of Naples (Campania), held local elections in 2002. The elected government was later dissolved at the end of 2005 and commissioners took over until the following elections, at the beginning of 2008. Our treatment period thus ranges from the election in 2002 to the dissolution in 2005. This decision reflects our aim to identify the period of time during which organised crime was plausibly colluding with the local government.

The control group is made of all non-dissolved governments and it comprises both municipalities that have never experienced dissolutions and municipalities that have experienced one or more dissolutions. In the example, all years before 2002 and after 2007 will make part of the control period. Due to the fact that external commissioners have specific duties regarding the administration of public finance, all years between the dissolution of a government and the subsequent elections are excluded from the sample. Therefore, in the case of Casoria the years 2006 and 2007 are not considered in the estimations.

Figure 5
Definition of the treatment period



Unlike classic DiD strategies, our setting is based on a treatment period beginning at different points in time for the treated municipalities. This framework has the advantage that it allows restricting the full sample to those municipalities belonging to the treatment group at any point in time, i.e. those that have experienced at least one dissolution for mafia infiltration. In such a way,

it is possible to obtain a sample of arguably very similar municipalities, minimising unobservable heterogeneity. Performing this sample restriction is indeed important, because as seen in figure 3 the geography of dissolutions displays significant concentrations in some provinces of the sample regions. An additional peculiarity of our setting is that the treatment period switches on and off, i.e. municipalities remain infiltrated until the dissolution takes place.

Threats to identification

There are some potential concerns associated to our identification strategy. First, it might be that the application of law 164/1991 has been imperfect. Some municipalities may have been infiltrated but not dissolved because judicial authorities have not detected the collusion. Similarly, some dissolutions may have been done erroneously as there was no real infiltration. Infiltrated municipal governments that are not dissolved would indeed belong entirely to the control group, determining an attenuation bias to the empirical results. Similarly, periods of erroneously detected infiltration would instead belong to *treated* years, again biasing the estimated impact of infiltrations towards zero. This means that the point estimate of regression coefficients is likely to be larger (in absolute value) than the one observed.

Another potential issue for our estimates could arise if the dissolution of municipal governments has been manipulated politically. In other words, it may be that the decision over which local governments to dissolve – or not to dissolve – is driven by political considerations. If, for example, the main party of the national government does not want to ‘lose’ the control of a local government ruled by the same party or an allied party of the same political coalition. This distorted use of law 164/1991 is, however, unlikely to happen for several reasons. First, the dissolution process is initiated and carried forward by the Italian Anti-Mafia Investigation Directorate (*Direzione Investigativa Antimafia*), one of the most efficient investigative bodies of the Italian State.⁷⁰ This is an organisation composed of highly trained and specialised individuals from the three main police forces (*Polizia di Stato*, *Carabinieri* and *Guardia di Finanza*), whose

⁷⁰ The Anti-Mafia Investigation Department (DIA) was founded in 1999. Its operations include preemptive investigations and judicial investigations. It investigates characteristics, objectives, and methods of the mafia as well as its domestic and international contacts.

experience is often valued and requested by other countries and institutions needing consults on the fight against organised crime⁷¹.

In addition, the multiplicity of actors involved in the dissolution decision, from national MPs to the Minister and the Cabinet to the President of the Republic, makes any form of manipulation of the law improbable.⁷² In order, however, to provide as much evidence as possible, we perform a test to rule out the possibility of systematic political manipulations. If dissolutions were manipulated, we would expect to observe that the political colour of provincial and national governments is significantly associated to the political colour of dissolved municipal governments. As shown in Appendix A1, which refers to the restricted sample of dissolved municipalities in the 1998-2013 period, there is no statistically significant correlation between the colour of national or provincial governments and that of municipal governments. Indeed, given the political cost generated by a dissolution for the national government – e.g. high national media coverage and political competitors exploiting the latter by asking for the government's resignation – it is extremely unlikely that the national government would strategically choose to dissolve municipal governments governed by opposing parties.

Moreover, Italian local governments can also be dissolved for reasons unrelated to mafia infiltration (e.g. resignation of the mayor, resignation of more than 50% of council members etc.). Hence, for politicians wishing to undermine the stability of a given municipality ruled by an opposing party, such routes would certainly represent cheaper and easier options than trying to establish a false mafia case.

A final potential issue with our empirical setting is that the definition of our treatment and control observations is based on the assumption that the entire period between the election of a local government and its dissolution consists of infiltration years. We test the validity of this assumption in the empirical analysis.

⁷¹ Some examples are the Italian Prosecutor Antonio Ingroia, responsible for significant investigation into the Sicilian mafia, who has been appointed Director of the United Nation – Central American country's International Commission against Impunity (CICIG).

⁷² The only case where the dissolution has not followed the normal legislative process is in the case of Fondi. The local prefect, together with the enforcement agencies, in 2009 proposed the dissolution of this municipality, but the Ministry of Interior opted for a political solution asking the municipality to proceed immediately with new elections without dissolving the government. The case of Fondi was covered by the Italian press and tv news for days, and no similar case has happened after that. Since the concern of the press and opposition parties was that the new elections were not sufficient to get rid of the criminal infiltration, this would constitute a downward bias in our setting.

4. Data and estimating equation

Institutional setting of municipalities and data

Local public spending and municipal revenues. Our primary data source is the *Certificati Consuntivi* database of the Italian Ministry of Interior, which contains yearly statistics on the public finance of Italian municipalities for a number of different spending categories. The full dataset is disaggregated into capital and current expenditures. These are further disaggregated into six specific spending categories reflecting the services and functions to which the resources have been allocated and spent and include: general administrative functions, social sectors, construction and waste management, transportation, public education and municipal police (see Appendix A2 for more details).

This dataset is available for the 1998-2013 time period. Table 1 and Appendix A2 illustrate average per capita spending for the municipalities in our sample over this period. The resources spent by the municipalities amounts to a yearly average of €543 per inhabitant for capital expenditures (i.e. investments) and a yearly per capita average of €731 for current expenditures (i.e. salaries and services). Summing these two figures we obtain the average total spending per municipality, €1274 per inhabitant. As shown in Table 1, the spending sector to which the most annual resources are allocated is construction and waste management, which makes up 34% of the annual capital expenditures budget. Average spending for this component is €382 per year, €217 for the capital and €147 for the current expenditures.

The same *Certificati Consuntivi* database of the Italian Ministry of Interior provides information on the revenues collected by municipal governments. Given the quasi-federal structure of the Italian State, municipalities are expected to maintain a certain level of independence and autonomy in collecting their own financial resources. Hence, local taxes represent an important source of income for municipalities⁷³.

We follow Drago et al. (2014), constructing a measure of efficiency in revenue collection calculated as the ratio between collected revenues and the total amount of forecasted revenues that the municipality should collect within the budget year. We focus on the two main local taxes, i.e. property tax and waste tax, and on total collected revenues (including all taxes and transfers).

⁷³ Local fiscal revenues correspond on average to 52% of the entire budget for Italian municipalities (Daniele et al., 2016).

As figure A2.2 shows, property tax and waste tax are the main source of income in the municipal fiscal budget. However, Table 1 indicates that municipalities in our sample do not collect all the expected fiscal revenues. In particular, the capacity to collect waste taxes is generally very low.

Infiltrations. In order to measure the infiltration of organised crime within local governments, we identify all municipalities that experienced government dissolution due to mafia infiltration from 1991 to 2013, exploiting information on the date of the dissolution available from the Ministry of the Interior.

Control variables. We exploit data on mafia-related homicides in each province and year of our sample from the Italian National Institute of Statistics (ISTAT). These data were collected by the Ministry of Interior and classified according to the Italian Penal Code.

A number of municipal level time-varying characteristics are obtained from the 1991, 2001 and 2011 ISTAT Censuses interpolated over time: unemployment rate, percentage of industry employment, percentage of agricultural employment, and percentage of tertiary education degree holders.

Table 1
Descriptive statistics

Variable	Full sample			Restricted sample		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
<i>Total per capita spending (log)</i>						
Total	21,156	6.974	0.555	2845	6.773	0.485
Capital expenditures	21,156	5.488	1.327	2845	5.118	1.214
Current expenditures	21,156	6.518	0.406	2845	6.429	0.396
<i>Capital expenditure component (share of total)</i>						
Administration	21,037	0.152	0.217	2813	0.164	0.211
Social sector	20,901	0.063	0.134	2789	0.056	0.124
Construction and waste management	21,137	0.342	0.292	2817	0.321	0.277
Transports	21,090	0.232	0.242	2818	0.228	0.233
Education	20,844	0.084	0.153	2799	0.106	0.166
Municipal police	20,477	0.003	0.019	2751	0.007	0.026
<i>Current expenditure component (share of total)</i>						
Administration	21,240	0.429	0.095	2842	0.400	0.093
Social sector	21,243	0.073	0.058	2842	0.086	0.061
Construction and waste management	21,239	0.228	0.085	2842	0.269	0.090
Transports	19,909	0.082	0.040	2664	0.068	0.036
Education	18,557	0.083	0.041	2480	0.075	0.038
Municipal police	21,239	0.059	0.027	2842	0.058	0.023
<i>Municipal revenues (collected/forecasted)</i>						
Total revenues	17,596	0.573	0.192	2381	0.563	0.157
Property tax	18,703	0.494	0.361	2524	0.477	0.425
Waste tax	18,692	0.136	0.249	2524	0.101	0.198
<i>Control variables</i>						
Percentage of agricultural employment	21,594	4.592	3.382	2912	4.303	4.066
Percentage of citizens holding tertiary education degrees	21,594	6.060	2.620	2912	5.687	2.272
Percentage of industry employment	21,594	6.489	2.128	2912	5.894	1.693
Unemployment rate	21,594	7.609	2.518	2912	8.890	2.646
Mafia-related homicides per inhabitant at province level	21,600	0.0058	0.0082	2912	0.0095	0.0092

Note: Full sample refers to all municipalities of Campania, Calabria and Sicily. Restricted sample refers to municipalities of these regions having experienced at least one government dissolution for mafia infiltration. The sum of the means of all capital or current expenditure components does not sum up to 1 due to the fact that there are some other minor spending components not considered in the analysis.

Estimating Equation

The difference-in-differences setting is exploited to test whether mafia infiltrations have any impact on public finances in the local governments of Campania, Calabria and Sicily during the 1998-2013 period. To this end, we compare municipal governments with and without infiltration before and after such infiltration is terminated by the national government.

We estimate various versions of the following model:

$$y_{m,t} = \alpha + \beta Inf_{m,t} + \gamma Mafia_{p,t} + \delta X_{m,t} + \varphi_m + \tau_t + \varepsilon_{m,t} \quad (1)$$

Where $y_{m,t}$ can be $PS_{m,t+1}$ or $T_{m,t}$.

$PS_{m,t+1}$ refers to public spending in municipality m at time $t+1$ ⁷⁴. This is either $\ln \frac{\sum_c PS_{c,m,t+1}}{pop_{m,t}}$, the natural logarithm of total per capita spending committed by a municipal government; or $\frac{PS_{c,m,t+1}}{\sum_c PS_{m,t+1}}$, the spending committed to component c as a share of total spending committed for the next financial year.

$T_{m,t} = \frac{\text{collected } T_{m,t}}{\text{expected } T_{m,t}}$ is the ratio between the collected tax and transfers and the amount of assessed revenues that the municipality should collect, a measure of government efficiency in collecting public resources.

The key variable in the model is $Inf_{m,t}$. This is a dummy taking value 1 from the year of the last regular election before the dissolution until the moment in which the municipal government was dissolved, and zero otherwise. Hence, the dummy takes value one in year t if in that year the municipality is ruled by a government later dissolved for mafia infiltration.

The coefficient of interest is β which captures the impact of the infiltration at time t on the public spending allocation at time $t+1$.

As our main aim is to identify the effect of a specific activity from organised crime – the *temporary* infiltration into local governments on governments' spending decisions – we need to make sure that the observed effect is driven by the mafia-politics collusion and not by

⁷⁴ The time lead derives from the fact that our dependent variable is based on spending commitments, i.e. annual allocations to different spending categories defined at the end of a financial year for the following year by a municipal government. This allows reducing issues of reverse causation as our main variable of interest is measured at time t .

heterogeneity in the local organised crime power across municipalities. This issue is tackled in two ways. First, we test the results by restricting our sample to municipalities that have seen their government dissolved at least once, reducing unobservable differences in local conditions. Second, we include in the model a control variable, $Mafia_{p,t}$, referring to mafia-related homicides and used as a proxy for the underlying strength of the mafia in the province of the municipality in year t .

Vector $X_{m,t}$ denotes a set of socio-economic and demographic characteristics of municipalities in the sample regions.

The model is completed by municipality dummy variables, controlling for time-invariant unobservables correlated with the timing of the infiltration (φ_m), and time fixed effects, controlling for year-specific shocks (τ_t). Finally, $\varepsilon_{m,t}$ is an idiosyncratic error term. Throughout the empirical analysis we cluster standard errors at the municipal level.

5. Estimation results

Infiltration and overall level of spending

We begin by presenting the estimates of the effect of mafia infiltration on total municipal spending (Table 2). In columns (1) and (2) we focus our attention to total spending per capita. The model is initially estimated for the full sample of 1350 municipalities from Calabria, Campania and Sicily (column (1)). In column (2) we restrict the sample to a group of more homogeneous municipalities – those 182 having experienced at least one government dissolution for mafia infiltration. In the following columns, we sub-divide total spending into total capital expenditures per capita (columns (3)-(4)) and total current expenditures per capita (columns (5)-(6)).

The results displaying the coefficients of all control variables, shown in Table A5, indicate that when the sample is restricted to the 182 municipalities that have experienced dissolutions, the proxy for the underlying strength of the mafia is not significantly associated with total municipal spending⁷⁵.

⁷⁵ The pairwise correlation between infiltration dummy and $Mafia_{p,t}$ variable, tested separately, is positive for the full sample and insignificant for the restricted sample of municipalities. This may imply that by restricting the sample to municipalities having experienced infiltration-related dissolutions, we have successfully managed to reduce heterogeneity in terms of mafia strength in the territory. Another interpretation may be that the decision of mafia groups

Throughout all different specifications, the coefficient of the infiltration dummies in Table 2 is not statistically significant. Hence, the results provide evidence that, other things equal, infiltration periods are not associated with significant variations in the total amount of local government expenditures, either for public investments (capital expenditures) or for services and maintenance (current expenditures).

Table 2
Effect of infiltration on total public spending

	Dependent Variable:					
	Total per capita spending		Total p/c spending - capital expenditures		Total p/c spending - current expenditures	
	(1)	(2)	(3)	(4)	(5)	(6)
Inf	-0.0223 (0.0189)	-0.0066 (0.0191)	-0.0796 (0.0697)	-0.0729 (0.0711)	0.0137 (0.0121)	0.0139 (0.0119)
Controls	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓
Municipality dummies	✓	✓	✓	✓	✓	✓
Full sample	✓		✓		✓	
Restricted sample		✓		✓		✓
Observations	20,888	2582	20,888	2582	20,888	2582
R-squared	0.510	0.522	0.353	0.347	0.713	0.556
Municipalities	1350	182	1350	182	1350	182

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Inf refers to infiltration dummy; Commissioning years excluded. Controls: mafia-related homicides, agricultural employment, industry employment, tertiary education degree holders, unemployment. Full sample: 1350 municipalities of Campania, Calabria and Sicily; restricted sample: municipalities having experienced at least one government dissolution for mafia infiltration.

Our findings differ from those of Olivieri and Sberna (2014), reporting a positive relationship between pre-electoral mafia violence and total public investment in local municipalities of Southern Italy. The difference can be due to the fact that we do not focus on mafia violent attacks, but on mafia infiltration within politics. Accordingly, a possible explanation for our results is that the mafia, when infiltrated into local governments, is not interested in forcing a modification of overall aggregate spending. Indeed, if municipal governments were running constant budget deficits during infiltration periods, they would risk being commissioned by the central government for reasons of financial instability, thus leaving the mafia without reliable political connections in the local councils.⁷⁶ Rather, a way to coercively condition the public finance of

to infiltrate within local governments is not directly related to the intensity of their violent activity (which is however measured at the province level).

⁷⁶ Article 244 of the *Testo Unico Enti Locali* (TUEL) foresees the possibility to declare municipalities non-solvent (*dissesto finanziario*) when it is incapable to provide the basic functions, services and public goods.

infiltrated governments may be to modify investment policy in those sectors that are strategic for protecting the interests of organised crime. We test this hypothesis in the following section.

Infiltration and specific spending components

We now break down total spending into different items of expenditure and test whether mafia infiltrations significantly affect the allocation of public resources in each components of governments' budgets.

The model is estimated both with capital and current expenditure components as dependent variables, each spending item being measured as a share of the total spending. Again, the model is estimated both for the full sample of municipalities and for the restricted sample of municipalities who have had their government dissolved at least once.

The estimation results are shown in Tables 3 and 4.

We begin with capital expenditures, i.e. investments (Table 3). We find that on average infiltrated municipalities spend more on construction and waste management (columns (5)-(6)) and less on municipal police (columns (11)-(12)). These results are consistent across both specifications, remaining significant and with similar magnitude. A first look at these results indicates that upon infiltration, organised crime's main strategy is to bias the allocation of resources towards specific sectors rather than affect total spending.

When we turn our attention to current spending (Table 4), the infiltration dummy is insignificantly correlated with most of the current spending components. The only significant effect is on municipal police.

Why are the construction and police sectors the only two being affected by infiltrations? We provide an interpretation of the size of estimates and the meaning of these results below.

Table 3
Effect of infiltration on capital expenditures by component

	Dependent variable: share of spending in the following component											
	Administration		Social sector		Construction and waste management		Transports		Education		Municipal police	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Inf	-0.0115 (0.0143)	-0.0146 (0.0139)	-0.00494 (0.00746)	-0.00674 (0.00764)	0.0448** (0.0175)	0.0442** (0.0181)	-0.0206 (0.0133)	-0.0220 (0.0133)	0.00633 (0.0111)	0.00949 (0.0109)	-0.00262** (0.00126)	-0.00222* (0.00118)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Municipality dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Full sample	✓		✓		✓		✓		✓		✓	
Restricted sample		✓		✓		✓		✓		✓		✓
Observations	20,682	2554	20,551	2535	20,783	2559	20,735	2559	20,490	2541	20,126	2496
R-squared	0.260	0.219	0.135	0.138	0.205	0.227	0.173	0.152	0.115	0.140	0.169	0.235
Municipalities	1350	182	1350	182	1350	182	1350	182	1350	182	1350	182

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

Table 4
Effect of infiltration on current expenditures by component

	Dependent variable: share of spending in the following component											
	Administration		Social sector		Construction and waste management				Transports		Education	
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Inf	-0.00538 (0.00497)	-0.00623 (0.00484)	-0.00163 (0.00512)	-0.000277 (0.00429)	0.00545 (0.00489)	0.00530 (0.00491)	-0.00105 (0.00193)	-0.000947 (0.00193)	0.000219 (0.00168)	0.000599 (0.00174)	-0.00256** (0.00130)	-0.00217* (0.00123)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Municipality dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Full sample	✓		✓		✓		✓		✓		✓	
Restricted sample		✓		✓		✓		✓		✓		✓
Observations	20,881	2579	20,884	2579	20,880	2579	19,582	2427	18,235	2242	20,880	2579
R-squared	0.736	0.698	0.650	0.612	0.732	0.687	0.752	0.752	0.816	0.787	0.622	0.665
Municipalities	1350	182	1350	182	1350	182	1350	182	1350	182	1350	182

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

Construction and waste management. According to the estimates in Table 3, infiltrated governments increase investment spending for construction and waste management by an average of 4 percentage points per year. This is a large figure if we consider that functions related to constructions and waste management account for the largest part of the capital expenditures budget (Table 1). Moreover, this is an average annual effect that is distributed over the whole period a government is in charge. Municipal administrations can last up to five years, and the average infiltration period in our sample of municipalities is 2.7 years. Therefore, the additional resources these governments put up on this sector of investment during the period of infiltration are substantial.

This particular spending item includes all expenses for urban planning, waste collection and the construction of new buildings, bridges, streets and highways.⁷⁷ This represents a strategic sector for the interests of criminal organisations for many reasons.

First, mafia groups need to find an outlet for all the resources obtained from their illegal traffics and the sector of constructions represents an easy and highly profitable option for money laundering. The technological and financial barriers to entry are relatively low, making this an ideal area for long-term investment. Second, this sector is associated with a set of activities which are deeply embedded into the local territory. Seizing the control of these activities is crucial for the mafia, in order to establish and expand the wide network of relationships which allow its survival and prospering. The construction of new buildings involves many agents: the political power in charge of awarding public work tenders, contractor enterprises responsible for delivering the project, and a labour pool carrying out the work. Organised crime groups may be involved at all levels of this chain, by exploiting the political connections they have in order to distort fair competition and rig public work bids at the advantage of the enterprises they control, or intend to favour. Moreover, access to privileged information on future bids and winning contractors allows the mafia to offer employment, therefore directly managing an important portion of the local labour market (Sciarrone, 2011).

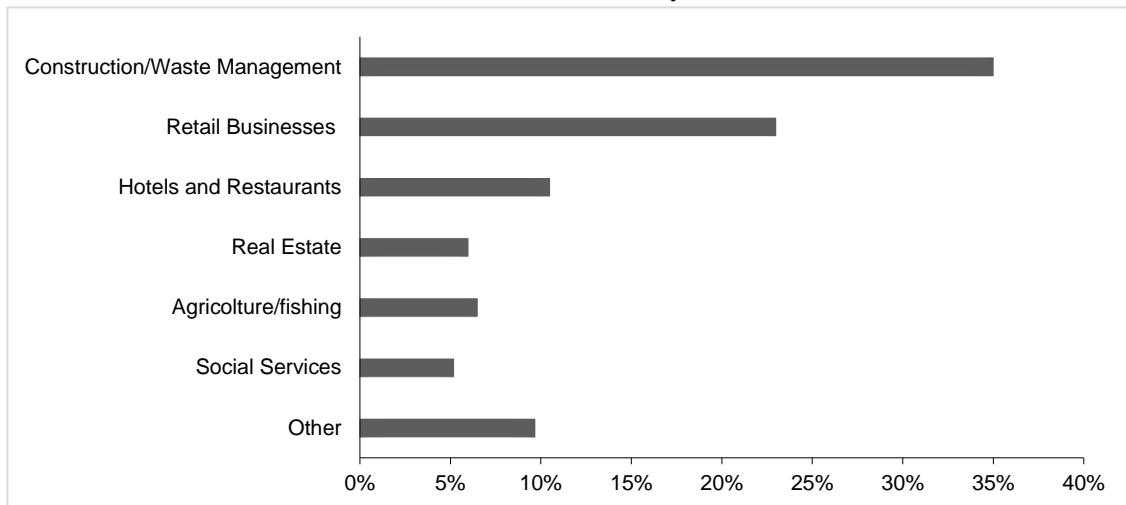
For the mafia, having political referents within local governments translates into the possibility of steering the outcomes of public work tenders and increasing the profits of affiliated firms. The more buildings to be constructed, the more contracts that will be awarded and the higher the potential gains for the criminal organisation (Lavezzi, 2008). Figure 6 shows the number of firms,

⁷⁷ At the end of each fiscal year, local governments must approve plans for the financing of public works, set to be realised either within the same year or part of a three-year plan. Annual plans include all projects below 100,000 euros, while three-year plans are for projects above this figure. While yearly plans are binding, three-year plans can annually be updated with new projects. Urban planning interventions represent a key prerogative of local administrations, and regional or national level governments have little say over these kinds of policy initiatives.

disaggregated by business sector, confiscated by police due to collusion with organised crime. In line with the above estimates, the majority operate in the construction and waste management sector.

The creation of collusive cartels between politicians, *mafiosi*, and entrepreneurs in the construction market not only causes distortions in the competition for public works, but also seriously inflates expenditures in this sector.

Figure 6
Mafia-controlled firms by sector



Source: Transcrime (2013).

Municipal police. The second significant variation in the local public spending is on municipal police. A significant decrease is seen both for capital and for current expenditures in this sector.

We find that during infiltration periods spending for police reduces by about 0.2 percentage points annually. While this might seem like a low figure, it should be compared to the average share of investment in local police forces made by governments in our sample. As shown in Table 1, the proportion of capital expenditures allocated to this sector is about 0.3% of the total for the full sample of municipalities, and 0.7% for the municipalities who had their government dissolved at least once. Therefore, an average annual reduction of about 0.2 percentage points represents a considerable change. In practice, given that police expenditures are typically low, they are thus nearly absent in infiltration years.

In turn, the significant reduction in spending on municipal police as part of current expenditures corresponds to a less radical change in budget decisions, given the share of current expenditures allocated to municipal police being 6% of the total (Table 1).

And yet, if we add up the current and the capital expenditures effects, a clear pattern emerges indicating that infiltrated governments tend to refrain from making expenditures on local police forces. A reduction of resources directed towards law enforcement bodies such as the municipal police may directly benefit the criminal organisations, facilitating their illegal activities. Indeed, the local police are responsible for maintaining public order and security, a task shared with the national police (*Polizia di Stato*) and low-quality equipment may imply a lesser ability to fight crimes such as drug trafficking, usury and murders. Perhaps most importantly, local police are also responsible for so-called ‘administrative police’ functions, including surveillance over construction works and abidance with building regulations. Given that a lack of compliance with building regulations is one of the most frequent motivations for government dissolutions, allocating fewer resources to municipal police forces may also be one of the ways in which corrupt local politicians attempt to prevent dissolutions.

Inclusion of time trends. In appendix A3, we replicate the analysis using capital expenditures for construction and for police, and current expenditures for police as dependent variables and perform a set of robustness tests. We gradually increase the number of controls and include linear time trends.

The coefficient of the infiltration dummy is consistently significant and positively correlated with investment in construction across different specifications. The coefficient of capital expenditures for police also remains negative and strongly significant, while the result of current spending for municipal police is not robust to the inclusion of time trends. For this reason, we do not further test its robustness in the remaining of the paper.

Infiltration and revenues collection

We now turn to verifying whether infiltrations impact the ability of local governments to collect revenues. Three are the dependent variables considered: total revenues, property taxes and waste taxes.

The results are presented in Table 5. The coefficient for total revenues is negative in columns (1) and (2) but insignificant, evidence that collected revenues do not modify during infiltration periods. No effect is found on property taxes either.

Instead, the coefficients on waste tax (column (7) and (8)) are negative and significant. The effect is economically sizeable: according to our estimates, infiltrated municipalities collect 15% less taxes on waste and garbage compared to the average of non-treated municipalities. The result is

stable to the inclusion of our set of controls, to the restriction of the sample (column (8)), and to the inclusion of time trends (Appendix A3).

The interpretation of this result is twofold. First, the direct or indirect presence of criminal organisations within the municipal government has an impact on the performance of the local government. Indeed, tax evasion generates significant losses and distortions in government revenues; the ability to efficiently enforce tax collection is one of the fundamental components of state capacity (Casaburi and Troiano, 2016). As shown in figure A5.1, waste tax represents 32% of the municipal budget. Second, lower fiscal revenues in the waste sector may correspond to a precise strategy on the part of criminal organisations who aim to weaken the presence and reputation of the legal institutions in order to open up the possibility of substituting it through a system of provision of private favours (Trocchia, 2009). This result, together with the evidence on spending on construction and waste management uncovered in section 5.2, seems to confirm the well-known presence of criminal organisations within the waste management sector⁷⁸.

Table 5
Effect of infiltration on local revenues collection

	Dependent variable:					
	Total revenues		Property tax		Waste tax	
	(1)	(2)	(3)	(4)	(5)	(6)
Inf	-0.0127 (0.0111)	-0.0123 (0.0114)	0.00006 (0.0214)	-0.0018 (0.0206)	-0.0210** (0.00912)	-0.0185** (0.00961)
Controls	✓	✓	✓	✓	✓	✓
Municipality dummies	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓
Full sample	✓		✓		✓	
Restricted sample		✓		✓		✓
Observations	18,464	2299	17,382	2169	17,103	2122
R-squared	0.314	0.374	0.410	0.445	0.502	0.470
Municipalities	1350	182	1350	182	1350	182

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

⁷⁸ The connection between the waste hauling industry and organised crime dates back decades. In the U.S., *Cosa Nostra* has been part of New York's commercial sanitation system since at least the 1950s (personal trash is hauled by the city's Department of Sanitation). "Carters", or trash haulers, have always been able to carve out and sell routes to one another, making the system vulnerable to strong-arm tactics. The *Camorra* is said to have controlled garbage in the city of Naples since the early 1980s. The poorly run system attracted worldwide attention when, back in 2008, uncollected garbage piled up on the city's streets for more than two weeks because, allegedly, the mafia had contributed to the closure of the dumps.

6. Robustness checks

In this section, we present a selection of tests verifying the robustness of our design and our three main estimation results: a significant inflation of construction and waste management investments, a contraction of police investments, and a reduction of waste taxes during infiltration periods.

Infiltration period beginning with elections. The starting assumption of our identification strategy is that the period of infiltration begins at the moment of the election of later-dissolved governments and ends with the dissolution. We test the validity of this assumption in Table 6, where we perform a placebo experiment on our restricted sample. If the significant variations in both public investments and revenues collection start in the period preceding infiltration, the decision to infiltrate a government might be taken as a result of these variations. This would occur if the criminal organisation were selecting municipalities where to extract rents on the basis of pre-determined variations in public expenditures or local taxes, made by governments with no links with organised crime. In this case, public spending decisions would be the cause, not the consequence, of organised crime infiltrations.

Our placebo test verifies the behaviour of governments preceding those later dissolved for mafia infiltration. For each of our key outcome variables we introduce three dummy variables taking value 1 respectively one, two, and three years before the election of later-dissolved government. All years coded as ‘infiltration years’ – from election to dissolution – are excluded from the sample.

We expect to find no significant correlation between pre-infiltration governments and any form of public spending or revenue collection distortion. Indeed, all the coefficients are insignificant, suggesting that the observed effects on public spending and revenue collection are significantly affected only after the election of later-dissolved governments.

Although we cannot reject with full certainty the possibility that infiltrations begin before elections, the results of our placebo test seem suggest that elections represent turning points for infiltrations. As suggested by Dal Bo’ (2007), elections may constitute a ‘recruitment process’ whereby a new bargaining table between crime and politics is established and the ‘criminal interest groups’ can select the political counterparts that best suit their interests.

Table 6
Robustness check – timing of the infiltration

	Dependent variable:								
	Public spending			Municipal police			Revenues collection		
	Construction and waste management			(4)	(5)	(6)	Waste tax		
	(1)	(2)	(3)				(7)	(8)	(9)
1 year before inf	0.0165 (0.0326)			0.00127 (0.00191)			0.00765 (0.0190)		
2 years before inf		0.0128 (0.0231)			0.00133 (0.00257)			0.00426 (0.0154)	
3 years before inf			0.0246 (0.0310)			0.000458 (0.0221)			0.0224 (0.0210)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Municipality dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2133	2133	2133	2072	2072	2072	1738	1738	1738
R-squared	0.255	0.255	0.364	0.256	0.256	0.497	0.474	0.474	0.616
Municipalities	182	182	182	182	182	182	182	182	182

Note: Clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Estimates performed on restricted sample. All years coded as 'infiltration years' – from the election to the dissolution of municipal governments – are excluded from sample.

As an additional test that the main effects do not begin before elections we perform a Granger causality test (Angrist and Pischke, 2008), analysing the dynamic evolution over time of investments and tax collections determined by the infiltration. The results, displayed in Appendix A6, further corroborate the evidence that the significant change in construction investments, police investments, and waste tax collection, do not precede the election of infiltrated governments.

Treatment correlated with outcome variable. Our results indicate that infiltrated local governments spend on average more on construction and waste management and less on municipal police. One concern, however, is that judicial investigators might choose to investigate precisely those municipalities that present anomalies in their balance sheets. If this is the case, the treatment would be correlated with the dependent variable, and the results would be biased.

In order to tackle this issue, we reproduced our analysis excluding from the sample all those municipalities for which the main reason for dissolution was related to distortions in public finances⁷⁹. The results, shown in table A7.1, are unaltered from the main specifications. Hence, we can safely dismiss the concern that our results were driven by selection into treatment bias.

Placebo test: mafia-unrelated dissolutions. One concern related to the changes in the public spending of infiltrated governments is that, rather than being caused by the mafia, they might be driven by some inherent characteristics of dissolved local governments. These may include the degree of political instability, or the quality of politicians governing these local councils. In order to test for this, we exploit the fact that in Italy local governments can be dissolved for reasons unrelated to mafia infiltrations, including: failure to approve the financial budget, resignation of the mayor, resignation of more than 50% of the council members, vote of no confidence. These dissolutions are in fact relatively common in our sample and time-span – in the period from 1998 to 2013 there were 463 cases of municipal government dissolutions unrelated to the mafia within the three regions of analysis. We use these dissolutions as proxies for unstable governments and for low quality of elected politicians, replicating the estimates of model (1) using as the main explanatory variable a dummy taking value 1 for all years in which governments later-dissolved for mafia-unrelated reasons were governing the municipalities⁸⁰. If the results in section 5 were

⁷⁹ In order to perform this test, we exploit official statements on the dissolutions produced by the Ministry of Interior. These documents contain descriptions of the final reasons motivating the dissolution, as well as the reasons why the investigation was initiated. We exclude from our sample all the municipalities for which the investigation started because of abnormal public expenditures and/or the reason for the dissolution was due to spending-related distortions.

⁸⁰ This type of dissolution is indubitably a bad outcome for a newly elected local government. When, in fact, the government is dissolved for non-mafia related reasons, the elected politicians cannot run again in the following election. Thus, they have every incentive to avoid this scenario.

driven by local government characteristics unrelated to the mafia - rather than by infiltrations - we would expect to obtain similar effects as those presented above.

The results of this placebo test are shown in Appendix A8. We exclude all infiltrated governments and compare dissolved governments for mafia-unrelated reasons with other governments, before and after the dissolution takes place. We do so using the entire sample of municipalities from Calabria, Campania and Sicily from 1998 to 2013, controlling for time and municipality fixed effects, and all other controls. We obtain no statistically significant coefficients, suggesting that the observed differences between infiltrated and non-infiltrated governments are truly produced by the presence of the mafia.

7. Organised crime and politics

Our results have thus far revealed that collusion between criminal organisations and politicians has a significant impact on the allocation of public resources. Public finances can, however, be affected by a multiplicity of factors, the most intuitive and important of which is politics. Hence, a question is whether our results so far are truly driven by criminal infiltration or simply by some unobserved political characteristics of the local elections of infiltrated municipalities.

In answering this question, this section investigates the empirical relationship between organised crime and politics. Consequently, not only we provide a crucial test for the validity of our results, but we also offer further insight into the infiltration phenomenon.

Mafia infiltration and local electoral factors

There are different political characteristics that might be associated with government capturing, one of which is electoral competition⁸¹. We assess whether mafia infiltration is related to the degree of electoral competition by exploiting the fact that there have been cases in which local elections in Southern Italy have been non-competitive, that is, *only one candidate* was potentially

⁸¹ Electoral competition may help giving rise to opposition parties that can inform the electorate about corruption or collusion (Schleiter and Voznaya, 2014) or, alternatively, more competitive elections may make it more difficult for voters to identify who is responsible for government policy and to coordinate in selecting the best politicians, hence increasing collusion (Lewis-Beck, 1988).

eligible as mayor because no other electoral lists were presented⁸². A lack of electoral competition may signal that the absence of political opposition within local councils facilitates the chances for the mafia to find valuable political referents, or it may imply that mafia pre-electoral intimidations limit the participation of other candidates.

Another political element which may be associated with infiltration is the mandate limit of the incumbent mayors⁸³. We look at the moment of their political office – first or second term as mayor – in which incumbents are more likely to engage in collusion behaviours. We exploit the fact that up until 2014 all mayors had a limit of maximum of two consecutive terms in office⁸⁴ and examine whether infiltration is associated with the fact that mayors have no possibility to be immediately re-elected.

Finally, infiltrations may be systematically correlated with the political colour of governments. We explore this relationship by verifying if there is any political party recurrently forming collusive ties with organised crime. To test for that, we divide the political spectrum into three categories: left-wing parties, right-wing parties, and centre parties.

In order to investigate whether any correlation exists between the political characteristics of municipal elections and cases of criminal infiltration we regress a set of political indicators on the *Inf* dummy⁸⁵. We focus on the 182 municipalities that have experienced at least one dissolution for mafia infiltration between 1998 and 2013 and estimate the following linear probability model:

$$Political\ factors_{m,t} = \alpha + \beta Inf_{m,t} + \gamma Mafia_{p,t} + \delta NatGov_t + \vartheta X_{m,t} + \varphi_m + \tau_t + \varepsilon_{m,t} \quad (2)$$

Political factors_{m,t} is sub-divided into a set of variables referring to key political features of the local government, namely *Single Candidate_{m,t}*, *Last Mandate_{m,t}*, *Party Colour_{m,t}*.

Single Candidate_{m,t} is a dummy variable taking value one if the mayor governing the municipality at time *t* in municipality *m* was the only one candidate at the previous local elections, while past elections of the same municipality were competitive with multiple candidates. *Last Mandate_{m,t}* is a dummy taking value one if the mayor is running for the last mandate and

⁸² In such cases, the only condition for elections to be valid is a voter turnout above 50%.

⁸³ Binding term limit tend to affect the behaviour of politicians (Besley and Case, 1995; List and Sturm, 2006) and may increase corruption and collusion cases (Ferraz and Finan, 2011).

⁸⁴ Even if this would allow mayors to run for a third term after a term break, third-term candidacies are rare.

⁸⁵ The analysis exploits the same dataset used in Section 3, augmented with data on election characteristics from the Historical Archive of Local Elections of the Italian Ministry of Interior.

has been in office for more than one term, and zero otherwise. $Party Colour_{m,t}$ represents the political party that is ruling the government of municipality m at time t . It is sub-divided into three categories: Right party, Left party, Centre party⁸⁶. Each of these is binary and takes value one if the party of that political side has won the previous elections and is ruling the municipality at time t . Descriptive statistics of these variables are in Appendix A9.

$NatGov_t$ is a dummy variable controlling for the political colour of the national government at time t . It takes value one when coalitions led by left-wing parties are ruling the country.

The model includes controls, fixed and year effects. We exclude from the sample all years in which municipal governments were commissioned, not just for mafia infiltration but also for other reasons. Table 7 summarises the results.

Table 7
Infiltration and political factors

	Dependent variable:				
	Single Candidate (1)	Last Mandate (2)	Right Party (3)	Left Party (4)	Centre Party (5)
Inf	0.0474** (0.0194)	0.189*** (0.0506)	0.0942** (0.0516)	-0.0682 (0.0464)	0.0351 (0.0327)
National gov (Left)	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓
Municipality dummies	✓	✓	✓	✓	✓
Observations	2869	2869	2582	2582	2582
R-squared	0.220	0.259	0.455	0.468	0.417
Municipalities	182	182	182	182	182

Note: Clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Governments without a clear political colour (right, left, or centre) excluded from sample in columns (3)-(5).

The coefficient of $Single Candidate_{m,t}$ is positive and significant in column (1). One interpretation of this finding is that due to mafia-government agreements, the mafia operates to reduce political competition, up to the point that only their preferred candidate is running for mayor. Alternatively, it may be that infiltrations are more likely to occur if the local council lacks any political group potentially contrasting the decisions of the government. Moving to column (2), the coefficient of the $Last Mandate_{m,t}$ dummy variable is positive and significant, suggesting that mayors in their last term in office are more likely to collude with organised crime. In columns (3) we look for a ‘partisanship effect’, i.e. a systematic relationship between

⁸⁶ When estimating the model with $Party Colour_{m,t}$ variables, we have excluded the few governments whose administration cannot be classified among the three categories of parties.

infiltrations and some types of parties. The result of a positive and significant coefficient for the Right party dummy variable suggests that infiltrations are significantly correlated with the probability of having conservative local governments.

Political factors and public finance in infiltrated municipalities

All the political and electoral elements discussed so far may not only be correlated with infiltrations, but also with investment decisions of local governments⁸⁷. Hence, for any uncovered correlation between political conditions and infiltration cases we test their correlation with key categories of local public finance.

Table 8
Political factors and key outcome variables

	Dependent variable:								
	Construction and waste management			Public spending			Municipal police		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Last mandate	0.0098 (0.0160)			0.0002 (0.0013)			0.0100 (0.0118)		
Single candidate		-0.0686 (0.0451)			-0.0012 (0.0025)			-0.0199 (0.0252)	
Centre party			-0.0453 (0.0301)			0.0001 (0.00242)			0.0018 (0.0288)
Right party			-0.0178 (0.0179)			-0.0002 (0.00242)			-0.0195 (0.0137)
Inf	0.0465*** (0.0164)	0.0512*** (0.0163)	0.0418*** (0.0182)	-0.0025** (0.0012)	-0.0024** (0.0011)	-0.0027* (0.0014)	-0.0227** (0.0088)	-0.0193** (0.0085)	-0.0161* (0.0095)
National gov (Left)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Municipality dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2,778	2,778	2,408	2,717	2,717	2,351	2,302	2,302	2,005
R-squared	0.227	0.228	0.236	0.235	0.235	0.239	0.451	0.451	0.465
Municipalities	182	182	182	182	182	182	182	182	182

Note: Clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Sample of municipalities having experienced at least one government dissolution for mafia infiltration.

⁸⁷ Local political conditions may influence the allocation of public expenditures (Johnston, 1977; Besley and Coate, 1998). The expectations for and results of electoral contests may be drivers of the territorial allocation of public investments if, for example, incumbent governments allocate public resources with the aim of extracting the highest electoral benefits (Cadot et al., 2006; Rodriguez-Pose et al., 2016), or if public investments are seen as a mean to reward voters for electoral support (Golden and Picci, 2008). While this is a possibility, there is substantial evidence suggesting that the distribution of public expenditures is not always influenced by pork-barrel politics or strategic electoral considerations (e.g. Larcinese et al., 2012; Luca and Rodriguez-Pose, 2015).

The results of model (4), displayed in Table 8, report no significant correlation between key political factors and the public finance components varying during infiltration periods. This suggests that, as hypothesised, the variations in public spending are not determined by any of the political elements linked with infiltrations.

Partisanship and mafia infiltration

The previous section uncovered a systematic correlation between criminal infiltrations and governments ruled by conservative parties. Although interesting, this result cannot be interpreted causally. The electoral victory of a right-wing candidate is plausibly correlated with a wide range of socioeconomic characteristics of the municipality. To give a more causal interpretation to the relationship between right-wing parties and infiltration, we implement a regression discontinuity design (RDD).

We compare municipalities where right-wing candidates won local elections by a narrow margin to municipalities where right-wing candidates lost by a narrow margin. The underlying assumption is that municipalities where right-wing candidates won or lost by a narrow margin are similar across all characteristics, except for the ideological leaning of the incumbent politician. Table A10.1 in the Appendix provides evidence that key covariates (socio-economic variables, mafia strength, local election characteristics) are not significantly different in treatment and control groups used for the RDD⁸⁸.

Let $X_{m,t}$ be the vote share of the right-leaning candidate minus the vote share of the non-right candidate, $R_{m,t}$ be the treatment dummy variable referring to electoral victories of right-wing parties, and $\Pr(Inf)_{m,t}$ the probability of infiltration. $R_{m,t} = 1$ if $X_{m,t} > 0$ and $R_{m,t} = 0$ if $X_{m,t} < 0$. We focus on the set of electoral races where $X_{m,t}$ is lower than a bandwidth h^{89} , such that the outcome of those races can be considered as good as random. Our treatment effect is the average difference between $\Pr(Inf)_{m,t}$ of a municipality where the right narrowly wins and $\Pr(Inf)_{m,t}$ of a municipality where the right is narrowly defeated.

⁸⁸ As a robustness check, the RDD estimates are replicated comparing all the close electoral races where the right barely wins or loses against the *left party* only. The results are unchanged from the ones obtained when all non-right parties belong to the control group. Estimation results available upon request.

⁸⁹ We use Calonico et al.'s (2014) optimal bandwidth, which in our setting corresponds to 0.075, meaning that the sample is made of governments whose election was characterised by a difference in votes between the right-wing party and other parties below 7.5%.

We estimate the RDD both parametrically and non-parametrically, and using linear and quadratic polynomials. Table 9 reports our results, obtained with the full sample of municipalities from Campania, Calabria and Sicily. Columns (1) and (2) present the results when using a linear and quadratic functional forms, respectively. We remove assumptions of linearity in columns (3)-(5). In all cases, we find a positive and significant correlation, indicating that the probability of infiltration increases as right-wing parties win local elections by a small margin.

Table 9
Effect of right-wing close electoral victory on the probability of infiltration

	Dep. variable: probability of infiltration				
	Non - parametric		Parametric		
	(1)	(2)	(3)	(4)	(5)
Right-wing winner	0.0751* (0.0399)	0.0846* (0.0524)	0.0722** (0.0366)	0.0722** (0.0365)	0.101* (0.0604)
Bandwidth	0.0751	0.0751	0.0751	0.0751	0.0751
Polynomial	Linear	Quadratic	Linear	Linear	Quadratic
Observations	911	911	911	911	911

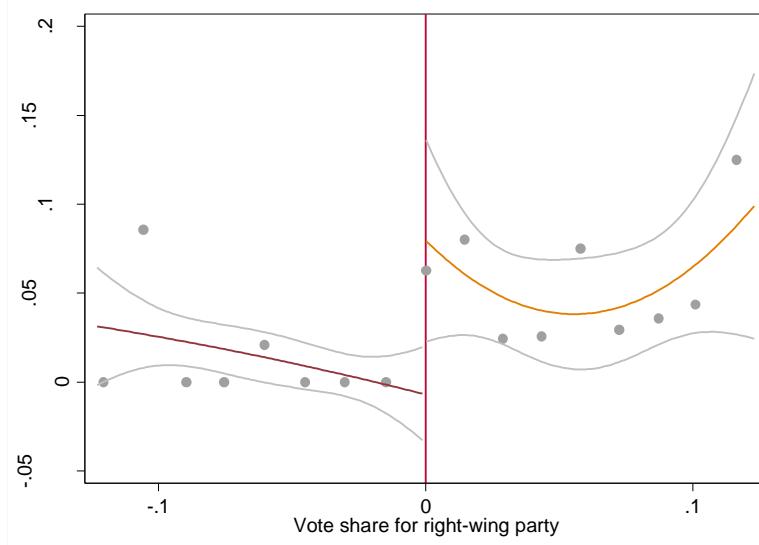
Note: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Forcing variable coefficients not displayed. Column 1: rddrobust linear; column 2: rddrobust polynomial; column 3: linear regression with kernel weights; column 4: linear regression varying linear slopes; column 5: polynomial regression of order 2 with interaction with forcing variable. All the estimations use Calonico et al.'s (2014) bandwidth.

Figure 7 illustrates these findings graphically, where observations are fitted with polynomials of order two and include confidence interval bands. A statistically significant increase in the number of infiltrated municipalities on the right-hand side of the threshold is evident.

These findings complement well those of Buonanno et al. (2016) and Alesina et al. (2016), focusing on Italian national elections and reporting a systematic correlation between mafia-plagued municipalities and the main right-wing party during a similar period of analysis.

As shown in Appendix A10, the results remain significant as the bandwidth increases or decreases to elections where the margin of victory is as low as 4% (Figure A10.2), and the effect is statistically insignificant at placebo cutoffs (Figure A10.3).

Figure 7
RDD – right-wing party victory and probability of infiltration



Note: polynomial fit of order 2. vote share>0 refers to elections won by right-wing parties; vote share<0 refers to elections barely lost by right-wing parties.

Partisanship and public finances

Such a significant relationship between right-wing parties and probability of infiltration may imply that changes in public finances are not caused by mafia infiltrations but rather by right-wing local governments. To rule out this concern, we replicate RDD estimates by using the key public finance components affected by infiltrations as dependent variables.

Table 10 reports the results. The insignificant coefficients of right-wing parties reveal that there is no statistically significant variation any of the three components in municipal governments ruled by right-wing parties that barely won the elections.

Table 10
Effect of right-wing close electoral victory on public finances

	Dependent variable:		
	Construction and waste management (1)	Municipal police (2)	Waste tax (3)
Right-wing winner	-0.0194 (0.0263)	-0.0480 (0.0551)	-0.0216 (0.0353)
Bandwidth	0.0751	0.0751	0.0751
Observations	620	620	620

Note: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

Figure 8 reproduce the estimation results in graphical forms, providing evidence that no significant discontinuity around the threshold is present for the three public finance components.

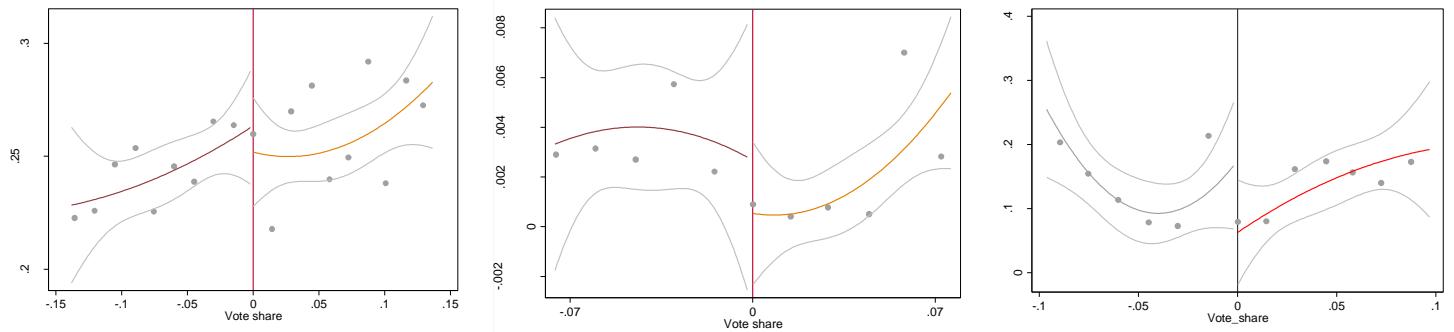
Figure 8

RDD – right-wing party victory and current account spending components

Construction and waste management

Municipal police

Waste tax



Note: polynomial fit of order 2. vote share>0 refers to elections won by right-wing parties; vote share<0 refers to elections barely lost by right-wing parties.

8. Conclusions

Government captures distort the functioning of administrative systems. Illegal and secretive agreements between elected officials and colluding parties may alter the political process and condition the definition of public policies in the interests of citizens. In this paper, we have explored the impact of the collusion between organised crime and local politicians in Southern Italy. Our study is the first in the literature to empirically study the phenomenon of infiltration, analysing both the conditions that make collusions more likely and their possible consequences.

The findings indicate that collusions between mafia and politics affect the allocation of public resources and the ability of local governments to collect fiscal revenues. Our analysis suggests that while the overall amount of financial resources invested by local governments remains unaltered, expenditures for specific components of municipal balance sheets vary significantly as a result of infiltrations. Infiltrated municipalities spend higher shares of resources in construction and waste management, reduce annual investment in municipal police forces, and are less efficient in collecting waste taxes. These results are robust to changes in specifications and to a series of robustness checks.

Furthermore, we have identified a set of political characteristics of municipal elections that are correlated with infiltrations. We find that infiltrations are linked with the absence of competition

at local elections, as well as with mayors running for their second and last mandate. In addition, we have tested for a systematic correlation between infiltrated governments and political parties of a specific colour, uncovering that infiltrations are more likely to occur when governments are controlled by right-wing mayors. This may imply that during our period of analysis, 1998-2013, mafia groups had a preference for right-wing parties when looking for political referents.

These findings shed light on the strategy of organised crime when it endeavours to take control of local politics and on the consequences of such meddling for local state capacity. Interestingly, influences on political choices perpetrated by organised crime seem to impact on public finances in a different way as compared to general forms of political interference (from any type of pressure group) as identified in the literature. While previous empirical studies on the capturing of political decision-making have found that the undue influence of powerful groups on politics (e.g. through corruption) determines a general inflation of public capital expenditures (Tanzi and Davoodi, 1997), our analysis reveals that organise crime operates differently when infiltrated within local governments. Mafia infiltrations neither entail generalised inflations of public expenditures – which would increase the probability of mafia's political trustees to be removed from power for financial instability reasons – nor do they seem to imply a conditioning of the current expenditures budget. Rather, local finances are modified only in the strategic sectors where the mafia has interests to protect. In particular, the largest influence on the municipal financial budget seems to involve a substantial diversion of investment funds towards the construction sector, which is considered crucial for mafia groups in order to reinforce their presence locally, protect their traffics, and further increase business profits (Gambetta, 1993; Sciarrone, 2011; Transcrime, 2013)

The fact that infiltrated governments are less likely to incur in financial mismanagement issues makes it more complicated to detect and remove them. As a consequence, in local territories where the presence of the mafia is more pervasive, efforts to 'clean up' legal institutions from politicians linked to criminal organisations must be considerable. The 164/1991 law has allowed to discover and put an end to hundreds of collusion cases, but the relative frequency of repeated dissolutions in the same municipality (sometimes after just a few years) demonstrates that more powerful legislative tools are needed to completely eradicate the phenomenon of political infiltrations. A strengthening of the law allowing mafia-related government dissolutions, under discussion in these years (Cantone, 2010), may prove helpful. However, this reform could be insufficient if not coupled with measures preventing any potential distortions to democratic competition at local elections. Equally important to limit the local power of mafia clans would be to guarantee public

services and employment opportunities in the small towns and urban neighbourhoods where organised crime currently has the upper hand.

How harmful is a protracted mafia-capturing of political systems for the socio-economic development of local communities? This will depend on how detrimental for the economy are the distortions in public finances and political competition identified by our study. While we have briefly discussed the negative implications of such interferences (e.g. on the fair competition for public work tenders), our estimates do not calculate their precise welfare impact. We leave the task of quantifying the socio-economic effects of infiltrations to future research.

To conclude, our analysis has unveiled the important distortionary effect that mafia infiltrations may have on politics and public policy choices. This study helps to gain a deeper understanding of such phenomenon and, possibly, aid in its prevention.

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Appendix

A1 Correlation between dissolved municipal governments and national or provincial governments, 1998-2013

Table A1.1
Municipal governments and national governments

no of dissolutions	Municipal government	National government	
		Right	Left
67	Right ^a	-0.108	0.061
43	Left ^b	0.139	-0.047
6	Centre ^c	-0.068	-0.011

Note: no statistically significant coefficient. Right-wing national governments: Berlusconi 2001-2005 and Berlusconi 2008-2011; Left-wing national governments: Prodi 1998, D'Alema 1999, Amato 2000, Prodi 2006-2007, Letta 2013; Centre national governments: Monti 2012. a / Right-wing municipal governments during infiltration period; b / Left-wing municipal governments during infiltration period; c / Municipal government ruled by a Centre party during infiltration period.

Table A1.2
Municipal governments and provincial governments

Municipal government	Province and provincial government									
	Caserta		Napoli		Reggio Calabria		Vibo Valentia		Palermo	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Right ^a	-0.143	/	0.277	/	0.233	/	N/A	/	-0.154	/
Left ^b	/	-0.149	/	0.194	/	0.143	/	0.239	/	N/A

Note: no statistically significant coefficient. None of these provinces had governments from the 'Centre' over the 1998-2013 period. Vibo Valentia only had left-wing governments while Palermo only had right-wing governments. a / Right-wing municipal governments during infiltration period in given province. b / Left-wing municipal governments during infiltration period in given province.

A2 Municipal institutional setting and public spending

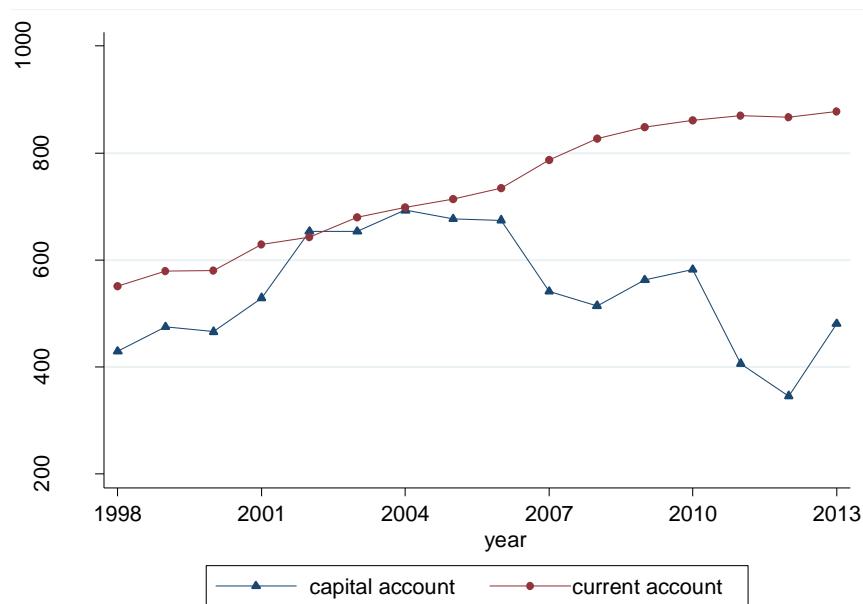
Institutional setting. As of 2016, there were 8,010 municipalities in Italy, 1350 of which are found in the regions of analysis, varying considerably by area and population. The institutional setting of the municipalities is centred on the figure of the mayor, who heads the local government and leads along with the legislative body, the local council, and the executive body, the local *giunta*. The mayor and members of the council are elected together by resident citizens. The *giunta* is chaired by the mayor, who appoints its members. Elections of local councils are staggered over time and not held at the same time for all municipalities.

Public spending components. The six key public spending categories of municipalities are: general administrative functions, social sectors, construction and waste management, transportation, public education and municipal police.

(1) General functions of administration include all expenses related to the management of offices coordinating the internal activities of the municipality; (2) social sectors include all expenses for the provision of social services and the creation of infrastructure to that aim (kindergartens, retirement homes, rehab centres); (3) construction and waste management refers to all expenses for urban planning – adoption of construction plans and building regulations, maintenance and construction of all new buildings (all part of capital spending), waste collection and disposal (current spending); (4) transportation includes expenses to guarantee local public transportation, public lighting, provision of local road infrastructure; (5) public education includes all expenses for all education infrastructure, school maintenance and school transportation; (6) functions of local police include the acquisition and maintenance of goods and equipment, cars and office structures.

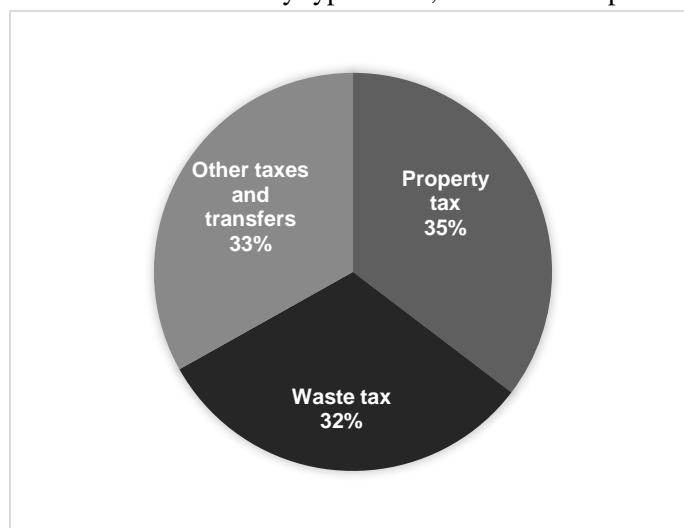
One key responsibility of Italian municipalities is to tender and award public procurement contracts to the contractor companies in charge of carrying out the work.

Figure A2.1
Current and capital expenditure allocations over time



Source: own elaboration with Ministry of Interior data.

Figure A2.2
Proportion of fiscal revenues by type of tax, Italian municipalities



Source: own elaboration with Ministry of Interior data.

A3 Robustness checks – time trends

In Tables A3.1, Table A3.2, Table A3.3, and Table A3.4 we provide a series of robustness checks for our main results. In all estimations, the sample is restricted to the municipalities that experienced at least one dissolution.

In the first column, a parsimonious specification is presented, including time fixed effects and no other controls. The second column adds mafia-proxy and municipal socio-economic factors as controls. In practice, the results in column (2) of table A3.1 – A3.4 replicate those in columns (6) and (12) of Table 3, column (22) of Table 4, and column (5) of Table 5. In the third column of Tables A3.1 – A3.4, we include a full set of linear time trends for each municipality, accounting for any previously omitted factors potentially affecting the temporal development of municipal governments and correlated with infiltrations. This specification reports a coefficient for the infiltration dummy of similar magnitude of those in the previous columns for both capital expenditures in construction and waste management and for municipal police. The result for waste taxes is also unaffected. However, the coefficient of current expenditures for municipal police turns insignificant.

In column (4) of Tables A3.1-A3.4, we relax the assumption of infiltrations beginning with the election of later-dissolved governments, by including the infiltration dummy with a one year lag. This classifies infiltrations as if they initiated in the year after the elections, by introducing one additional lag between the moment of infiltration and the moment in which the financial resources were actually spent by local governments (the spending variable is measured at period t+1).

Table A3.1
Effect of infiltration on capital expenditures in construction and waste management

	Dep. variable: Capital expenditures for Construction and waste management			
	(1)	(2)	(3)	(4)
Inf	0.0469*** (0.0177)	0.0442** (0.0181)	0.0466** (0.0200)	
Lagged Inf				0.0674*** (0.0249)
Controls		✓	✓	✓
Year dummies		✓	✓	✓
Municipality dummies		✓	✓	✓
Time trends			✓	✓
Observations	2559	2559	2559	2405
R-squared	0.220	0.227	0.333	0.348
Municipalities	182	182	182	182

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Lagged Inf is the infiltration dummy lagged by one period.

Table A3.2
Effect of infiltration on capital expenditures in municipal police

	Dep. variable: Capital expenditures for municipal police			
	(1)	(2)	(3)	(4)
Inf	-0.00277** (0.00125)	-0.00222* (0.00118)	-0.00467* (0.00242)	
Lagged Inf				-0.00335* (0.00206)
Controls		✓	✓	✓
Year dummies		✓	✓	✓
Municipality dummies		✓	✓	✓
Time trends			✓	✓
Observations	2496	2496	2496	2412
R-squared	0.230	0.235	0.419	0.431
Municipalities	182	182	182	182

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Lagged Inf is the infiltration dummy lagged by one period.

Table A3.3
Effect of infiltration on current expenditures in municipal police

	Dep. variable: Current expenditures for municipal police			
	(1)	(2)	(3)	(4)
Inf	-0.00301** (0.00128)	-0.00217* (0.00123)	-0.000757 (0.00116)	
Lagged Inf				-0.000756 (0.00126)
Controls		✓	✓	✓
Year dummies		✓	✓	✓
Municipality dummies		✓	✓	✓
Time trends			✓	✓
Observations	2579	2579	2579	2415
R-squared	0.658	0.665	0.775	0.784
Municipalities	182	182	182	182

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Lagged Inf is the infiltration dummy lagged by one period.

Table A3.4
Effect of infiltration on waste and garbage taxes

	Dep. variable: Waste tax collection			
	(1)	(2)	(3)	(4)
Inf	-0.0201** (0.00928)	-0.0185** (0.00961)	-0.0173** (0.00816)	
Lagged Inf				-0.0151* (0.00799)
Controls		✓	✓	✓
Year dummies		✓	✓	✓
Municipality dummies		✓	✓	✓
Time trends			✓	✓
Observations	2122	2122	2122	1981
R-squared	0.454	0.470	0.645	0.652
Municipalities	182	182	182	182

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Lagged Inf is the infiltration dummy lagged by one period.

A4 Effect of infiltration on capital expenditure components by municipal population

Our analysis has unveiled that mafia infiltrations modify the investment decisions of local governments. The impact of the mafia on public finance allocations is likely to vary according to some characteristics of the local context. In this appendix section we investigate whether the intensity of the effect depends on the size of the municipalities whose governments are infiltrated.

We test this by sub-dividing the entire sample into municipalities with less than 2000 inhabitants, between 2000 and 5000 inhabitants, and above 5000 inhabitants, replicating the main estimates. As shown in Table A4.1 below, inflations in capital expenditures for construction and waste management are higher, the smaller the population of a municipality. The coefficient of the infiltration dummy is positive and significant for medium and small-size municipalities and the magnitude is larger for towns below 2000 inhabitants. One interpretation for this result is that small towns are where the power of the mafia can be more pervasive, due to the high control of territory it exercises and to the greater distance from the central State felt by the citizens. In the context of small localities where the presence of the mafia is more diffused, collusion is expected to lead to a stronger predatory behaviour – i.e., more public work tenders awarded to mafia-controlled firms.

By using the same sub-division by population size, we replicate the estimates adopting the share of municipal police spending as the dependent variable. In this case, the reduction of the investment share is larger in cities with greater than 5,000 inhabitants. This result can be explained by the fact that the investment budget for police forces managed by large cities is significantly larger than those of small towns. The mafia has more interest in limiting expenses for law enforcement where the latter can affect the productivity of police investigations.

Table A4.1
 Effect of infiltration on capital expenditure components by municipal population

Dep. Variable:	Capital expenditures for construction and waste management			Capital expenditures for municipal police		
	population:			population:		
	below 2000 (1)	between 2000 and 5000 (2)	above 5000 (3)	below 2000 (4)	between 2000 and 5000 (5)	above 5000 (6)
Inf	0.0951** (0.0425)	0.0795** (0.0331)	0.0199 (0.0219)	0.00283 (0.00259)	-0.00183 (0.00180)	-0.00338** (0.00168)
Controls	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓
Municipality dummies	✓	✓	✓	✓	✓	✓
Observations	6,817	6,514	7,447	6,564	6,299	7,258
R-squared	0.193	0.222	0.234	0.139	0.157	0.175
Municipalities	473	469	502	473	469	502

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

A5 Main results with coefficients of control variables

Table A5.1
Effect of infiltration on public expenditures and on revenues collection

	Dependent variable:							
	Total per capita spending		Capital expenditures construction and waste management		Capital expenditures municipal police		Waste tax	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inf	-0.0223 (0.0189)	-0.0066 (0.0191)	0.0448** (0.0175)	0.0442** (0.0181)	-0.00262** (0.00126)	-0.00222* (0.00118)	-0.0203** (0.00908)	-0.0176* (0.00951)
Mafia homicides	1.150** (0.536)	-2.177 (1.533)	0.178 (0.368)	-0.858 (0.904)	-0.0246 (0.0248)	-0.0428 (0.0574)	0.309 (0.213)	-0.284 (0.565)
Agricultural employment	0.0152** (0.00611)	0.0189* (0.0105)	0.00332 (0.00312)	0.0126 (0.00882)	-0.000324** (0.000150)	-0.00180*** (0.000581)	-0.00257 (0.00283)	-0.00248 (0.00445)
Tertiary educated	-0.0104 (0.0113)	0.0315 (0.0246)	0.00193 (0.00343)	0.0423*** (0.0151)	-0.000285 (0.000235)	-0.00233* (0.00120)	0.00761** (0.00344)	-0.00553 (0.0150)
Industry employment	-0.0100 (0.0105)	-0.0167 (0.0340)	0.00563 (0.00517)	0.0120 (0.0162)	-0.000151 (0.000274)	-0.00103 (0.00163)	0.00341 (0.00499)	0.00594 (0.0105)
Unemployment	0.00179 (0.00434)	0.0213** (0.00919)	-0.000988 (0.00270)	0.00796 (0.00874)	-0.000229* (0.000124)	-0.000755 (0.000785)	-0.000627 (0.00204)	0.00193 (0.00361)
Municipality dummies	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓
Full sample	✓		✓		✓		✓	
Restricted sample		✓		✓		✓		✓
Observations	20,888	2582	20,783	2559	20,126	2496	17,103	2122
R-squared	0.510	0.522	0.205	0.227	0.169	0.235	0.521	0.472
Municipalities	1350	182	1350	182	1350	182	1350	182

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

A6 Granger causality test

In order to perform the Granger causality test (Angrist and Pishke, 2008), a set of dummy variables is created for each year of the treatment period, i.e. the period from the governments' election to their dissolution. Similar dummy variables are also constructed for pre-treatment years, while one additional dummy is created for the whole post-treatment period.

Given that some municipalities have witnessed more than one government dissolutions, the post-treatment period cannot be codified as continuous in these cases. As a result, all municipalities with more than one infiltrated government in the 1998-2013 period have been excluded from the sample for this test. In the case of municipalities having had government dissolutions occurring prior to 1998, the post-treatment dummy takes value 1 for the entire period of analysis.

The following equation is estimated:

$$y_{m,t} = \varphi_m + \tau_t + \sum_{\tau=0}^p \delta_{-\tau} Inf_{m,t-\tau} + \sum_{\tau=1}^q \delta_{+\tau} D_{m,t+\tau} + X_{mt}\beta + \varepsilon_{m,t}$$

Where p represents the post-treatment effect and q represent the anticipatory effects.

We re-estimate the model for the main dependent variables (investments for construction and waste management and for municipal police) by including the set of leads and lags dummies, controlling for fixed-time effects and municipality time trends.

The evolution of municipal spending has been assessed up to 2 years before the election of an infiltrated government, during the period in which the infiltrated government was in charge, and in the post-dissolution years. Each point in the figures refers to the estimated coefficient for a given year.

Figures A6.1- A6.3 show that there is no statistical difference in the pre-treatment trends of treatment and control groups in the years before the elections of infiltrated governments. Hence, we can discard the possibility that changes in local public finances (investments or revenues collection) 'Granger-cause' infiltrations.

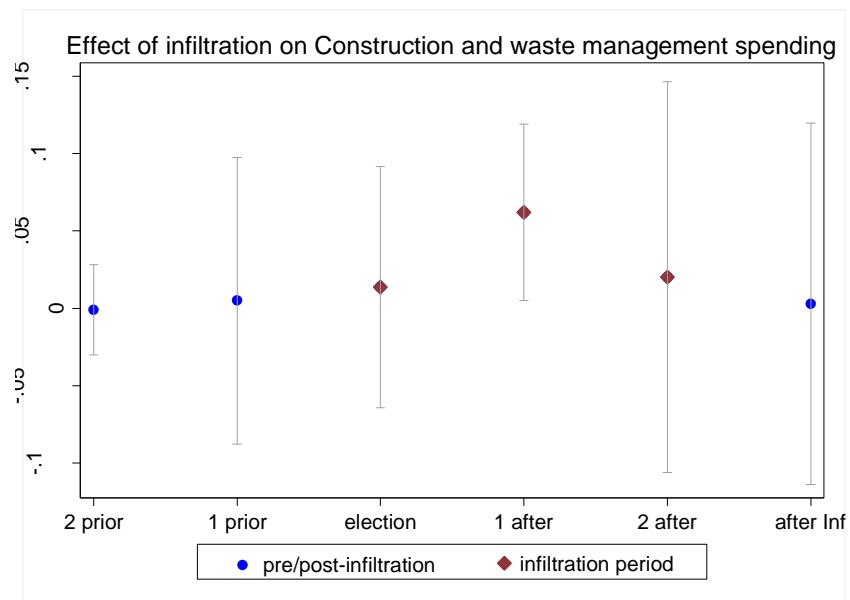
Interestingly, Figure A6.1 shows a jump in investment for construction and waste management in the first year after elections. This may be due to the fact that the second budget year is also the last one in which governments can promote three-year investment plans of public works (worth

more than 100,000 Euros) and hope to see the end of construction works while still in office. These medium-term investment initiatives are potentially very appealing for the mafia.

Table A6.1
Granger causality test - number of municipalities by year of government

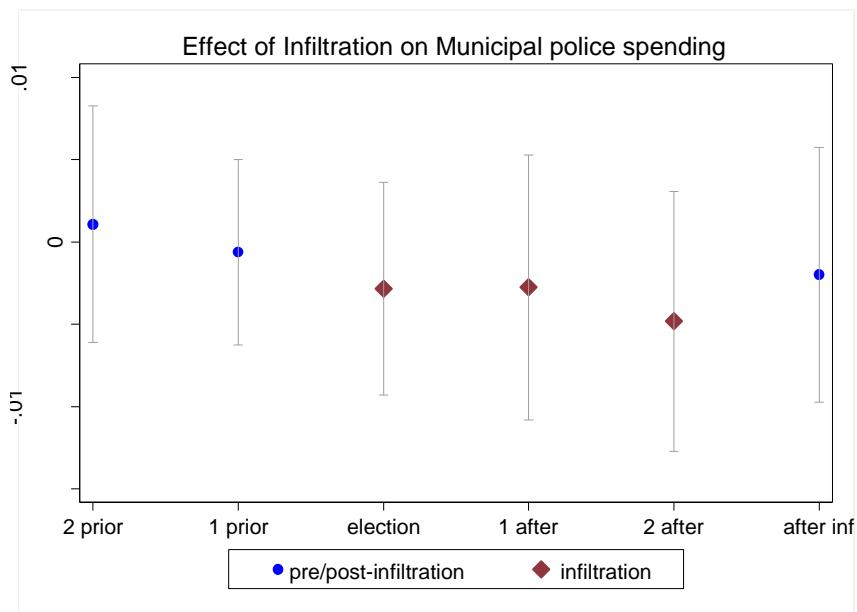
	Years of government before dissolution				
	1 or more	2 or more	3 or more	4 or more	5
Municipalities	117	110	79	49	23

Figure A6.1
Granger causality test – Capital expenditures for construction and waste management



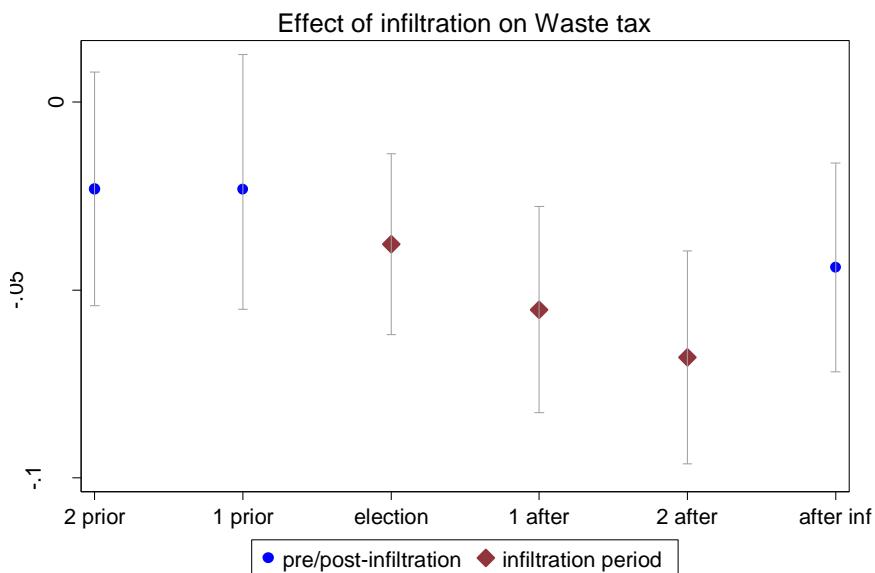
Note: Granger causality test estimated with 2 leads and 2 lags. Municipalities dissolved more than once dropped from the sample. The estimates for each year include time and municipalities dummies, time trends, controls.

Figure A6.2
Granger causality test – Capital expenditures for municipal police



Note: Granger causality test estimated with 2 leads and 2 lags. Municipalities dissolved more than once dropped from the sample. The estimates for each year include time and municipalities dummies, time trends, controls.

Figure A6.3
Granger causality test – Waste and garbage tax



Note: Granger causality test estimated with 2 leads and 2 lags. Municipalities dissolved more than once dropped from the sample. The estimates for each year include time and municipalities dummies, time trends, controls.

A7 Robustness check – selection into treatment

Table A7.1
Dissolutions for reasons unrelated to public finances

	Dependent variable:		
	Construction and waste management (1)	Municipal police (2)	Waste tax (3)
Inf	0.0492** (0.0201)	-0.00267** (0.00131)	-0.0172* (0.0101)
Controls	✓	✓	✓
Municipality dummies	✓	✓	✓
Year dummies	✓	✓	✓
Observations	1452	1407	1190
R-squared	0.335	0.239	0.500
Municipalities	182	182	182

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. All municipalities for which the reasons for dissolutions is related to distortions in the balance sheets excluded from sample.

A8 Placebo – mafia-unrelated dissolutions

Table A8.1
Mafia-unrelated dissolutions and total public spending

	Total spending	Total capital expenditures	Total current expenditures
	(1)	(2)	(3)
Mafia-unrelated dissolutions	-0.0316 (0.0290)	-0.0930 (0.0734)	-0.00563 (0.00671)
Controls	✓	✓	✓
Municipality dummies	✓	✓	✓
Year dummies	✓	✓	✓
Observations	18,306	18,307	18,308
R-squared	0.500	0.347	0.735

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

Table A8.2
Mafia-unrelated dissolutions and key outcome variables

	Dependent variable:		
	Public spending components		Revenues collection
	Construction and waste management	Municipal police	Waste tax
	(1)	(2)	(3)
Mafia-unrelated dissolutions	0.00723 (0.00938)	-0.000692 (0.00071)	-0.00399 (0.00843)
Controls	✓	✓	✓
Municipality dummies	✓	✓	✓
Year dummies	✓	✓	✓
Observations	18,218	17,624	14,981
R-squared	0.292	0.227	0.259

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

A9 Descriptive statistics – political factors

Table A9.1
Descriptive statistics – political factors

Variable	All municipalities			Infiltration years		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Single candidate	2869	0.023	0.149	437	0.059	0.237
Last mandate	2869	0.203	0.402	437	0.327	0.470
Left party	2869	0.320	0.467	437	0.316	0.465
Centre party	2869	0.082	0.274	437	0.098	0.298
Right party	2869	0.461	0.499	437	0.563	0.497
Civic list	2869	0.510	0.500	437	0.584	0.494

Note: All municipalities: municipalities of Campania, Calabria and Sicily having experienced at least one government dissolution for mafia infiltration. Infiltration years: years classified as infiltration for these municipalities.

A10 RDD tests

Table A10.1
Balance of covariates

	Dependent variable:								
	Unemployment	Industry employment	Human capital	Population	Total spending	Mafia-related homicides	White ballots	Turnout	Non-valid ballots
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment vs. control	-0.594 (0.795)	0.480 (0.551)	-0.0919 (0.670)	-0.269 (0.364)	-0.0195 (0.0263)	5.45e-06 (0.00233)	0.129 (0.306)	-2.397 (2.428)	0.8 (0.520)
Observations	620	620	620	620	614	620	619	621	619

McCrory test. Reliable RDD estimates need to make sure that there is no random sorting around the cutoff. If the density of $X_{m,t}$ for each municipality is continuous, then the marginal density of $X_{m,t}$ over the sub-sample of municipalities used for the RDD study should be continuous as well (McCrory, 2008). If, for examples, close races are disproportionately resolved in favour of right wing parties – e.g. via manipulation of electoral outcomes, electoral fraud, etc.– this would challenge the idea that the outcome of these electoral races is as good as random, and indicate some degree of sorting around the threshold.

As shown in Table A10.2 and Figure A10.1, there is no statistically significant jump in the density of observations at the cutoff point for the RDD sample of close elections.

While to a given extent mafia groups are indeed expected to manipulate electoral results by redirecting voting to their preferred candidates, this test shows that this does not seem to be the case in our RDD sample. One possible reason may be that, if the mafia actively distorts electoral results, this is unlikely to bring to a victory of the preferred party by a small margin. Electoral manipulations normally come with abnormal numbers of non-valid or white ballots. As a descriptive indication that electoral manipulation is not occurring in the RDD sample, the average non-valid ballots in infiltrated municipalities won by the left is 4.4% whereas it is 3.8% when the right-wing party wins and the government is infiltrated. The number of white ballots is respectively 1.6% and 1.4%.

Table A10.2
Test for sorting around cutoff

	t	P> t
Conventional	-0.9782	0.3280
Bias-corrected	-0.3842	0.7008
Robust	-0.3252	0.7450
Bandwidth	mserd	
Polynomial	Quadratic	
Observations	594	

Note: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

Figure A10.1
Test for sorting around cutoff

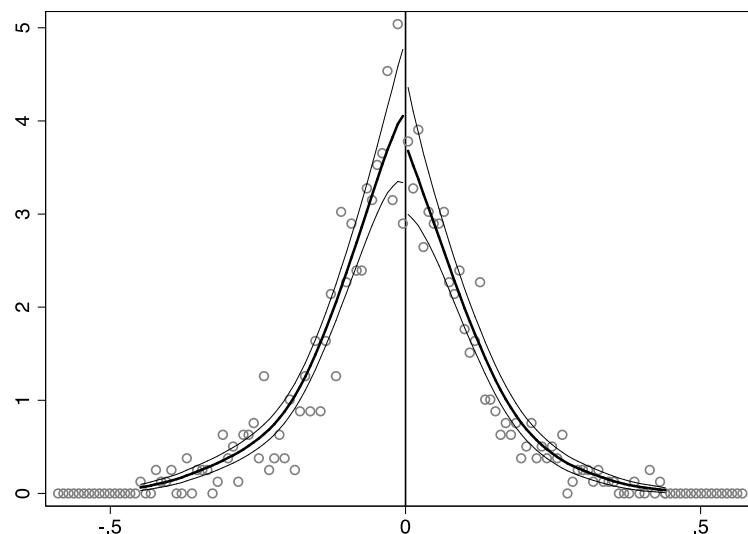
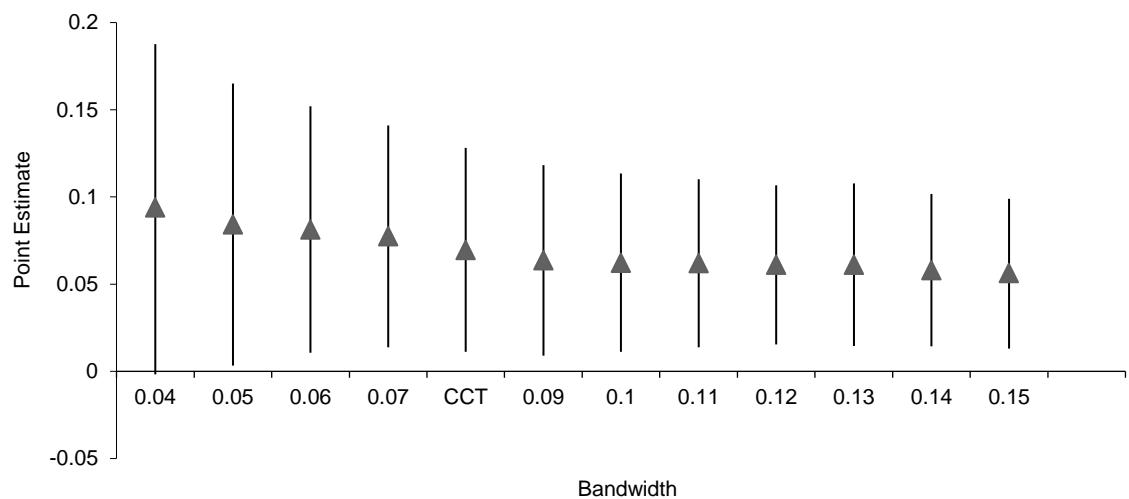
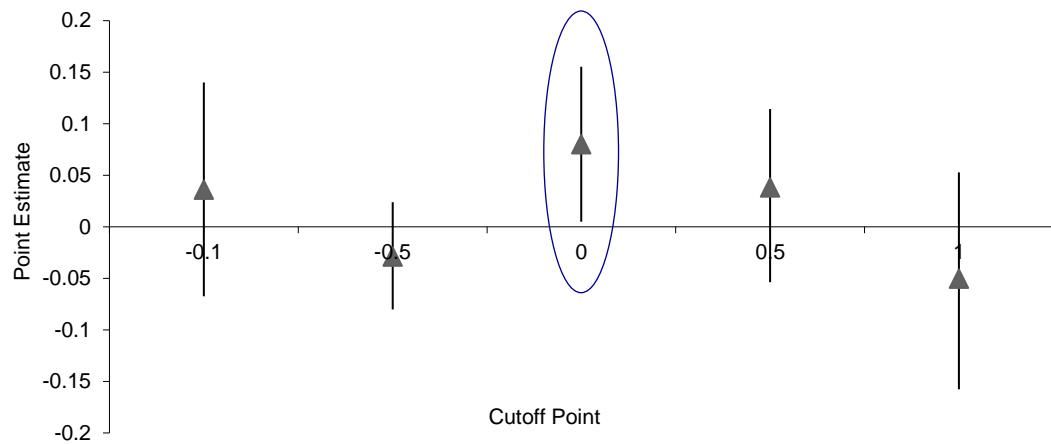


Figure A10.2
Robustness checks – Moving bandwidths



Note: The line extends from the lower bound to the upper bound. 90% confidence interval. CCT: optimal bandwidth.

Figure A10.3
Robustness checks – point estimates at different cutoff points



Note: The line extends from the lower bound to the upper bound. 90% confidence interval.