University of Ioannina

School of Economics and Management Science

Department of Economics

Structural reforms, human capital, culture and local development in Europe

By

MICHAIL E. PAPAZOGLOU

A dissertation submitted in partial fulfilment of the requirements for the degree

DOCTOR OF PHILOSOPHY
in Economics

IOANNINA, 2025

Πανεπιστήμιο Ιωαννίνων

Σχολή Οικονομικών και Διοικητικών Επιστημών

Τμήμα Οικονομικών Επιστημών

Διαρθρωτικές μεταρρυθμίσεις, ανθρώπινο κεφάλαιο, πολιτισμός και τοπική ανάπτυξη στην Ευρώπη

Του

ΜΙΧΑΗΛ Ε. ΠΑΠΑΖΟΓΛΟΥ

Διατριβή που υποβλήθηκε σε μερική εκπλήρωση των απαιτήσεων για την απόκτηση του πτυχίου

ΔΙΔΑΚΤΟΡΙΚΟ ΔΙΠΛΩΜΑ

ΙΩΑΝΝΙΝΑ, 2025

PhD Committee

1) Nikolaos Benos, University of Ioannina, Greece

2) Maurizio Conti, University of Genoa, Italy

3) Nikolaos Tsakiris, University of Ioannina, Greece

4) Konstantinos Karanatsis, University of Ioannina, Greece

5) Vasileios Logothetis, University of Ioannina, Greece

6) Massimiliano Ferraresi, University of Ferrara, Italy

7) Anastasia Litina, University of Macedonia, Greece

Table of Contents

List of tables

Chapter 1

Chapter 2

Chapter 3

List of figures

Chapter 1

Chapter 2

Chapter 3

List of maps

Chapter 1

Chapter 2

Chapter 3

Structural reforms, human capital, culture and local development in Europe

By

Michail E. Papazoglou

Abstract

This dissertation examines crucial topics in structural reforms, educational infrastructure, and cultural transformations under the prism of policy impact evaluation, providing empirical insights into their economic and social implications. I apply advanced econometric techniques and leverage unique historical and contemporary datasets to provide evidence-based insights into the outcomes of significant historical and contemporary policy interventions. It is divided into three comprehensive chapters where I draw on contemporary as well as historical events to analyse them in the context of urban and regional economics, economic history, and policy impact evaluation.

In the first chapter, I evaluate the economic effects of structural reforms, specifically the large-scale municipal amalgamations enacted during Greece's economic adjustment program. Drawing on unique administrative data, I examine the impact of the "Kallikratis" reform on public finances, including revenues and expenditures. My findings reveal that amalgamation significantly reduced per capita investments by approximately 25–30% —perhaps due to pre-trends related to the period before the amalgamation of municipalities— but had negligible effects on current costs and no impact on total revenues or expenditures. These results provide valuable insights for policymakers regarding the complexities and limitations of institutional consolidation in driving regional economic growth.

In the second chapter, I investigate the role of universities in pre-industrial Europe in promoting urbanisation and regional economic development in the very long-run. Using a state-of-the-art staggered Difference-in-Differences methodology and addressing issues of data skewness with advanced Poisson regression models, I demonstrate that the establishment of universities in Europe acted as a catalyst for human capital formation, knowledge diffusion, and economic dynamism. My findings indicate that cities with universities experienced significantly higher rates of population, underscoring the transformative impact of educational institutions on regional

development, while highlighting the potential for uneven economic outcomes across broader regions.

In the third chapter, I explore the economic repercussions of the Protestant Reformation in Europe, focusing on how religious shifts influenced urban and economic development. Using historical maps and GIS techniques to trace the spread of religious change and its economic impact in a unique Pan-European dataset, I employ a robust econometric framework to address endogeneity and spatial spillover effects. My research finds that early conversions to Protestantism negatively affected urban growth, while later conversions had more moderate impacts. I find evidence that cities adopting Protestantism benefited at the expense of their neighbours, as economic activity and resources were concentrated in Protestant cities. I also highlight the importance of geography, pre-existing infrastructure, and the dissemination of the printing press in shaping these economic outcomes, emphasizing the complex interplay between cultural transformations and economic development.

Together, these chapters make significant contributions to the fields of urban and regional economics, economic history, and policy impact evaluation. I introduce original contributions, including the development of unique datasets and the application of advanced econometric methodologies, such as staggered Difference-in-Differences and spatial econometric models, to uncover the complex effects of reforms and transformations on economic outcomes. I provide methodological innovations, policy-relevant insights, and a deeper understanding of how historical and institutional contexts shape economic trajectories over time. Overall, this dissertation offers a rich and interdisciplinary perspective, enhancing our knowledge of the long-term drivers of urban and regional economic development.

Περίληψη

Η παρούσα διατριβή εξετάζει κρίσιμα ζητήματα δομικών μεταρρυθμίσεων, εκπαιδευτικών υποδομών και πολιτισμικών μετασχηματισμών υπό το πρίσμα της αξιολόγησης πολιτικών, παρέχοντας εμπειρικές γνώσεις για τις οικονομικές και κοινωνικές τους επιπτώσεις. Εφαρμόζω προηγμένες οικονομετρικές τεχνικές και αξιοποιώ μοναδικά ιστορικά και σύγχρονα σύνολα δεδομένων, ώστε να προσφέρω τεκμηριωμένες εκτιμήσεις των αποτελεσμάτων σημαντικών παρεμβάσεων πολιτικής, ιστορικών και σύγχρονων. Η διατριβή χωρίζεται σε τρία ολοκληρωμένα κεφάλαια, όπου συνδυάζω σύγχρονα και ιστορικά γεγονότα και τα αναλύω στο πλαίσιο της αστικής και περιφερειακής οικονομικής, της οικονομικής ιστορίας και της αξιολόγησης πολιτικών.

Στο πρώτο κεφάλαιο αξιολογώ τις οικονομικές επιπτώσεις των δομικών μεταρρυθμίσεων, εστιάζοντας στις μεγάλης κλίμακας δημοτικές συνενώσεις («Καλλικράτης») που υλοποιήθηκαν κατά το πρόγραμμα προσαρμογής της ελληνικής οικονομίας. Αξιοποιώντας πρωτογενή διοικητικά δεδομένα, εξετάζω τον αντίκτυπο της μεταρρύθμισης στα δημόσια οικονομικά, συμπεριλαμβανομένων εσόδων και δαπανών. Τα ευρήματά μου δείχνουν ότι οι συνενώσεις μείωσαν σημαντικά τις επενδύσεις ανά κάτοικο κατά περίπου 25–30 % — ενδεχομένως λόγω προϋπαρχουσών τάσεων πριν από τη συγχώνευση των δήμων — χωρίς ουσιαστική επίδραση στο λειτουργικό κόστος ούτε στα συνολικά έσοδα ή έξοδα. Τα αποτελέσματα αυτά φωτίζουν τις πολυπλοκότητες και τους περιορισμούς της θεσμικής ενοποίησης ως μοχλού περιφερειακής οικονομικής ανάπτυξης.

Στο δεύτερο κεφάλαιο διερευνώ τον ρόλο των πανεπιστημίων στη προ-βιομηχανική Ευρώπη ως παράγοντα αστικοποίησης και περιφερειακής ανάπτυξης μακράς διάρκειας. Χρησιμοποιώντας μια σύγχρονη μεθοδολογία σταδιακού Difference-in-Differences και αντιμετωπίζοντας το πρόβλημα της ασυμμετρίας των δεδομένων με εξελιγμένα μοντέλα Poisson, αποδεικνύω ότι η ίδρυση πανεπιστημίων λειτούργησε ως καταλύτης συσσώρευσης ανθρώπινου κεφαλαίου, διάχυσης γνώσης και οικονομικής δυναμικής. Τα ευρήματά μου καταδεικνύουν πως οι πόλεις με πανεπιστήμια σημείωσαν σημαντικά

ταχύτερους ρυθμούς πληθυσμιακής αύξησης, υπογραμμίζοντας τον μετασχηματιστικό αντίκτυπο των εκπαιδευτικών θεσμών στην περιφερειακή ανάπτυξη, αλλά και τις πιθανές άνισες επιπτώσεις μεταξύ ευρύτερων περιοχών.

Στο τρίτο κεφάλαιο εξετάζω τις οικονομικές συνέπειες της Προτεσταντικής Μεταρρύθμισης στην Ευρώπη, εστιάζοντας στο πώς οι θρησκευτικές μεταβολές επηρέασαν την αστική και οικονομική ανάπτυξη. Με τη χρήση ιστορικών χαρτών και τεχνικών GIS για την ιχνηλάτηση της διάδοσης της θρησκευτικής αλλαγής και του οικονομικού της αντίκτυπου σε ένα μοναδικό πανευρωπαϊκό σύνολο δεδομένων, εφαρμόζω ένα στιβαρό οικονομετρικό πλαίσιο για να αντιμετωπίσω την ενδογενή αιτιότητα και τα χωρικά φαινόμενα διάχυσης. Διαπιστώνω ότι οι πρόωρες υιοθετήσεις του Προτεσταντισμού επηρέασαν αρνητικά την αστική ανάπτυξη, ενώ οι μεταγενέστερες είχαν μετριότερες επιπτώσεις. Παρουσιάζω στοιχεία ότι οι προτεσταντικές πόλεις ωφελήθηκαν εις βάρος των γειτόνων τους, καθώς οικονομική δραστηριότητα και πόροι συγκεντρώθηκαν σε αυτές. Τονίζω επίσης τη σημασία της γεωγραφίας, των προϋπαρχουσών υποδομών και της διάδοσης της τυπογραφίας στη διαμόρφωση αυτών των οικονομικών αποτελεσμάτων, αναδεικνύοντας τη σύνθετη αλληλεπίδραση πολιτισμικών μετασχηματισμών και οικονομικής ανάπτυξης.

Συνολικά, τα τρία αυτά κεφάλαια συμβάλλουν ουσιαστικά στα πεδία της αστικής και περιφερειακής οικονομικής, της οικονομικής ιστορίας και της αξιολόγησης πολιτικών. Παρουσιάζω πρωτότυπες συνεισφορές, όπως την ανάπτυξη μοναδικών βάσεων δεδομένων και την εφαρμογή προηγμένων οικονομετρικών μεθόδων, όπως το staggered Difference-in-Differences και τα χωρικά οικονομετρικά μοντέλα, για την αποκάλυψη των πολύπλοκων επιδράσεων μεταρρυθμίσεων και μετασχηματισμών στα οικονομικά αποτελέσματα. Προσφέρω μεθοδολογικές καινοτομίες, πολιτικά χρήσιμες γνώσεις και βαθύτερη κατανόηση του τρόπου με τον οποίο τα ιστορικά και θεσμικά πλαίσια σχηματίζουν τις οικονομικές πορείες σε βάθος χρόνου. Συνολικά, η διατριβή προσφέρει μια πλούσια διεπιστημονική οπτική, διευρύνοντας τη γνώση μας σχετικά με τους μακροχρόνιους παράγοντες της αστικής και περιφερειακής οικονομικής ανάπτυξης.

Introduction

Economic policies, structural reforms, and cultural transformations have played pivotal roles in shaping development trajectories across regions and societies. This dissertation contributes to understanding the economic dynamics that drive the development and transformation of cities and regions, exploring how governance structures, educational institutions, and historical reforms impact economic outcomes. Understanding the economic forces shaping contemporary and historical urban and regional development is crucial for addressing challenges in city planning, governance, and regional policy. By engaging with disciplines such as urban and regional economics, economic history, and policy analysis, the research provides an interdisciplinary perspective on long-term economic and social development.

Through three standalone chapters, I examine the impacts of specific policy interventions and historical transformations, drawing on advanced econometric methodologies and diverse data sources. The chapters focus on distinct yet policy-relevant questions, shedding light on the effectiveness and consequences of institutional reforms, educational investments, and religious changes. Collectively, this dissertation addresses the overarching theme of how shifts in governance structures, knowledge institutions, and religious reforms have reshaped urban and regional landscapes.

To begin with, in the first chapter, I investigate the economic implications of the Greek amalgamation reform by analysing its impact on key fiscal indicators, including per capita investments, current costs, and total revenues and expenditures. In fact, municipal amalgamations, often pursued as a structural reform strategy, have been implemented worldwide to address challenges of administrative inefficiency, fiscal imbalances, and fragmented governance. These reforms aim to consolidate local governments into larger administrative units to achieve economies of scale, improve public service delivery, and enhance regional cooperation. However, the effectiveness of amalgamation policies remains contested. While some studies suggest that larger

municipalities benefit from reduced per capita costs and streamlined governance, others highlight potential drawbacks, such as increased administrative complexity, loss of local autonomy, and uneven economic impacts across municipalities. In the first chapter of my dissertation, I examine these issues in the context of Greece's 2010 municipal amalgamation reform, enacted as part of the country's broader economic adjustment program during a period of severe fiscal crisis.

The Greek reform, known as the "Kallikratis Plan", reduced the number of municipalities from 1,034 to 325, representing one of the most significant local government consolidations in recent European history. The reform sought to enhance fiscal discipline, reduce administrative costs, and improve the efficiency of local public services. However, its implementation coincided with intense austerity measures and public sector restructuring, which may have influenced its outcomes.

To assess the effects of the Kallikratis reform, I employ a Difference-in-Differences (DiD) approach, leveraging a unique dataset of municipal financial data spanning from 2005 to 2018. This dataset, which I compiled from official administrative records, allows for a comprehensive evaluation of the reform's fiscal outcomes. My findings reveal that while the reform led to significant reductions in per capita investments -perhaps due to pre-trends related to the period before the amalgamation of municipalities- while its impact on current costs and total revenues was negligible. These results challenge the assumption that municipal amalgamations inherently lead to fiscal efficiency and highlight the importance of considering local context and implementation challenges.

Through this chapter, I contribute to the literature on structural reforms and fiscal federalism by providing empirical evidence on the economic impacts of large-scale municipal amalgamations in a crisis setting. My findings have important policy implications for governments considering similar reforms, particularly in contexts where fiscal constraints and institutional capacity play critical roles. By examining the Greek case in detail, I shed light on the broader dynamics of municipal governance and the trade-offs associated with consolidation as a policy tool.

In the second chapter, I explore the pivotal role that higher education institutions play in shaping urban economies. Universities have long been recognized as pivotal institutions in fostering human capital formation, driving innovation, and catalysing economic growth. From their emergence in medieval Europe to their evolution into modern centres of knowledge, universities have played a transformative role in shaping urbanisation and regional development. In this chapter, I investigate the long-term impacts of universities on urban economies, exploring how their establishment influenced demographic, economic, and spatial dynamics over several centuries. By focusing on the historical context of European universities, I provide new insights into the mechanisms through which higher education institutions contribute to economic prosperity and regional transformation.

My research examines the establishment of universities across Europe from the medieval period through the early modern era, emphasizing their role as engines of urban growth. Universities often acted as attractors of human capital, drawing students, scholars, and resources to their host cities. However, their impact was not confined to the cities themselves; neighbouring regions frequently experienced relative declines in population and economic activity as resources were reallocated to the university cities. This dynamic underscores the dual nature of universities as drivers of localised growth but also as potential sources of spatial economic disparities.

To assess these impacts, I use a state-of-the-art staggered Difference-in-Differences (DiD) methodology to estimate the causal effects of university establishments. Drawing on historical data from European cities between 700 and 1800, I have created a unique dataset and integrated econometric techniques with demographic and economic indicators to analyse patterns of urbanisation and regional development. To address issues of data skewness and small sample sizes, I implement advanced Poisson regression models, ensuring robust and reliable estimates of university impacts over time.

My findings demonstrate that cities with universities experienced significantly higher population growth, increased economic activity, and enhanced innovation compared to cities without universities. These results highlight the transformative potential of universities while revealing the uneven distribution of their benefits across broader regions.

This chapter contributes to the literature on the economic history of higher education, urban economics, and regional development by providing empirical evidence on the long-term effects of universities. By analysing their historical role, I offer broader policy insights into how investments in higher education can drive sustainable urban and regional development while addressing the challenges of spatial disparities. The findings emphasize the enduring importance of educational institutions in shaping economic trajectories and provide a historical perspective on the relationship between education and economic growth.

In the third chapter I examine one of the most significant socio-religious transformations in European history—the Protestant Reformation—and its economic repercussions. Emerging in the early 16th century, the Reformation challenged the hegemony of the Catholic Church and introduced new religious, social, and political dynamics across Europe. It not only redefined religious practices but also had profound and lasting impacts on urban economies and institutional frameworks.

The Reformation was a catalyst to a range of institutional and behavioural changes, including shifts in education, governance, and social trust, which in turn influenced economic development. Protestantism emphasized literacy, education, and individual accountability, contributing to human capital formation and institutional reforms in the regions that adopted it. However, the economic impacts of these changes were uneven, with early conversions to Protestantism often stalling urban growth due to social upheaval and conflict, while later conversions yielded more moderate outcomes. Moreover, the benefits experienced by Protestant cities frequently came at the expense

of neighbouring regions, which saw resources and economic activity redirected to urban centres aligned with the Reformation.

To examine these dynamics, I combine historical data with advanced econometric techniques, using urbanisation as a proxy for economic growth. Employing a staggered Difference-in-Differences approach and integrating Geographic Information Systems (GIS) methods, I trace the spread of Protestantism across Europe and its associated economic impacts over time. By addressing challenges related to endogeneity and spatial spillovers, I provide a comprehensive analysis of the varied effects of religious change on urbanization. My analysis incorporates factors such as geography, pre-existing infrastructure, and the dissemination of technologies like the printing press, which played a critical role in amplifying the Reformation's influence.

My findings reveal that early adopters of Protestantism experienced no significant impacts on urban growth. Conversely, cities that converted later faced mildly positive impact, benefiting from the institutional and educational advancements associated with Protestantism. Furthermore, Protestant cities often attracted resources and talent from neighbouring areas, creating uneven economic benefits across regions through negative spillover effects.

This chapter contributes to the broader literature on the economic impacts of cultural and institutional changes by providing empirical evidence on the Reformation's economic effects. It highlights the importance of contextual factors, such as timing and geography, in shaping the outcomes of cultural transformations. By situating the Reformation within a broader framework of urban and regional development, I offer insights into how ideological shifts influence economic trajectories, providing lessons for understanding the relationship between culture, institutions, and economic growth.

Overall, this dissertation makes a contributes significantly to a deeper understanding of how structural reforms, educational institutions, and cultural transformations shape economic

development across different historical and institutional contexts. By adopting a policy impact evaluation perspective, I provide empirical insights that bridge the fields of urban and regional economics, economic history, and institutional analysis. Each chapter offers a distinct yet complementary analysis to address policy-relevant questions and uncover the complex effects of reforms and transformations on economic outcomes, providing evidence-based insights.

This research introduces original contributions, including the development of a pan-European dataset on universities, enabling a Pan-European analysis of their impacts on urbanisation and regional development, as well as a dataset mapping dominant religious affiliations at the city level in Europe from 700 AC to 1800 AC, which provides unprecedented granularity for studying the economic effects of the Protestant Reformation. To ensure robust and reliable analyses, I employ advanced econometric methodologies, including staggered Difference-in-Differences approaches to capture causal effects over time, spatial econometric models to account for geographic dependencies and spillover effects, and Poisson regression techniques to address data skewness and distributional challenges.

This dissertation also highlights the importance of context in shaping the success or limitations of policies and reforms. The findings emphasize that institutional changes often produce uneven outcomes, benefiting some regions while disadvantaging others. These dynamics underscore the need for policymakers to consider local conditions, historical legacies, and the broader economic environment when designing and implementing reforms. My findings have important policy implications, suggesting that effective urban governance requires a deep understanding of historical legacies and the socio-cultural fabric of cities. Moreover, the research highlights the strategic importance of universities and other educational institutions in driving innovation and regional competitiveness, while also recognizing the long-term influence of major ideological and religious transformations.

In sum, this dissertation not only bridges gaps in the existing literature but also lays a foundation for future research and policy development, offering a comprehensive and empirically grounded understanding of the historical drivers of urban economic development. It serves as a testament to the enduring interplay between past reforms and present economic realities, advocating for informed and strategic urban and regional economic policies that honour both historical context and modern innovation.

Chapter 1

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

Abstract

Amalgamation reforms have extensively been implemented in several countries as policies meant to improve local government service provision and reduce costs based on scale economies. However, their effectiveness has proved ambiguous in practice. I investigate the impact of a substantial large-scale amalgamation that took place in 2011 and reduced the number of municipalities substantially, on per-capita total revenues and expenditures, current costs and investments of Greek municipalities, using data for the 2005-2018 period. I find very weak evidence that current costs are affected by the amalgamation reform, while the amalgamation of municipalities is associated with a significant decrease in per capita investment of around 25-30%, though this may be attributed to pre-existing trends from the period before the amalgamation of municipalities. This may be due to inefficiencies stemming from the failure to achieve economies of scale, poorly aligned incentives among the merging entities, and a lack of political and cultural compatibility. No effect found for total revenues and expenditures. Overall, the effects of amalgamation do not seem to dominate in the Greek case and question the efficiency of the process amid the Greek sovereign debt crisis.

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

JEL Classifications: H11, H72, R51, R53

1.1   Introduction

In the last 50 years, municipalities across Europe have faced different economic and government budget challenges that put pressure on their performance in terms of efficiency, effectiveness, and quality of public services (Ferraresi et al., 2018). On the one hand, the demand for the provision of public goods has registered a general increase. Citizens are more conscious and demand a wider and more specialized set of public goods, together with greater accountability and transparency than in the past. On the other hand, the fulfilment of the EU requirements for fiscal discipline in public finance, imposed by central governments to local governments, has led municipalities to reduce their expenditures. Therefore, municipalities - especially small ones - often find it difficult to meet the demands for generally acceptable levels of local public goods while reducing their expenditures.

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

In particular, there is a recent strand of literature investigating the effect of amalgamation on municipal financial outcomes On the one hand, several scholars (Blesse & Baskaran, 2016; Hanes, 2015; Reingewertz, 2012) found that amalgamated municipalities display lower per capita expenditure after amalgamation relative to non-amalgamated ones. On the contrary, other studies

noticed that municipalities' spending was higher in merged municipalities or at least do not reduce per capita total expenditures and specific per capita expenditures(Allers & Geertsema, 2016; Moisio & Uusitalo, 2013; Roesel, 2017).

My study aims to shed fresh light to this debate by investigating the municipal amalgamation that took place in 2010 in Greece and put into effect on January 1, 2011. Overall, this municipal amalgamation reduced the number of municipalities from 1,034 (910 municipalities and 134 communities) to 325. In total, 86 municipalities were not affected from this mass reform. This reform aimed to improve the public financial management and administration of local governments and was part of the economic adjustment programme of the country. Therefore, in this study I focus on the amalgamation effect on current costs and investments. Nevertheless, I also provide baseline results of the amalgamation effect on total revenues and expenditures.

Specifically, my objective is to identify the impact of the amalgamation process by implementing a Difference in Differences approach. Yet, to control for various potential sources of biases that may arise due to the heterogeneity of the municipalities in my sample, I adopt parametric and nonparametric DiD matching methods. To ensure the validity of my findings a battery of robustness checks is conducted so as to address possible issues related to the research design and could bias the baseline estimates. First, the classical placebo test is performed, then I move to a falsification exercise to prove that the estimated effects do not ensue from outliers.

To the best of my knowledge, there is only one study trying to examine the effect of the amalgamation process in Greece (Pazarskis et al., 2019). Relying on accounting measures to evaluate the efficiency of municipalities (i.e., mean t-tests for unequal variances), the authors reported that several local governments managed to be more efficient by increasing their cash and cash equivalents and their securities, while decreasing their short-term debt. In addition, the financial performance of some municipalities improved, limiting their obligations, and improving their net fiscal position.

However, the present analysis is conducted using a unique dataset created by compiling the annual municipal financial reports, which are not publicly available, and therefore, the final outcome is considered more credible. In addition, I employ advanced econometric techniques specifically designed to measure the impact of interventions on target groups. Finally, the robustness checks adopted ensure the validity of my findings.

My findings indicate that significant negative effects on current costs associated with the amalgamation process exist only when I control for region-by-year fixed effects as well as vertical transfers. As for investments, I find a negative and robust effect of amalgamation in the range of 11 to 20%. I observed no significant effect on total expenditures and revenues.

The structure of this chapter is as follows. Section 1.2 presents literature review, while section 1.3 describes the institutional framework of the administrative structure in Greece; Section 1.4 gives an overview of the data used in this study, while Section 1.5 illustrates the empirical strategy. Sections 1.6 presents and discuss the results, robustness checks and heterogeneous effects. Finally, section 1.7 concludes.

1.2   Literature review

Research on the consequences of amalgamations has reached maturity in terms of theories, research designs and methods, justifying a systematic survey of results. Researchers around the world, from Europe to Canada, New Zealand and Japan investigated the effect of the amalgamation reforms not only on the public expenditures but also on other several aspects of public performance[1].

---

[1]   There are also qualitative studies that explore this effect. However, for the purposes of this literature review section I do not include them.

1.2.1 The effect of the amalgamation process on public expenditure

In particular, there is a recent strand of literature investigating the effect of amalgamation on municipal financial outcomes. The outcome of these research, however, is ambiguous; on the one hand several studies demonstrated that there is no significant effect of amalgamation reforms on the public expenditures, while others uphold that this effect is indeed vital and so, should be taken into consideration.

To begin with, Kjaer et al. (2010) examined the effects of the structural reform in Denmark in 2007 – 239 municipalities were amalgamated to 66 – on local councillors' influence on decisions taken in the local political realm. Using a differences-in-differences estimator they found an increase in the perceived influence of leading councillors vis-a`-vis other councillors and a decrease in the perceived influence of the council vis-a`-vis its top administrative officer but this increase cannot be ascribed to the amalgamations.

Lyytikäinen (2012) studied the tax competition among Finnish local governments. Based on panel data of 411 Finnish municipalities from 1993 to 2004, he compared the causal estimates based on the policy change using Spatial Lag estimates and Spatial Instrumental Variables estimates. No evidence of interdependence in property tax rates among Finnish municipalities has been found.

Calciolari et al. (2013) investigated how several enviromental pressures i.e. institutional, economic, and political, influence the behaviour of public organizations when confronted with amalgamation reforms providing evidence from the Swiss canton of Ticino. They analysed data over a period of 9 years, from 2000 to 2009 ,by applying a multinomial logit model, and they noticed that economic and institutional pressures alone are not sufficient to explain why municipalities decide to be merged.

Allers and Geertsema (2016) analysed the effects of municipal amalgamation on local expenditures and public service levels in the Netherlands between 1997 and 2011 for 418 Dutch municipalities.

They used a difference-in-differences estimation comparing changes in spending of amalgamated municipalities, as well as a model including spatial spending interaction and a model using an instrumental variable that reflects the increase in size through amalgamation. They found no significant effect of amalgamation on aggregate spending, on taxation and on the level of public services.

Drew et al. (2016) had also examined the statistical association between local government expenditure and population size for Queensland municipalities, Australia, both before and after the program of forced local government amalgamations that took place in 2007 and reduce the number of municipalities from 157 to 73. By applying ordinary least-squared regressions they discovered no empirical evidence to support the claim that increasing economies of scale would yield more financially sustainable local councils.

Kortt et al. (2016) examined the relationship between local government expenditure and population size for the Hawke's Bay region, New Zealand, using a 10-year panel dataset covering the period 2003 to 2012. No evidence of a statistical relationship between population size and expenditure for the councils were found.

Blom-Hansen et al. (2016) exploit the particular characteristics of the Danish reform in 2007 to provide more credible difference-in-differences estimates of the effect of mergers but no clear and systematic effect were found.

Also Roesel (2017) wanted to identify the effect of mergers of large local governments in Germany (districts) on public expenditures. He applied a synthetic control method to state-level aggregates of Saxony districts, which were reduced from 22 to 10. His findings showed that mergers of large local governments do not reduce per capita total expenditures and specific per capita expenditures in categories such as social care, education or administration.

Additionally, Aaskoven (2018) tried to answer the question whether electorally motivated increases in public deficits -political budget cycles- larger in new political units. Using the Danish local government reform that took place in 2007 and reduced the number of municipalities from 271 to 98, and applying a fixed-effect OLS regression he discovered that political budget cycles seem to be of a smaller scale in the new municipalities, but only regarding budget cycles in budgetary overruns.

Hanes and Wikström (2008) examined whether the Swedish municipal reform in 1952 (2,498 to 1,037 municipalities) affected subsequent income growth and population movement using an OLS estimator. They found that the municipal amalgamations had no effect on the municipal income growth patterns. On the other hand, a positive effect on population growth is found for the municipalities that were small in size prior to the reform.

Moreover, Blom-Hansen (2010) investigated the last-minute spending by Danish municipalities before the local government reform of 2007 (271 to 66 municipalities). Using OLS regression analysis he found that there are common pool problems in amalgamation situations, however, the availability of a common pool matters, not its size.

Lassen and Serritzlew (2011) tried to estimate a causal effect of jurisdiction size on internal political efficacy using the Danish local government reform that took place in 2007 and reduced the number of municipalities from 271 to 98. They applied a repeated cross-section model of different individuals surveyed before and after the reform, difference-in-difference and propensity score matching estimators and discovered that jurisdiction size has a causal and sizeable detrimental effect on citizens' internal political efficacy.

On the contrary, Reingewertz (2012), by using Israelis data for the years 1999–2007, analysed the Israeli amalgamation reform of 2003 (from 264 to 253 municipalities) based on the Difference-in-

Differences methodology. The results indicated that amalgamated municipalities display lower per capita expenditure after amalgamation with respect to other municipalities.

Moisio and Uusitalo (2013) compared the changes in average per-capita spending between the municipalities that merged and the non-amalgamated municipalities (the number of municipalities dropped from 517 to 464 due to the 1970's municipal amalgamations) over a period of time from 1970 to 1981. They have applied the approach as described by (Lechner, 2002) and they noticed that Finnish municipalities' spending was higher in the merged municipalities, even 10 years after amalgamation.

Blom-Hansen et al. (2014) also evaluated the argument on economies of scale in the economic costs of running political systems using a difference-in-difference estimator over a period of 6 years (2005-2011). Taking data from the Danish amalgamation reform that took place in 2007 and merged 239 municipalities to 66, found that the relationship differs across policy sectors.

Foged (2014) using the same data for Denmark as (Blom-Hansen et al., 2014) found that common pool exploitation is stronger if more municipalities participate and when municipalities amalgamate by annexation.

Moreover, Hanes (2015) studied the Swedish municipalities' amalgamation process that took place in 1952 and reduced the number of the Swedish municipalities from 2,498 to 1,037 (available data for 1,037). He applied and ordinal least square regression model and he spotted that the reform had a negative impact on expenditures only if municipalities do not exceed a critical size.

Besides, Tavares and Rodrigues (2015) providing evidence from Portugal examined how fragmentation affects municipal size in terms of both expenditures and grants to sub-city units. Using ordinary least squares (OLS) regression he found that more fragmented municipalities increase total expenditures, capital expenditures and grant transfers to sub-city governments.

Haruaki & Hideo (2016) investigated whether the merged municipalities rapidly their increase expenditures and bond just before mergers providing evidence from the Japan amalgamation (3,232 to 1,820 municipalities). They used a propensity score matching method and they found that the subordinate merger partner suffers from adverse fiscal conditions and creates the fiscal common pool problem in public projects just before mergers.

Blesse & Baskaran (2016) explored the fiscal consequences of municipal mergers by making use of a large-scale merger reform in the German federal state of Brandenburg from 2001 to 2003. The merger reform reduced the number of municipalities substantially, from 1,474 (end of year 2000) down to 421 in 2004. They found significant reduction in the municipal expenditures after compulsory mergers while, voluntary mergers, on the other hand, had no effect on expenditures.

Suzuki & Sakuwa (2016) assessed the impact of municipal mergers on local population growth in Japan where the number of municipalities were reduced from 3,232 in 1999 to 1,718 in 2014. They used propensity score-matching and found that municipal mergers negatively affect population growth for municipalities if they are not the largest municipalities among their merging partners.

Zeedan (2017) examined whether a local government needs to be sufficiently large to maximize efficiency and sufficiently small to maximize local democracy by analyzind the 2003 Israeli plan to consolidate 24 existing local governments into 12 new local governments. Using a conventional linear regression his results indicate that a new amalgamated local government must be sufficiently small to maximize local democracy.

Lima & Silveira Neto (2018) - by using data from Brazilian local governments - investigated the impact of the municipal secessions on local expenditure. The Brazilian reform increased the number of municipalities from 4,491 in 1991 to 5,561 in 2001. They showed that municipalities involved in the secession process increase the per capita capital expenditure applying a difference-in-differences approach.

Strebel (2018) analysed the local determinants for voluntary municipal mergers and their impact in different stages of a merger. He used data from the voluntary municipal mergers that took place in the Swiss canton of Fribourg between 2000 and 2006 and reduced the number of municipalities from 245 to 168. Applying a Cross-Sectional Logistic Regression Analysis, he found that different paths might lead to these two different outcomes. Functional factors appear to be especially relevant for starting a merger process, and they could be understood as triggers, while, political factors play a role at the end of the process, when the final decision on the merger is taken.

Ferraresi et al. (2018) examined whether intermunicipal cooperation has an impact on the level of per-capita expenditure of the single municipalities using evidence from the Emilia Romagna region, Italy. They implemented a two-way fixed effect linear model and propensity score matching models and they found that municipal union reduces the total per capita current expenditures without affecting the level of local public services. In addition, they claimed that the expenditure reduction is consistent, increasing up to six years after joining a municipal union and that the reduction of the municipal expenditure is not driven by the size of the municipality, and it is not related to the number of municipalities in the union.

Miyazaki (2018) explored the cost-reduction effects of local government consolidation, using panel data from Japanese municipalities for the years 2000, 2005 and 2010. An instrumental variable (IV) methodology is employed to deal with possible endogeneity associated with consolidation decisions. The main finding is that municipal current expenditure per capita increases immediately after consolidation, but then gradually declines.

Cobban (2019) evaluated the program of compulsory amalgamations in Ontario, Canada, where the munixipalities number were reduced from 587 to 146 over a period of 15 years (1995-2010). Using a difference-in-differences methodological approach he examines the causal effect of jurisdiction size on the cost of local administration in Ontario, Canada. He found that increasing local jurisdiction size reduces the cost of local administration.

Fritz and Feld (2019) investigated the relation between the common pool effects and the local public debt in amalgamated municipalities provining evidence from the amalgamation process in the German state of Baden-Wuerttemberg between 1968 to 1975 (3379 to 1111 municipalities). They found that common pool exploitation is stronger if more municipalities participate and when municipalities amalgamate by annexation by using a difference-in-differences approach.

Blesse and Roesel (2019) used a difference-in-differences approach and analysed county mergers in Austria and Germany. In both countries they concluded that the amalgamations do not reduce costs and thus, are not beneficial.

Strebel (2019) provided some evidence regarding economies of scale showing that voting decisions on municipal mergers in three Swiss cantons are affected by size. Small municipalities, in particular, are less inclined to reject a merger probably because the diseconomies of being small, which impose a financial obligation and hence decrease opposition to mergers.

Hansen (2019) examined the common pool problems during Denmark's 2007 amalgamation confirming the conclusions of previous studies indicating an increase in spending prior to the merger. In addition, he demonstrated that it also has a significant political dimension as only in municipalities where mayors were not re-elected did spending increase.

Finally, Tran et al. (2019) looked at the spending patterns of 68 South Australian local governments and found that economies of scale patterns are fully determined by population density rather than population size. Due to the fact that most merger measures do not improve density, their capacity to fully leverage economiesofscale may be constrained.

1.2.2 The effect of the amalgamation process on other aspects of public performance

In an attempt to address the problem of endogeneity, Bhatti and Hansen (2019) exployed a quasi-experiment to investigate the relationship between size and turnout. While many amalgamations

are gradual, and they may impemented to solve specific municipal issues, such as democratic issues, the authors found a 1.5 percent to 2% short-term beneficial effect of amalgamation on voter turnout.

On the contrary, Heinisch et al. (2018) investigated the short-term effects of the 2015 merger reform in Styria, Austria analyzing voter turnout in the 2015 elections to voter turnout in 2010. They estimated that the merging would reduce voter turnout by 1.3 percentage points in the short run. Lapointe et al. (2018) investigated the impact of municipal amalgamations on voter turnout using data from Finland's 2009 amalgamation reform. They discovered that amalgamations reduce voter turnout in small municipalities by 4 percentage points, but have no effect on turnout in large municipalities. Finally, Blesse and Roesel (2019) investigated voter turnout in Germany in the medium term following the 2007 county merger change. After the merger, voter turnout in county elections fell by 4.3 percentage points.

Drew et al. (2019) analysed the marketing of the amalgamation and how arguments in favor or against amalgamation are built. They found that opponents of amalgamation frequently exploit the danger of "dreadful repercussions" as a rhetorical technique.

1.3   Institutional framework

1.3.1   Fiscal Federalism Theory

The idea of decentralized responsibilities among different levels of central and local governments emerges mainly from the fiscal federalism theory. Fiscal federalism refers to the division of governmental responsibilities and the financial relationships that exist between levels of government. Fiscal federalism assumes that a federal system of government can be efficient and effective in addressing challenges, such as equitable income distribution, efficient and effective resource allocation, and economic stability Because of its flexibility in dealing with these issues, the federal government can achieve economic stability and equitable income distribution. As

income disparities exist between states and municipalities, federal government involvement is required (Kapucu, 2016).

The traditional theory of fiscal federalism establishes a broad normative framework for the delegation of responsibilities to various levels of government, as well as the proper budgetary tools for carrying out these functions (Oates, 2005). In the same content, Oates (1972, 2008) formalized the idea of the Decentralisation Theorem arguing that in the absence of economies of scale related with centralised public goods provision, a decentralized system would be more efficient or at least as efficient as a centralized.

In general, fiscal federalism theory supports that central government should bear primary responsibility for macroeconomic stability and income redistribution in the form of assistance to the poor (Oates, 1999, 2005). It is important to note here that the effective amount of local public goods is likely to differ across different administrative levels, due to discrepancies in both preferences and costs (Oates, 1999). According to Musgrave (1959), the federal or central government should be responsible for economic stabilization and income redistribution, while state and local governments should be responsible for resource allocation.

The implementation of fiscal federalism theory could lead to lower planning and administrative costs as differences among local administrative levels are taken into account. In addition, competition among local governments supports organizational and political innovations and more efficient politics (Kapucu, 2016). Nevertheless, according to J. K. Brueckner (2006) "The drawbacks of fiscal federalism, include the sacrifice of scale economies due to smaller jurisdiction sizes (Alesina & Spolaore, 1997; Oates, 1972) losses from interjurisdictional tax competition when government revenue comes from taxation of a mobile tax base (M. Brueckner & Lederman, 2017), and failure to properly account for public-good spillovers across jurisdictions (Besley & Coate, 2003; Oates, 1972)." Moreover, the lack of accountability of central and local governments, the

lack of qualified personnel and unavailability of infrastructure at the local level could be significant obstacles in the success of a decentralised administrative system.

Grounded on the fiscal federalism theory as described above, a new strand of fiscal federalism literature named second generation fiscal federalism "examines the workings of different political and fiscal institutions in a setting of imperfect information and control with a basic focus on the incentives that these institutions embody and the result behaviour they induce from utility-maximizing participants" (Oates, 2005). Second generation fiscal federalism implies that political institutions impose priorities on public officials that frequently differ from maximizing citizen welfare (J. K. Brueckner, 2006).

Finally, quite a long strand of literature investigates a different effect of fiscal federalism by examining the impact of decentralized public spending on economic growth, partially inspired by Oates (1993) who argued that better targeting of growth-enhancing infrastructure investment under federalism could increase an economy's growth rate (J. K. Brueckner, 2006). Indeed, many scholars investigated Oates argument confirming a positive relationship between decentralization and growth (Akai & Sakata, 2002; J. K. Brueckner, 2006; Iimi, 2005; Lin & Liu, 2015; Stansel, 2005; Thiessen, 2003; Yilmaz, 1999). On the contrary, zero or negative association between fiscal decentralization and growth has been identified in several other studies (Davoodi & Zou, 1998; Woller & Phillips, 1998; Xie et al., 1999; Zhang & Zou, 1998) refuting Oates' conjecture.

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

1.3.2 Administrative structure of Greece

In Greece, the implementation of fiscal federalism theory through the compulsory amalgamation reform called "Kallikratis" programme, led to three levels of administration: central state, regions, and municipalities. As of January 1, 2011, between the central state and the regions there is another administration unit, named Decentralized Administration Authorities, which are not a level of local government but the decentralized representation of the central state in each respective region. Currently, Greece consists of seven Decentralized Administration Authorities (Government Gazette 87A/2010, 2010).

In terms of responsibilities, the Decentralized Administrations have the general responsibility for state matters in accordance with Article 101 of the Hellenic Constitution (Hellenic Republic, 2019). The Decentralized Administration Authorities enjoy both administrative and financial autonomy and exercise devolved state powers in urban planning, environmental and energy policy, forestry, migration, and citizenship. They are also in charge of supervising regions and municipalities (Council of Europe, 2013). Furthermore, they are in charge of directing the state's executive and control actions in their jurisdiction. In particular, they are in charge of (Council of Europe, 2013):

- State problems that cannot be managed by local governments due to constitutional constraints (control of the legality of the acts of the local government, protection of forests, management of public property and state wealth, etc.)
- State affairs that are progressively decentralized by the central government in order to create a staff and flexible government.
- Cases involving the government aimed at providing citizens with rapid and high-quality service.

The regions, which are self-governing geographical legal entities, are the second level of local government. According to the Law 3852/2010, the regional bodies should act in line with the

principles of openness, efficiency, and effectiveness (Government Gazette 87A/2010, 2010). Currently, the nation is divided into thirteen regions (Council of Europe, 2013).

They are responsible for developing and implementing regional policies in their areas of responsibility, based on the principles of sustainable development and social cohesion. More precisely, they are in charge of formulating, planning, and implementing policies at regional level, taking into account (Government Gazette 87A/2010, 2010):

- National and European policies related to their responsibilities.

- The need for collaboration and coordination with other local or public authorities and organizations.

- The resources availability so as to cover their responsibilities as well as the necessity to guarantee efficient usage and equal distribution.

- The need to ensure the adequacy, quality, transparency, and equity of the services provided.

- The importance of long-term development and cultural heritage preservation.

Finally, municipalities are self-governing territorial entities which form the lowest level of local authorities. The main administrative bodies of the municipalities are the Mayor, the Municipal Council, the Economic Committee, the quality-of-life Committee and the Executive Committee (Government Gazette 87A/2010, 2010).

Municipalities are responsible for managing local affairs. They manage and regulate all local issues in accordance with the principles of subsidiarity and proximity in order to protect, develop and continuously improve the interests and quality of life of the local community. The municipal authorities execute their authority in accordance with the applicable legislation, rules, and management regulations applied (Council of Europe, 2013).

In particular, a set of responsibilities has been formulated in 8 pillars of activities in diverse fields, namely (Kyvelou & Marava, 2017):

(i)   development,

(ii)   environment,

(iii)   quality of life and proper functioning of cities and settlements,

(iv)   employment,

(v)   social protection and solidarity,

(vi)   education, culture, and sports,

(vii)   civil protection and

(viii)   rural development-livestock-fisheries

Finally, seven Independent Local Government Supervision Services have been established in the site of each of the Decentralized Administrations, which are decentralized services reporting directly to the Ministry of Interior, which oversees local governments in Greece. The responsibility of the Independent Local Government Supervision Services is to control the legitimacy of the actions of local governments, i.e. Regions and Municipalities (Government Gazette 87A/2010, 2010).

The aforementioned administrative structure came as a result of the compulsory amalgamation reform called "Kallikratis" programme. In brief, the administrative division of Greece after the 2010 reform is:

1. At the first-tier local government, the number of municipalities and communities reduced from 1,034 (910 municipalities and 124 communities) to 325 municipalities (Government Gazette 87A/2010, 2010).

2. At the second-tier local government, 13 administrative regions have been established replacing the 54 prefectures.

3. Simultaneously, seven decentralized administration units have been instituted, so as to supervise the first and second-tier local governments.

The Greek Parliament approved the reform in May 2010 and part of its provisions were immediately implemented, just after its publication in the Government Gazette on June 7, 2010. The first municipal elections under the new reform took place the same year while the programme was entirety put into effect on January 1, 2011 (Kalimeri, 2018).

Overall, the "Kallikratis" programme introduced 239 amalgamations, so as to decrease the number of municipalities from 1,034 (910 municipalities and 134 communities) to 325. In total, 86 municipalities were not affected from this mass reform.

In fact, this was not the first amalgamation process took place in Greece. Another amalgamation process had taken place in 1998, called "Kapodistrias" reform. The "Kapodistrias" reform increased the total number of the Greek municipalities to 910 also growing their size in terms of area and population by incorporating former communities (Government Gazette 244A/1997, 1997). The local administrative structure that existed before the two amalgamation processes that took place in Greece goes back to 1974. There were 56 prefectures, in 7 regions, 441 municipalities until 1998. In addition, some thousand communities existed, which were incorporated in nearby municipalities during the amalgamations.

In order to be harmonized with the Lisbon Treaty, that was in force since 2009, the "Kallikratis" programme aimed on the one hand, at the decrease of the administrative structure to two levels local government, municipalities and regions, and on the other hand, to clarify the competencies of the local governments (Ministry of Interior, 2010a). Doing so, the central government aimed at minimizing the overlapping of activities and increasing the collaboration between the two levels of local administration i.e., municipalities and regions.

In line with the initiatives, principles and values of the European Union, this new structure was expected to integrate the basic principles of the Lisbon Treaty, i.e. proximity, transparency[2], extroversion, respect for human rights and participatory democracy (Ministry of Interior, 2010a).

According to the Ministry of Interior the decrease of the number of municipalities throughout the country and thus the formation of larger spatial and population geographical units facilitates the development of a stronger administrative system, which meets these objectives (Ministry of Interior, 2010b).

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

- Population factors i.e., number of citizens, number of inhabitants, population density.

- Social factors i.e., average household size, educational indicators, percentage of foreigners.

- Economic factors i.e., employment, employment structure, labour mobility, income.

- Geographic factors i.e., area and morphology, shape, accessibility, infrastructure networks.

- Development factors i.e., the structure of local economic activity and local development in general, the existence of educational and research bodies, participation in European and National Programmes.

- Operational and sustainability factors in terms of resources and endogenous working personnel.

- Cultural, historical, and other spatial factors.

In addition, the Ministry of Interior declared that the implementation of the aforementioned reform is supplemented by specific criteria. In particular, a minimum population size of 10,000

---

[2] At all levels of government i.e., decision-making process, administrative and financial transparency, electoral processes, civil society participation, public ethics of elected officials and staff.

permanent residents is introduced, so that a municipality resulting from the reform could adequately exercise its new responsibilities, ensuring a functional, administrative, and financial industry. The above limit is increased by 20% so as a municipality would be able to maintain its old administrative limits (Ministry of Interior, 2010a).

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

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

The "Kallikratis" reform was introduced, as mentioned before, in 2011, amid the beginning of the Greek financial crisis and coincided with the economic adjustment programme for Greece. In fact, the economic adjustment programme, provided for detailed steps of structural reforms on public services in Greece (Ladi, 2012).

In addition, the economic adjustment programme presupposes the reduction of the salaries of all political officials at the local level, i.e., the elected and related staff, by 10%, as well as the decrease of the number of deputy mayors and related staff (Dimitropoulos, 2012). In the same direction, the fourth review of the economic adjustment programme stated that the "Kallikratis" local government reform led to the closure or merge of 4,500 non-essential public entities and agencies (European Commission, 2011).

Indeed, according to Kalimeri (2018) "this reform was an essential first step for the creation of independent, transparent, and reliable domestic structures and the pursuit of cost - cutting and effective governance. These were also preconditions for Greece's receipt of funds from the Troika – that is, the IMF, the EU, and the European Central Bank". Moreover, in the economic adjustment programme was clearly stated that "parliament should adopt legislation to reform public administration at the local level, notably by merging municipalities, prefectures and regions with the aim of reducing operating costs and the wage bill" (Chortareas & Logothetis, 2016).

1.4   Data

1.4.1   Fiscal data

For this study I rely on a unique dataset on expenditures and revenues of Greek municipalities by incorporating data from 2005 to 2018. This dataset has been assembled for the very first time, by compiling the annual municipal financial reports, which are not publicly available. The data on municipal revenues and expenditures were obtained by the Hellenic Statistical Authority for the period 2005-2009, and the Ministry of Interior for the period 2011-2018, (Hellenic Statistical Authority, 2019; Ministry of Interior, 2019) by means of financial reports. The respective authority collecting the data changed in 2010, and thus no reliable data are available for this year.

However, along with the transfer of responsibility for the Hellenic Statistical Authority to the Ministry of Interior, a new encoding system was introduced. In fact, the implications of the new encoding system included the further disaggregation of the sub-categories in several lower-level clusters. In order to harmonize and correspond the new system with the previous one, I summarize the lower-level clusters to sub-categories. In addition, the annual municipal reports delivered up to 2009 as digital documents (in pdf format). Using a specialized software (ABBYY FineReader PDF version 15) I was able to transform them in editable format. Finally, the revenues and expenditure of each respective reference year, was reported on different files after the

amalgamation. Hence, I had to integrate them to a unique dataset per year and afterwards merge the annual files into the unique database.

The dataset includes detailed disaggregation on both expenditures and revenues, for all municipalities in the sample period. Each category, is subsequently broken down in two subgroups, including five sub-categories for revenues (regular revenues, extraordinary revenues, income from past financial years, receivables from loans and previous financial years, receipts for the State or third parties and refunds, cash balance) and four for the expenditures (current costs, investments, payments from previous financial years returns and forecasts, reserves). On the next level of disaggregation, the revenues and expenditures of the municipal budget are structured in 45 specific items. The structure of all fiscal items as well as a brief description is presented in Table 1. 1 and Table 1. 2.

Table 1. 1 Total revenues main categories and specific items

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

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

Table 1. 2 Total expenditures main categories and specific items

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

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

In 2009, just before the implementation of the "Kallikratis" reform, the total expenditures of the local administration in Greece were 4.1% of GDP, while in 2011, they reduced to 3.2% of GDP. Similarly, total revenues were 4.1% of GDP in 2009 and dropped to 3.4% of GDP in 2011 (Eurostat, 2021).

In terms of the overall budget of the general government, in 2009 the total local administration's revenues represented the 19.45% of general government's revenues, while total expenditures accounted for 11.67% of general government's expenditures. In 2011, the corresponding shares of total revenues and total expenditures were 12.47% and 8.22%, respectively (Ministry of Finance, 2011; 2013).

While this might be considered as a minor part of the public sector in Greece, the municipalities are highly dependent on the state, as over the 2005-2018 period, almost 50% of their total revenues came from intergovernmental grants. The other half of their revenues came from taxation, fees, and other independent resources[3].

Figure 1. 1 and Figure 1. 2 and below present the evolution of current costs and investments over the period of analysis. As it is evident, both indicators present a significant drop after 2011, for both amalgamated and non-amalgamated municipalities.

---

[3]   For a full description of total revenues please see Table 1. 1.

Figure 1. 1 Current costs per capita in amalgamated and non-amalgamated municipalities
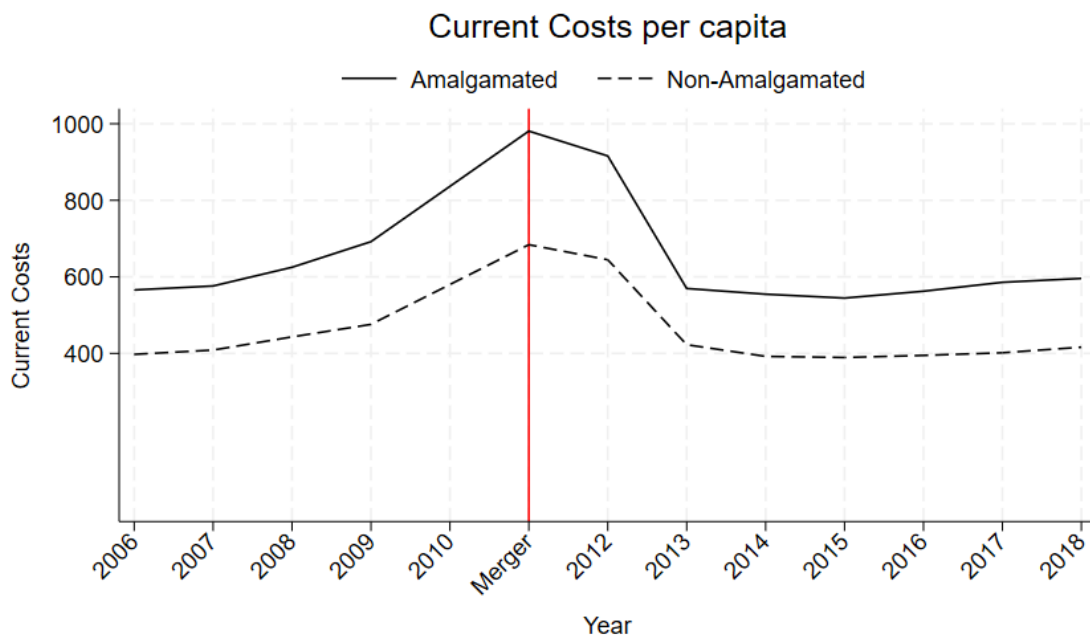
Figure 1. 2 Investments per capita in amalgamated and non-amalgamated municipalities
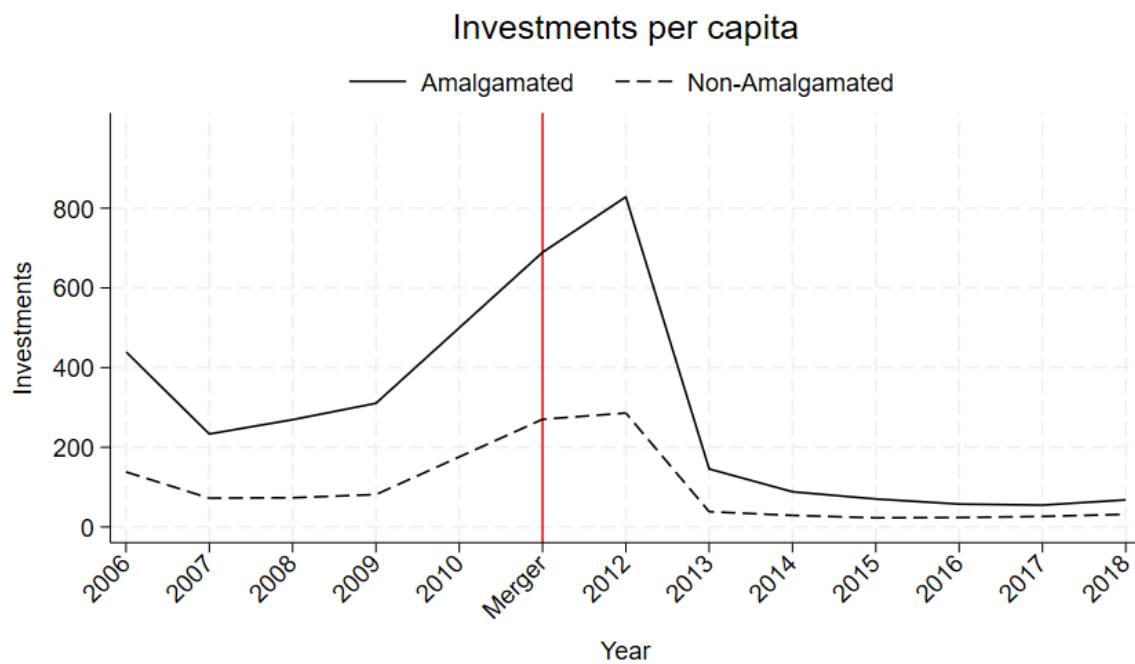
Table 1. 3 reports summary statistics for all fiscal variables used in this study.

Table 1. 3 Summary statistics for fiscal data used in the analysis

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
Total revenues	4143	7.24	0.683	4.73	10.65	5.87	9.20	0.59	4.18
Total expenditures	4137	7.02	0.762	1.86	10.65	5.28	9.16	0.26	5.17
Current costs	4136	6.48	0.64	0.41	9.76	4.86	8.27	-0.01	7.73
Staff fees and expenses	4136	5.51	0.62	1.40	8.84	3.85	7.17	0.04	6.27
Remuneration of elected and third parties	3817	3.78	0.94	0.71	7.18	1.81	6.13	0.16	3.02
Third party benefits	3816	4.55	0.97	0.23	8.58	2.33	6.88	0.00	3.30
Taxes - Fees	3629	0.489	1.43	-4.33	6.75	-2.76	3.96	0.17	3.15
Other overheads	3816	2.64	1.16	-2.85	8.64	-.084	5.62	0.01	3.77
Payments for public credit service	3868	2.87	1.40	-6.37	6.52	-1.73	5.61	-1.19	5.91
Expenditure on the supply of consumables	3816	3.43	0.96	-2.76	7.87	1.16	5.69	-0.11	3.83
Payments - transfers to third parties	3799	4.60	0.90	-0.59	8.40	2.02	6.73	-0.40	4.70
Other expenses	2383	-0.22	2.20	-10.05	6.13	-5.89	4.14	-0.44	3.26
Investments	3834	5.17	1.44	-1.71	9.94	1.85	8.54	-0.09	3.21
Purchases of buildings, technical works, and supplies	3499	2.88	1.46	-4.79	7.71	-1.02	6.10	-0.43	4.15
Projects	3504	4.87	1.50	-3.23	9.49	0.92	8.39	-0.38	3.92
Studies, research, experimental work, and specific costs	3444	2.25	1.77	-5.68	8.43	-2.19	6.12	-0.31	3.44
Fixed investment titles (business holdings)	1692	0.79	2.01	-9.93	7.97	-4.29	5.04	-0.18	3.38

1.4.2 Demographic and socioeconomic data

Furthermore, a number of municipal demographic and socioeconomic data are collected from diverse sources, including population (total and age groups), number of births, number of deaths, working age population, Persons in/not in the labour force (% persons 15-74), employment and unemployment (included young employment) and GDP per capita at regional (NUTS 2) and prefectural (NUTS 3) level. The average population of municipalities for the period 2005-2018 is presented in Map 1. 1, below. The sources and details of the data are reported in Table 1. 4 and summary statistics in Table 1. 5.

Map 1. 1 Average municipal population (2005-2018)
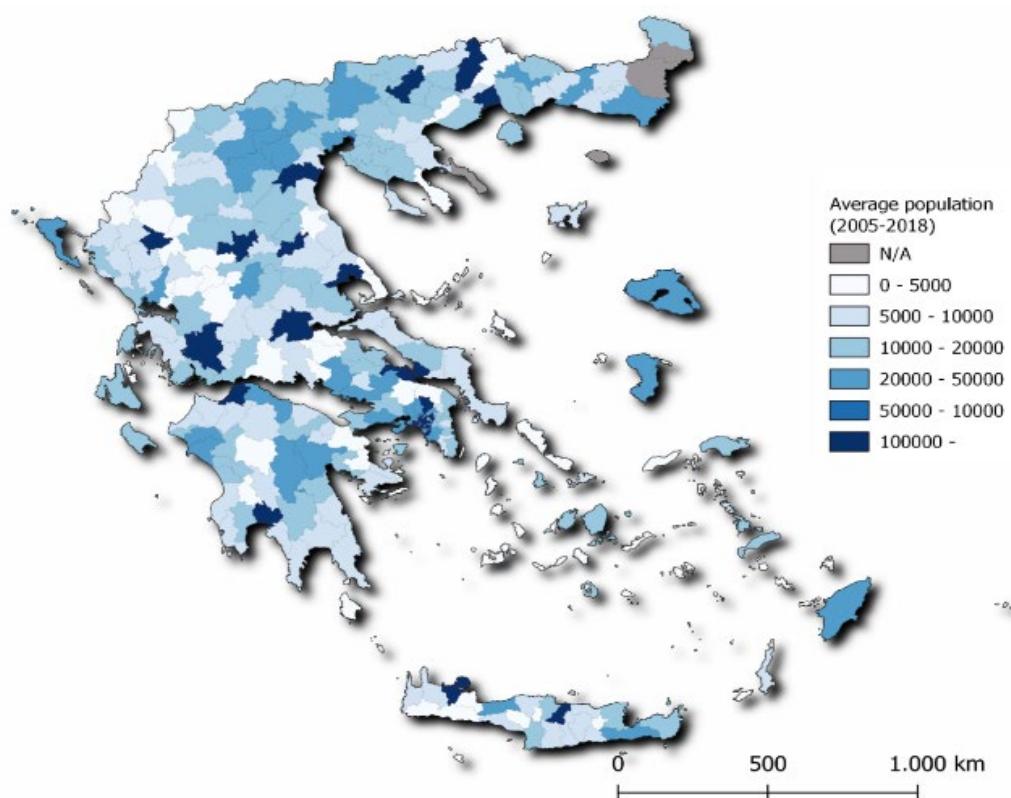
Table 1. 4 reports the sources of all fiscal data, socioeconomic indicators and outcome variables used in this study. Table 1. 5 presents summary statistics for the socioeconomic indicators as well as the outcome variable.

Table 1. 4 Data sources

Variable name	Source
Fiscal indicators (as presented in Table 1. 1 and Table 1. 2)	Hellenic Statistical Authority (2005-2009); Ministry of Interior (2011-2018)
Municipal area (in square kilometres)	Own calculations
GDP NUTS 2- NUTS 3 level	Hellenic Statistical Authority
Population (and aged groups)	Eurostat
Total number of births	Eurostat (data for population and aged groups) and own calculations
Total number of deaths	Eurostat (data for population and aged groups) and own calculations
Population aged 15-74	Eurostat (data for population and aged groups) and own calculations
Working age population	Census 2001 (Hellenic Statistical Authority), Eurostat and own calculations
Persons in the labour force (% persons 15-74)	Census 2001 (Hellenic Statistical Authority) and own calculations
Persons not in labour force (% persons 15-74)	Census 2001 (Hellenic Statistical Authority) and own calculations
Employed persons (% persons in the labour force)	Census 2001 (Hellenic Statistical Authority) and own calculations
Unemployed persons (% persons in the labour force)	Census 2001 (Hellenic Statistical Authority) and own calculations
Young employed persons (% employment)	Census 2001 (Hellenic Statistical Authority) and own calculations
Young employed persons (% pop_15_24)	Census 2001 (Hellenic Statistical Authority) and own calculations

Table 1. 5 Summary statistics for socioeconomic and outcome variables

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
Municipal area (in square kilometres)	4153	299.74	324.39	1.02	1861.68	2.09	1476.54	1.60	5.89
GDP NUTS 2	4225	17084.14	4659.01	11193.01	29215.07	11225.17	29215.07	0.89	2.92
GDP NUTS 3	3895	15918.94	4255.20	9491.83	29921.42	9763.50	28185.20	0.72	2.88
Population	4153	24138.25	51773.28	98.00	745514.00	371.00	163446.00	9.64	124.53
Total number of births	3803	1246.72	3013.71	1.00	49637.00	3.00	13040.00	8.68	110.75
Total number of deaths	3614	1438.31	3191.96	0.00	59577.00	3.00	9643.00	11.91	199.09
Population aged 15-74	4153	19096.93	41878.38	81.00	604769.00	301.00	129774.00	9.76	126.55
Working age population	4030	22920.77	50960.37	269.00	730232.00	488.00	154235.00	9.77	126.14
Persons in the labour force (% persons 15-74)	4030	0.44	0.05	0.22	0.63	0.28	0.54	-0.64	4.23
Persons not in labour force (% persons 15-74)	4030	0.55	0.05	0.36	0.77	0.45	0.71	0.64	4.23
Employed persons (% persons in the labour force)	4030	0.88	0.04	0.68	0.97	0.73	0.95	-1.22	5.80
Unemployed persons (% persons in the labour force)	4030	0.11	0.04	0.02	0.31	0.04	0.26	1.22	5.80
Young employed persons (% employment)	4030	0.07	0.07	0.00	1.02	0.01	0.17	9.47	112.14
Young employed persons (% pop_15_24)	4080	0.17	0.20	0.00	2.67	0.02	0.45	9.50	104.91
Transfers (Revenues from grants)	4142	5.84	0.63	0.16	8.42	4.59	7.54	-0.27	7.82
Transfers (Grants to cover operating costs)	3987	3.22	1.43	-3.21	8.68	-0.69	6.56	-0.346	4.07
Transfers (Grants for investments)	4137	5.21	1.26	-2.35	9.72	2.42	8.35	-0.04	3.29

1.5   Empirical Strategy

In order to compare the pre and the post-amalgamated municipalities, the dataset has been aggregated. This means that for every x municipalities which were amalgamated I generate one observation for every year prior the amalgamation, instead of x observations. Overall, I have data available for all 325 Greek municipalities over the reference time frame. I use fiscal data for each municipality, in per-capita terms, as an aggregate measure to compare the performance of amalgamated and non-amalgamated municipalities.

My first objective is to identify the average effect of the law on the expenditures of amalgamated municipalities. Ideally, I would like to compare decisions on expenditures for municipalities that were amalgamated (treated group), to the same decisions for municipalities in the counterfactual situation of not being amalgamated. This is impossible, and the best alternative would be to run a randomized control trial, which assigns participation and non-participation to the treatment status, allowing us to compare the average expenditures of the two groups. Since in my analysis I cannot make use of a controlled randomized trial, I have to turn to quasi-experimental methods in order to define a suitable control group that can credibly estimate the counterfactual. The main concern regarding identification using this approach is due to unobservable characteristics that may vary between amalgamated and non-amalgamated municipalities, which might be correlated to expenditures; I address this in what follows.

The first method I implement is a DiD approach, because I can exploit the panel dimension of my data and remove time-invariant unobservable municipalities' characteristics. In particular, since 2005 I have amalgamated (treated group) and non-amalgamated (control group) municipalities. Therefore, the goal of the analysis is to compare the difference between the control group (unaffected municipalities) and treatment group (affected municipalities) before and after the introduction of the treatment, in a sort of a quasi-natural experiment. As I have already discussed,

in order to compare treated municipalities before and after the merger, the financial reports of the amalgamated municipalities before the amalgamation were aggregated.

I estimate my basic model, which considers municipality expenditure as dependent variable and is expressed as follows:

$$Y_{it} = \mu_i + \tau_t + \gamma Amalgamation_{it} + \beta x_{it} + \epsilon_{it} \text{ (1.1)}$$

where Y_{it} is log of the per capita expenditure (i.e., either total, current or investment expenditures) or revenues, in municipality i at time t; *Amalgamation* is a dummy variable that takes on the value of one if the municipality i at time t has been amalgamated and zero otherwise; x_{it} includes the control variables described in Section 1.4. To take account of unobserved heterogeneity across municipalities, I include a set of municipal fixed effects, μ_i; I control for shocks common to all municipalities in period t adding year fixed effects, τ_t. Moreover, since Greek regions might have experienced differential growth paths over the considered period, one might argue that there could be some other unobservable characteristics related to the specific region that might influence municipal choices over spending decisions. For this reason, in additional specifications I augment model (1) by including an interaction of region-by-year fixed effects. Finally, ϵ_{it}, is the error term, clustered at the municipal level. It is important to note at the outset that in this estimating framework, the coefficient γ represents my DiD estimate of the effect of municipal amalgamation on public spending.

While the decision of merging municipalities is ultimately a national government choice, and hence it seems unlikely that one single municipality could influence this process, there is still one potential source of bias that might affect my estimation approach, as the amalgamation process is not homogeneous and, hence, it might vary according to some of the characteristics of municipalities. In practice, municipalities in the treatment group might be somehow different than those belonging to the control group. I attempt to eliminate this bias in the estimations by adopting

matching methods. The main purpose of matching is to find a group of non-treated municipalities, which are similar to treated ones in all relevant pre-treatment characteristics, **x**, the only remaining difference being that one group is subject to amalgamation and the other group is not.

In the first stage, I therefore estimate the propensity score (PS) of being amalgamated using a discrete response model. In particular, I use data from the 2001 Census and run a logit regression, where the dependent variable is given by a dummy variable which takes on the value of 1 if the municipality is amalgamated and zero otherwise. The included control variables are population, per-capita surface (area per-capita), population disaggregated by age (aged), working age population, labour force participation rate, unemployment rate, youth unemployment rate and local GDP, in per-capita terms, at the NUTS 3 level. All these variables refer to the year 2001. The results of the estimation of the propensity score model are reported in Table 1. 6. Once I have obtained the propensity score, following Sianesi (2004) and Smith and Todd (2005), I adopt a trimming procedure to define the common support as the region of values of PS that have positive density within both the treatment and control groups distributions. I then re-estimate Equation (1.1) by using information only on the observations that lie on the common support.

Table 1. 6 Estimation of the propensity score model

Estimated propensity score				
	Percentiles	**Smallest**		
1%	0.220	0.195		
5%	0.358	0.214		
10%	0.485	0.220	**Obs**	217
25%	0.762	0.221	**Sum of Wgt.**	217
50%	0.968		**Mean**	0.847
		Largest	**Std. Dev.**	0.220
75%	0.999	1.000		
90%	1.000	1.000	**Variance**	0.048
95%	1.000	1.000	**Skewness**	-1.410
99%	1.000	1.000	**Kurtosis**	3.755

Indeed, the results of the balancing test for the variables used so as to define the subset of matched municipalities indicate that there were no significant differences[4] between control and treated municipalities after the matching (see Table 1. 7). In addition, the t-test on the current costs and investments focusing explicitly on the subset of matched municipalities reveals that such differences do not exist on this sample (see Table **1. 8**). Therefore, I present only the findings based on the subset of matched municipalities.

Table 1. 7 Balancing test

		Mean				t-test	
Variable	**Unmatc**	**Treated**	**Control**	**%bias**	**% reduct |bias|**	**t**	**|p>|t|**
Population aged 15-74	U	17,708.00	4615.90	81.30	99.50	3.59	0.000***
	M	7001.10	6934.70	0.40		0.09	0.927
Total number of births	U	2,333.70	262.26	93.50	98.70	4.10	0.000***
	M	599.50	571.54	1.30		0.41	0.684
Total number of deaths	U	2,492.10	478.76	120.10	93.30	5.58	0.000***
	M	1,186.30	1,051.00	8.10		0.91	0.363
Municipal area (in square kilometres)	U	0.01	0.05	-83.90	83.90	-5.47	0.000***
	M	0.04	0.04	-13.50		-0.93	0.352
Population aged 65+	U	0.19	0.19	-5.30	-442.90	-0.31	0.757
	M	0.21	0.23	-28.70		-1.77	0.080*
Population aged 5-19	U	0.17	0.16	37.00	18.50	2.02	0.045**
		Mean				**t-test**	

---

[4] The only marginal significance refers to the young population aged 5–19 years old. Nevertheless, young population remains substantively important for the analysis due to its established role in shaping labour market dynamics, educational attainment, and household labour supply decisions, which are critical in labour economics studies (Angrist & Pischke, 2009; Card, 1999).

Variable	Unmatch	Treated	Control	%bias	% reduct |bias|	t	|p>|t|
Working age population	U	15,985.00	3,973.30	80.00		3.53	0.001***
	M	5,984.00	5,953.70	0.20	99.70	0.05	0.962
Unemployed persons (% persons in the labour force)	U	0.12	0.12	11.00		0.69	0.493
	M	0.12	0.11	12.20	-11.30	0.82	0.412
Young employed persons (% employment)	U	0.08	0.06	37.30		1.70	0.091*
	M	0.07	0.7	3.20	91.30	0.43	0.665
Young employed persons (% pop_15_24)	U	0.21	0.13	41.10		1.82	0.071*
	M	0.17	0.16	1.00	97.60	0.18	0.858
GDP pc NUTS3 level	U	16,484.00	20,387.00	-99.50		-6.13	0.000***
	M	16,896.00	16,739.00	4.00	96.00	0.28	0.781

Table 1. 8 Two-sample t test with equal variances for current costs and investments

					95% conf. interval	
Group	Obs	Mean	Std. err.	Std. dev.	LCI	UCI
0	32	6.493	0.103	0.586	6.282	6.705
1	185	6.662	0.037	0.503	6.554	6.700
Combined	217	6.607	0.035	0.517	6.538	6.676
diff		0.0133	0.0987		-0.328	0.061

Panel A. Current costs

diff = mean(0) - mean(1)   t = -1.352

H0: diff = 0   Degrees of freedom = 215

Ha: diff < 0   Ha: diff != 0   Ha: diff > 0

Pr(T < t) =0.088*   Pr(\|T\| > \|t\|) = 0.177   Pr(T > t) = 0.911

Panel B. Investments

Group	Obs	Mean	Std. err.	Std. dev.	95% conf. interval	
					LCI	UCI
0	32	6.161	0.137	0.779	5.880	6.442
1	185	6.148	0.050	0.686	6.048	6.248
Combined	217	6.150	0.047	0.699	6.056	6.244
diff		0.0134	0.134		-0.251	0.277

diff = mean(0) - mean(1)		t = -0.099
H0: diff = 0		Degrees of freedom = 215
Ha: diff < 0	Ha: diff !=	Ha: diff > 0
Pr(T < t) =0.540	Pr(|T| > |t|) = 0.920	Pr(T > t) = 0.460

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

$$Y_{it} = \mu_i + \tau_t + + \sum_{\pi=2}^{5} \gamma_\pi \, Amalgamation_{i,\pi} + \sum_{\tau=0}^{7} \gamma_\tau \, Amalgamation_{i,\tau} + \beta x_{it} + \epsilon_{it} \quad (1.2)$$

The omitted year is the year before the national law imposing mandatory mergers. This specification allows testing for the presence of parallel trends in the pre-treatment period, namely, whether the coefficients associated with the lead (γ_π, with π going from 5 years to 2 years before the adoption) are not statistically different from zero. As already anticipated, this approach is

convenient to understand whether the treatment effect fades, increases, or stays constant over time, depending on the estimated coefficients of the lags (γ_τ, with τ going from the year of adoption to 7 years since the amalgamation)[5].

In order to account also for potential cumulative effect, which might contradict the common trend assumption, we estimated the following regression for the pre-treatment periods in both outcomes:

$$Y_{it} = \mu_i + \delta T_i + \partial(t * T_i) + \epsilon_{it}, \text{ (1.3)}$$

where t is a deterministic trend; T_i is equal to 1 for the treatment group and 0 for the control group; and μ_i is a set of municipal fixed effects. If ∂ is not significant, we can be more confident that the common trend assumption is satisfied.

1.6   Results

1.6.1   Expenditures and revenues at local level

In this section I present the main findings of the analysis conducted with regards to the total expenditures and revenues per capita at local level. Following the approach described in section 1.5, the results of the first set of three regressions estimated using as dependent variable the (log of) per capita total expenditures and revenues are provided in Table 1. 9. In terms of expenditures, the results indicate no significant change of the total expenditures per capita nor in the total revenues.

The placebo exercise does not lead to any effect as the γ coefficients turns out to be indistinguishable from zero in the specification that uses total expenditures as the dependent

---

[5]   A lead is the amount of time whereby a successor activity can be advanced with respect to a predecessor activity whereas a lag is the amount of time whereby a successor activity will be delayed with respect to a predecessor activity.

variable (Table 1. 10, cols. 1, 2 and 3), and in the specification where total revenues is used as the dependent variable (Table 1. 10, col. 4, 5 and 6).

Table 1. 9 Total expenditures and revenues in logarithmic scale

Dep. Variables	Total expenditures			Total Revenues		
	(1)	(2)	(3)	(4)	(5)	(6)
Amalgamation	0.064	0.025	0.004	0.008	-0.015	0.005
	(0.051)	(0.044)	(0.050)	(0.040)	(0.036)	(0.040)
Observations	4,137	4,137	4,137	4,143	4,143	4,143
R-squared	0.818	0.824	0.835	0.868	0.873	0.883
Controls	No	Yes	Yes	No	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region * year FE	No	No	Yes	No	No	Yes

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

Table 1. 10 Placebo (total expenditures and revenues)

Dep. Variables	Total expenditures			Total Revenues		
	(1)	(2)	(3)	(4)	(5)	(6)
Amalgamation fake 2007	0.028	---	---	0.016	---	---
	(0.083)			(0.040)		
Amalgamation fake 2008	---	0.027	---	---	0.019	---
		(0.052)			(0.031)	
Amalgamation fake 2009	---	---	0.028	---	---	0.017
			(0.042)			(0.029)
Observations	1,551	1,551	1,551	1,555	1,555	1,555
R-squared	0.774	0.774	0.774	0.910	0.910	0.910
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

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

1.6.2 Expenditures: Current Costs and Investments

1.6.2.1 A test for the common trend assumption

As for current costs, the estimates and their 95% confidence intervals are plotted in Figure 1. 3. According to these, there is no difference in expenditures over the pre-treatment period. In a similar vein, the coefficients associated to lags turn out to be not statistically significant at the conventional level. The only exception is given by the coefficient associated with "6 years" and after the merger, which turns out to be negative and marginally statistically significant. This implies that the current costs of amalgamated municipalities were lower 6 years after the merging process as compared to 1 year prior. Moreover, there is no cumulative effect that could contradict this finding (See Table 1. 11).

Table 1. 11 Estimation of the cumulative effect on pre-treatment periods

Dep. Variable	Current Costs	Investments
	(1)	(2)
∂	-0.355	-0.081
	(0.475)	(0327)
Observations	1,127	948
R-squared	0.797	0.720
Transfers	Yes	Yes

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

Figure 1. 3 Autor test on (log) current costs per capita

Time passage relative to years of the merger
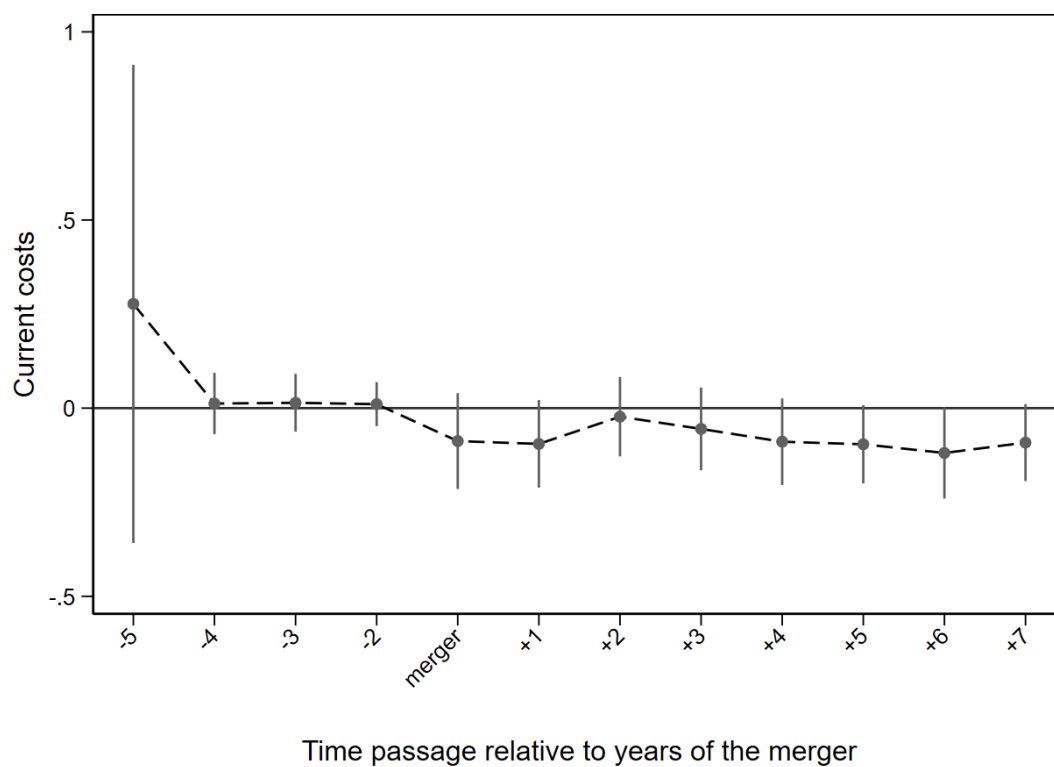
Investments' estimates and their 95% confidence intervals are depicted in Figure 1. 4. Point

estimates for both current costs and investments are reported in Table 1. 12.

Table 1. 12 Current Costs and investments' estimates (as presented in Figure 1.3 and Figure 1.4)

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

According to the estimates, there is no difference in investment expenditure over the pre-treatment period except for "3 years" prior the amalgamation. Likewise, the coefficients associated to lags turn out to be not statistically significant up to 3 years after amalgamation. On the contrary, we observe a significant reduction in investment spending 4 to 7 years after the amalgamation. Furthermore, the test for potential cumulative effect suggests that the common trend assumption might be satisfied. All in all, while in the current cost case we are quite confident that the common trend assumption is likely to be satisfied, the evidence in the case of investment expenditure is less clear-cut and we will apply the "honest-DID" approach of Rambachan and Roth (2023) to evaluate whether the impact of the Reform might be associated to possible violations of the common trend assumption.

Figure 1. 4 Autor test on (log) investments costs per capita

Time passage relative to years of the merger
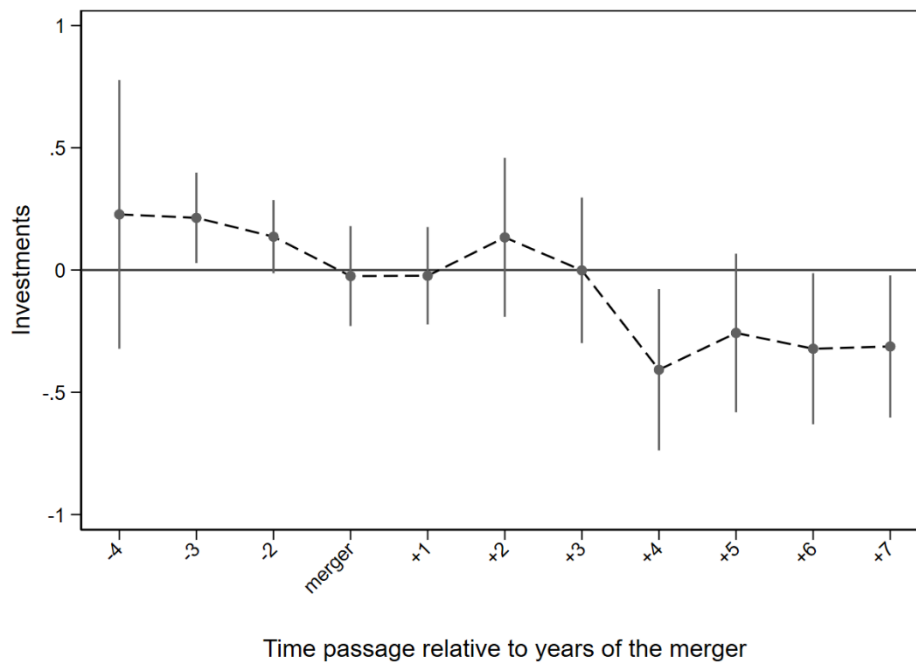
1.6.2.2 Baseline results

The results of the first set of three regressions estimated using as dependent variable the (log of) per capita current costs are provided in Table 1. 13, cols. 1-3, while that using the (log of) per capita investment expenditure are shown in Table 1. 13, cols. 4-6.

To control for bias arising when municipalities in the treatment group differ from those included in the control group, we report estimates obtained by restricting the analysis in the subsample of matched municipalities. In particular, in column 1 I estimate Equation (1.1) in the full sample, including only municipal- and year-fixed effects. The model in column (2) includes the following additional covariates: population, population density and inverse population, as these variables capture the (possible) presence of economies of scale in the provision of public services and goods; Column (3) takes into account region-by-year fixed effects. A potential source of bias that might affect our results is the omission of vertical transfers, hence, we control for grants from upper-level governments in all model specifications. In fact, the amalgamation of municipalities can lead to changes in the flow of funds between levels of government (Allers and Geertsema, 2016; Eulau and Prewitt, 1973) and hence it is crucial to control for these potential changes.

The results in Table 1. 13, cols. 1-3 show a negative effect of amalgamation on current costs for all the specifications. In particular, significant effects associated with the amalgamation reform arise only when we control for region-by-year fixed effects, thereby suggesting that it is important to account not only for transfers and other covariates, but also for region-specific trends. Overall, I believe that column 3 provides the most reliable results, because we also control for region-by-year fixed effects and thus the most complete picture is presented, which shows that current costs decline by 12.8% after amalgamation.

Table 1. 13 Per capita Current costs (col 1, 2, 3) and Investments (4, 5, 6) in logarithmic scale

Dep. Variables	Current costs			Investments		
	(1)	(2)	(3)	(4)	(5)	(6)
Amalgamation	-0.036	-0.057	**-0.128****	**-0.249****	**-0.283*****	**-0.296*****
	(0.063)	(0.058)	**(0.057)**	**(0.101)**	**(0.098)**	**(0.099)**
Observations	2,961	2,961	2,961	2,836	2,836	2,836
R-squared	0.830	0.832	0.843	0.832	0.833	0.841
Transfers	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Region * year FE	No	No	Yes	No	No	Yes

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

Turning to investments, Table 1. 13, cols. 4-6 indicates that the amalgamation of municipalities has led to a significant decrease in the (log of) per capita investment. In particular, we find a negative and robust effect of amalgamation on investment decisions,' the size of the coefficients being also remarkably similar across models. In terms of magnitude, the amalgamation process leads to a decline in the (log of) per capita investment in the range of 25%- 30%.

1.6.2.3   Robustness checks

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

1.6.2.4   Placebo Test

A common way to conduct a placebo test in the context of DiD analysis is to focus on the span prior to the shock, that is, to simulate what would have happened to the expenditure of amalgamated municipalities if a fake year of the "Kallikratis" programme forcing mandatory merger was used. Specifically, I replicate the main analysis by assuming that the amalgamation occurred 1, 2 and 3 year(s) earlier than the true data. Were the coefficient associated to amalgamation significant, it would suggest that even before the true year of the merging process, future treated municipalities had already a different path of expenditure, thus casting doubt on the validity of previous results.

The placebo exercise does not lead to any effect on expenditure as the γ coefficient turns out to be indistinguishable from zero in the specification that uses current costs as the dependent variable (Table 1. 14, cols 1-3). Regarding the specification where investment is used as the dependent variable (Table 1. 14, cols 4-6), we observe that the γ coefficient turns statistically significant for col. 6. indicating that eventually treated municipalities had already a different path of investments prior to the amalgamation. These findings question the robustness of the baseline results as we cannot be sure whether the effect is fully associated with the reform or if it is due to a violation of the parallel trends assumption.

Table 1. 14 Placebo

Dep. Variables	Current costs			Investments		
	(1)	(2)	(3)	(4)	(5)	(6)
Amalgamation fake 2007	-0.091			-0.123		
	(0.119)			(0.275)		
Amalgamation fake 2008		-0.032			-0.160	
		(0.074)			(0.139)	
Amalgamation fake 2009			-0.022			**-0.203***
			(0.061)			**(0.111)**
Observations	1,127	1,127	1,127	948	948	948
R-squared	0.797	0.797	0.797	0. 720	0. 720	0.720
Transfers	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Region * year FE	Yes	Yes	Yes	Yes	Yes	Yes

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

To further explore the validity of these findings, we employ a robust inference and sensitivity analysis in differences-in-differences (DiD) and event study designs, introduced by Rambachan and Roth (2023). More specifically, Rambachan and Roth (2023) note that in a DiD setting we can still learn something on the treatment effect even when a violation of parallel trends in the pre-treatment period seems to have happened, as in the case of investment expenditure. Rambachan and Roth (2023) have formalized a methodology to investigate how large the violation of parallel trends in the post-treatment period should be in order to make the treatment effect of the intervention equal to zero. More specifically, following Rambachan and Roth (2023) we allow the

violation of parallel trends in the post-treatment periods to be up to M times larger than the maximum pre-treatment violation for different values of M.[6]

The finding of this additional analysis indicates that we cannot reject the null hypothesis that the average post-treatment effect is zero (please see Table 1. 15). In other words, the decline in the investment expenditure cannot be associated with the reform as the presence of pre-trends in the future merged municipalities may have entirely driven the outcome.

Table 1. 15 Sensitivity analysis of parallel trends assumption for correct costs and investments

Panel A. Current costs						
Effect on the first post-treatment period (Relative magnitudes restrictions)		Effect on the first post-treatment period (Smoothness Restrictions)		Average post-treatment effect		$\bar{M}$
LB	UB	LB	UB	LB	UB	
-0.214	0.039	-0.214	0.039	-0.177	0.013	Original
-0.477	0.347	-0.705	0.551	-1.651	1.487	0.5
-0.853	0.728	-1.205	1.051	-2.247	2.083	1
-1.243	1.115	-1.705	1.551	-2.843	2.679	1.5
-1.628	1.504	-2.205	2.051	-3.438	3.274	2
Panel B. Investments						
Effect on the first post-treatment period (Relative magnitudes restrictions)		Effect on the first post-treatment period (Smoothness Restrictions)		Average post-treatment effect		$\bar{M}$
LB	UB	LB	UB	LB	UB	
-0.228	0.179	-0.228	0.179	-0.331	0.027	Original
-0.331	0.295	-0.616	0.841	-1.257	0.988	0.5
-0.527	0.509	-1.116	1.341	-2.316	2.052	1
-0.748	0.740	-1.616	1.841	-2.906	2.599	1.5
-0.986	0.974	-2.116	2.341	-3.210	2.906	2

---

[6] For example, if M= 0.5 (1) we allow for a post-treatment violation of parallel trends up to 50% (or 100%) of the largest pre-treatment lead.

1.6.2.5   Outliers

To check the robustness of my findings with regards to excluding extreme values, I replicate regressions in Table 1. 13 and by dropping all observations in which the dependent variable is below the 1st or above the 99th percentile. In the same spirt, I exclude observations in which the dependent variable is below the 5th percentile or above the 95th percentile.

Results for current costs are shown in suggest that the main findings are not driven by outliers, as the amalgamation coefficient is negative and statistically significant at the 1% level, both in the case where the sample is trimmed at 1% (columns 1-3) and at 5% (columns 4-6) both for the baseline and matching samples.

Table 1. 16-Panel A and it emerges that current costs are not affected by the amalgamation process, as the coefficient turns out to be not statistically different from zero in all specifications. These results also indicate that findings presented in the baseline setting are driven by some outliers, and hence we are confident that the amalgamation effect on current costs is negligible.

As far as expenditure on investment is concerned, results in suggest that the main findings are not driven by outliers, as the amalgamation coefficient is negative and statistically significant at the 1% level, both in the case where the sample is trimmed at 1% (columns 1-3) and at 5% (columns 4-6) both for the baseline and matching samples.

Table 1. 16-Panel B suggest that the main findings are not driven by outliers, as the amalgamation coefficient is negative and statistically significant at the 1% level, both in the case where the sample is trimmed at 1% (columns 1-3) and at 5% (columns 4-6) both for the baseline and matching samples.

Table 1. 16 Current costs and investments (trimming 1% and 5%)

	Panel A. Current Costs					
	Trimming 1%			Trimming 5%		
	(1)	(2)	(3)	(4)	(5)	(6)
Amalgamation	0.020	-0.000	-0.021	-0.003	-0.013	-0.037
	(0.051)	(0.043)	(0.039)	(0.050)	(0.042)	(0.040)
Observations	2,905	2,905	2,905	2,711	2,711	2,711
R-squared	0.887	0.895	0.902	0.879	0.887	0.896
Transfers	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	No	Yes
Region * year FE	No	No	Yes	Yes	No	No
	Panel B. Investments					
	Trimming 1%			Trimming 5%		
	(1)	(2)	(3)	(4)	(5)	(6)
Amalgamation	**-0.243****	**-0.277*****	**-0.307*****	**-0.309*****	**-0.329*****	**-0.370*****
	(0.098)	**(0.095)**	**(0.099)**	**(0.084)**	**(0.081)**	**(0.091)**
Observations	2,802	2,802	2,802	2,620	2,620	2,620
R-squared	0.840	0.841	0.850	0.831	0.833	0.845
Transfers	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	No	Yes
Region * year FE	No	No	Yes	Yes	No	No

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

To sum up, the analyses conducted in this section, along with the evidence supporting the presence of a common trend, at least for the current costs, have strengthened our prior findings of a negative but not statistically significant relationship between municipal amalgamation and current costs of

municipalities. On the contrary, while the negative effect on investment expenditure appears to be persistent across specifications, the findings of the placebo test led us to be very cautious in interpreting them. In addition, the results indicate that it is very likely that such an effect is not due to the shock caused by the "Kallikratis" programme, but mainly to the different path of investment prior to the amalgamation that eventually treated municipalities might already had.

1.6.2.6   Heterogeneous effects

It is important to note that the amalgamation reform occurred amidst the economic crisis and a broader public sector reform, which may impact the results of our analysis. The economic crisis, for instance, could have affected municipalities in different ways, depending on their economic base and vulnerability to external shocks. Likewise, other elements of the reform, such as changes in tax policies or intergovernmental transfers, could have influenced the outcomes of interest. Therefore, to provide a more complete understanding of the effects of the amalgamation reform, it is necessary to consider the broader context in which it took place. While we include year, municipal and region by year fixed effects in our models, we further investigate this potential source of heterogeneity. We do so by including municipality linear time trends that eliminate unobservables at municipality level that evolve smoothly over time. When we do this, we find again no statistically significant effect, which lends further support to our previous conclusions, as presented in Table 1. 17.

Table 1. 17 Heterogeneity control (municipal linear time trends)

Dep. Variables	Current costs			Investments		
	(1)	(2)	(3)	(4)	(5)	(6)
Amalgamation	-0.006	0.019	0.014	0.117	0.178	0.206
	(0.069)	(0.068)	(0.068)	(0.154)	(0.153)	(0.131)
Observations	2,961	2,961	2,961	2,836	2,836	2,836
R-squared	0.870	0.870	0.878	0.870	0.871	0.878
Transfers	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipal lin. time trends	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Region * year FE	No	No	Yes	No	No	Yes

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

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

Permanence

To begin with, and in order to investigate whether there has been a heterogeneous response according to the time since the amalgamation occurred, I build a continuous variable, *permanence*. This is also because potential cost savings of amalgamation may need time to materialize. This variable measures the time since the amalgamation took place (1 to 8 years). In a similar vein, its quadratic term (*permanence²*) is also included, allowing the effect to be a non-linear function of time. The two terms, *permanence* and *permanence²*, are then interacted with Amalgamation, such that the estimated model is a generalized version of Eq. (1.1), taking the following form:

$$Y_{it} = \mu_i + \tau_t + Amalgamation_{it} \times (\gamma + \delta permanence_t + \lambda permanence_t^2) + \beta x_{it} + \epsilon_{it} \quad (1.4)$$

Results of estimation for this model are reported in Table 1. 18.

Table 1. 18 Effect of the amalgamation on Current Costs and Investments per capita

Dep. Variables	Current costs		Investments	
	(1)	(2)	(1)	(2)
	Linear	Quadratic	Linear	Quadratic
Amalgamation	**-0.104***	**-0.138***	-0.022	-0.046
	(0.061)	**(0.071)**	(0.109)	(0.190)
Permanence	-0.005	0.015	**-0.061***	-0.046
	(0.008)	(0.027)	**(0.019)**	(0.107)
Permanence square		-0.002		-0.002
		(0.003)		(0.012)
Constant	**2.762***	**2.766***	**2.004***	**2.004***
	(0.508)	**(0.511)**	**(0.270)**	**(0.270)**
Observations	2,961	2,961	2,836	2,836
R-squared	0.844	0.844	0.842	0.842
Controls	Yes	Yes	Yes	Yes
Transfers	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Region * year FE	Yes	Yes	Yes	Yes

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

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

For ease of interpretation, I plot the coefficients for reference values of the *permanence* (Panel A) and *permanence²* (Panel B) in Figure 1. 5 for current costs, while the same graph is depicted Figure 1. 6 for investment.

In relation to current costs, the visual depiction (Figure 1. 5) suggests a negative relationship between the time since amalgamation and current spending decisions. In particular, we observe a

statistically significant decline immediately after the amalgamation onwards. Similarly, we do observe a significant decline in investments 3 years after the merger (Figure 1. 6, Panel A), both in the linear and quadratic specifications (Figure 1. 6, Panel B).

Figure 1. 5 Time since the amalgamation- Current costs per capita in logarithmic scale
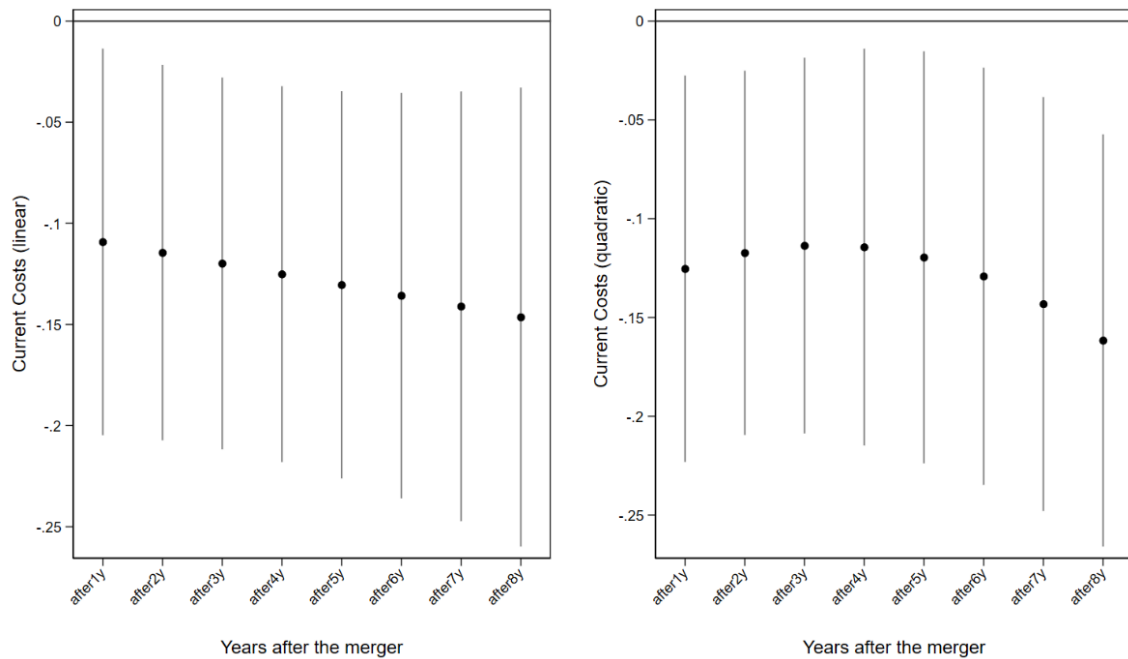
Figure 1. 6 Time since the amalgamation- Investments per capita in logarithmic scale
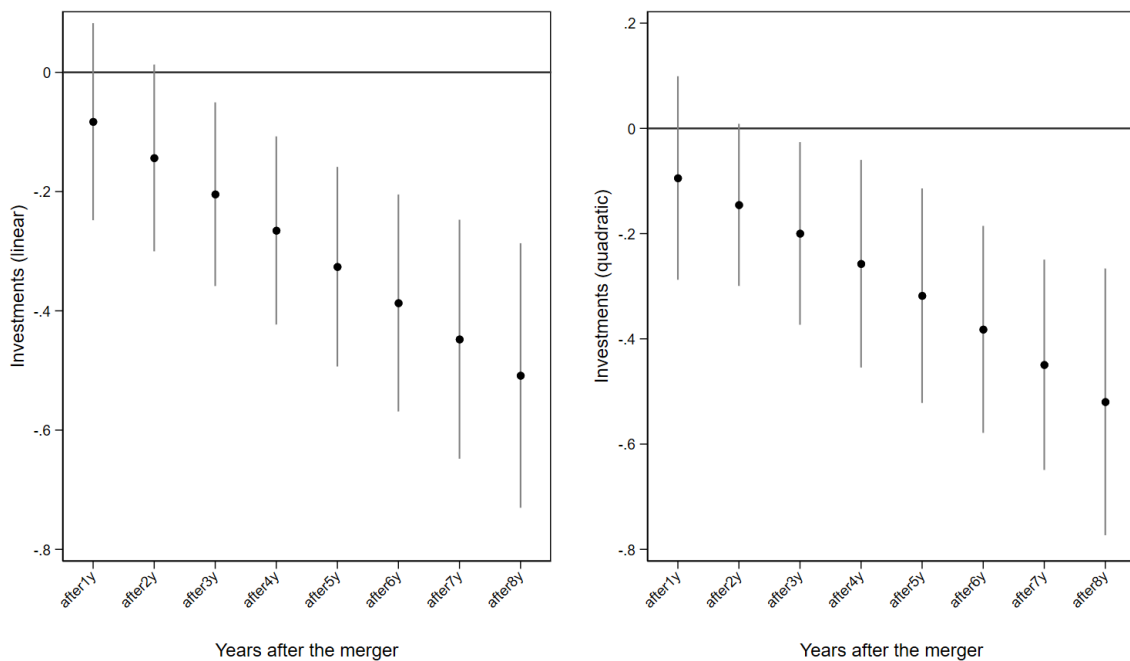
Table 1. 19 presents the coefficients depicted in Figure 1. 5 and Figure 1. 6.

Table 1. 19 Permanence of the amalgamation effect

	Current Costs		Investments	
	(1)	(2)	(3)	(4)
Dep. Variables	linear	quadratic	linear	quadratic
1 year after	-0.109*	-0.125**	-0.083	-0.094
	(0.058)	(0.059)	(0.100)	(0.118)
2 years after	-0.114**	-0.117**	-0.144	-0.145
	(0.056)	(0.056)	(0.095)	(0.094)
3 years after	-0.120**	-0.114**	-0.204**	-0.200*
	(0.056)	(0.058)	(0.094)	(0.105)
4 years after	-0.125**	-0.114*	-0.265***	-0.257**
	(0.056)	(0.061)	(0.096)	(0.120)
5 years after	-0.130**	-0.120*	-0.326***	-0.318**
	(0.058)	(0.063)	(0.102)	(0.124)
6 years after	-0.136**	-0.129**	-0.387***	-0.382***
	(0.061)	(0.064)	(0.111)	(0.120)
7 years after	-0.141**	-0.143**	-0.448***	-0.449***
	(0.065)	(0.064)	(0.122)	(0.122)
8 years after	-0.146**	-0.162**	-0.508***	-0.520***
	(0.069)	(0.063)	(0.135)	(0.154)
Observations	2,961	2,961	2,836	2,836

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

Spending categories

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

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

Results of this analysis are reported in Table 1. 20, where in each specification I include control variables, municipal- and year-fixed effects. According to the findings, all categories yield effects not statistically different from zero.

Table 1. 20 Specific items: current costs

Dep. Variables	Personnel costs	Financial costs	Third parties' costs	Other costs
	(1)	(2)	(3)	(4)
Amalgamation	-0.074	-0.205	-0.074	-0.045
	(0.054)	(0.224)	(0.092)	(0.085)
Observations	2,960	2,924	2,732	2,732
R-squared	0.861	0.706	0.772	0.832
Transfers	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Region * year FE	Yes	Yes	Yes	Yes

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

It is also interesting to note that results do not change when we trim the sample at 1%; in this case, in fact, the coefficient of other costs turns out to be statistically significant (see Panel B Table 1. 21). Conversely, when the sample is trimmed at the 5% level, it emerges that the amalgamation process is associated with an increase in personnel and financial costs, with the coefficients of

interest being positive (0.015 and 0.141 respectively) but not statistically significant (see Panel A of Table 1. 21). In practice these results reveal no effect in current expenditure in amalgamated municipalities[7].

Table 1. 21 Specific items of current costs (trimming 5% and 1%)

Panel A. Specific items: Current costs trimming 5%				
Dep. Variables	**Personnel costs**	**Financial costs**	**Third parties' costs**	**Other costs**
	(1)	(2)	(3)	(4)
Amalgamation	0.015	0.141	-0.080	-0.069
	(0.034)	(0.120)	(0.072)	(0.059)
Observations	3,597	3,533	1,873	3,319
R-squared	0.899	0.693	0.697	0.828
Controls	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

---

[7] Regarding personnel costs we know that their reduction was a presupposition of the economic adjustment programme. However, as presented in Table 1. 20, we did not find statistically significant evidence to support this presupposition. While we have considered several reasons that could explain the lack of evidence, including measurement errors and unobserved heterogeneity, further research should explore this issue more in depth. Given the institutional weakness of all government tiers in Greece, various factors such as corruption and free-riding behaviour (Hinnerich, 2009) by some members of the new amalgamated municipalities may have contributed to this result.

Dep. Variables	Panel B. Specific items: Current costs trimming 1%			
	Personnel costs	Financial costs	Third parties' costs	Other costs
	(1)	(2)	(3)	(4)
Amalgamation	-0.006	-0.079	-0.008	**-0.135****
	(0.038)	(0.140)	(0.069)	**(0.066)**
Observations	3,907	3,845	3,604	3,600
R-squared	0.902	0.702	0.774	0.845
Controls	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

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

As for investment decisions', I have found evidence that the amalgamation process led to a reduction of spending allocated for investments -although we argued that it might be due to previous trends. Nevertheless, and having said this, it is not clear which component of investments drives the results. Therefore, I estimate Equation (1.1) using, as dependent variables, the per capita (log) of the four components of investments: (i) purchases of buildings, technical works and supplies of fixed assets (which accounts for 10% of total investment expenditure); (ii) projects (corresponding to approximately 80%); (iii) studies, research, experimental work and specific costs (it amounts to 8% of the total budget devoted to investments); and (iv) Fixed investment titles (business holdings). Results of this analysis are reported in Table 1. 22, where in each specification I include control variables, and municipal and year-fixed effects. According to the estimates, purchases of buildings and technical works, which represent investment on physical capital, yield significant and negative effects at the conventional level (5%). Moreover, it turns out that the building purchases and associated technical works decrease significantly once municipalities are forced to merge, as the amalgamation coefficient turns out to be negative (-0.561) and statistically significant at 1% level.

Table 1. 22 Specific items: investments

Dep. Variables	Purchases of buildings, technical works, and supplies of fixed assets	Projects	Studies, research, experimental work, and specific costs	Fixed investment titles (business holdings)
	(1)	(2)	(3)	(4)
Amalgamation	**-0.561***	-0.121	**-0.343***	0.700
	(0.192)	(0.142)	**(0.204)**	(0.447)
Observations	2,595	2,598	2,616	1,389
R-squared	0.626	0.815	0.631	0.585
Transfers	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Region * year FE	Yes	Yes	Yes	Yes

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

It is also worth noting that results do not change if I trim the sample at 5% (see Panel B of Table 1. 23) and 1% of the observations (see Panel A of Table 1. 23).

Table 1. 23 Specific items of investments (trimming 5% and 1%)

	Panel A. Specific items: Investments trimming 1%			
Dep. Variables	Purchases of buildings, technical works, and supplies of fixed assets	Projects	Studies, research, experimental work, and specific costs	Fixed investment titles (business holdings)
	(1)	(2)	(3)	(4)
Amalgamation	**-0.485***	-0.094	**-0.384**	0.367
	(0.150)	(0.106)	**(0.158)**	(0.363)
Observations	3,431	3,433	3,373	1,635
R-squared	0.625	0.832	0.650	0.614
Controls	Yes	Yes	Yes	Yes
Transfers	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Region * year FE	Yes	Yes	Yes	Yes
	Panel B. Specific items: Investments trimming 5%			
Dep. Variables	Purchases of buildings, technical works, and supplies of fixed assets	Projects	Studies, research, experimental work, and specific costs	Fixed investment titles (business holdings)
	(1)	(2)	(3)	(4)
Amalgamation	**-0.504***	-0.111	**-0.335**	0.241
	(0.129)	(0.084)	**(0.144)**	(0.345)
Observations	3,431	3,433	3,375	1,637
R-squared	0.619	0.741	0.645	0.614
Controls	Yes	Yes	Yes	Yes
Transfers	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Region * year FE	Yes	Yes	Yes	Yes

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

1.6.3 Revenues

I continue the analysis investigating more in depth the specific items of total revenues. It is interesting to note here that the two main income sources at municipal level, namely regular and extraordinary revenues, account for almost 68% of the total revenues. Table 1. 24 presents the outcome of the baseline models for all the specific item of the total revenues. I can observe a significant increase in the regular revenues, albeit slight, and a significant decrease in the cash balance.

However, while for the regular revenues the placebo test indicates that the finding is robust, this does not apply for the cash balance. More specifically, the γ coefficients turns out to be significantly different from zero in the specification that uses cash balance as the dependent variable (Table 1. 25, cols. 16, 17 and 18).

This finding would suggest that even before the true year of the merging process, future treated municipalities had already a different path of cash balance, thus casting doubt on the validity of previous results.

Table 1. 24 Specific items of total revenues

Dep. Variables	Regular revenues	Extraordinary revenues	Income from past financial years	Receivables from loans and receivables from previous financial years	Receipts in favour of the State and third parties, and refunds	Cash balance
	(1)	(2)	(3)	(4)	(5)	(6)
Amalgamation	**0.066****	0.050	-0.122	-0.235	-0.166	**-0.307*****
	(0.032)	(0.071)	(0.133)	(0.143)	(0.215)	**(0.117)**
Observations	4,142	4,140	3,593	4,080	3,957	3,800
R-squared	0.901	0.788	0.662	0.659	0.555	0.738
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

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

Table 1. 25 Placebo Regular and extraordinary revenues, income, receivables from loans and receivables from previous financial years, receipts in favour of the State, third parties, refunds, and cash balance

Dep. Variables	Regular revenues (cat. 0)			Extraordinary revenues (cat. 1)			Income from past financial years (cat. 2)			Receivables from loans and receivables from previous financial years (cat. 3)			Receipts in favour of the State and third parties, and refunds (cat. 4)			Cash balance (cat. 5)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Amalgamation fake 2007	0.009 (0.027)	---	---	0.016 (0.073)	---	---	-0.139 (0.128)	---	---	-0.052 (0.153)	---	---	**0.506*** (0.173)**	---	---	**0.206** (0.103)**	---	---
Amalgamation fake 2008	---	0.014 (0.020)	---	---	-0.011 (0.057)	---	---	-0.160 (0.129)	---	---	-0.007 (0.168)	---	---	**0.373*** (0.124)**	---	---	**0.204** (0.088)**	---
Amalgamation fake 2009	---	---	0.019 (0.019)	---	---	-0.036 (0.058)	---	---	-0.113 (0.127)	---	---	-0.129 (0.153)	---	---	**0.300** (0.131)**	---	---	**0.211** (0.094)**
Observations	1,555	1,555	1,555	1,552	1,552	1,552	1,405	1,405	1,405	1,519	1,519	1,519	1,381	1,381	1,381	1,538	1,538	1,538
R-squared	0.942	0.942	0.942	0.832	0.832	0.832	0.773	0.773	0.773	0.614	0.614	0.614	0.708	0.706	0.705	0.791	0.791	0.791
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

1.7   Concluding remarks

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

Specifically, I have analysed the Greek experience of municipal amalgamations which took place in 2011, using administrative data on expenditures and revenues at the municipality level from 2005 to 2018. A unique dataset has been assembled for the very first time, by compiling the -not publicly available-annual municipal financial reports derived from diverse sources. I employed a Difference-in- Differences approach combined with matching models and found very weak evidence that current costs are affected by the amalgamation reform.

Conversely, a significant decrease in per capita investment is observed, which however cannot be associated with the amalgamation of municipalities. In particular, I have found a persistent reduction of per capita investment expenditure after the amalgamation; however, I have uncovered that the effect might be driven by the violation of parallel trends. In particular, the test proposed by Rambachan and Roth (2023) suggests that it is very likely that the effect of the reform was essentially zero.

Overall, my findings question the success of the "Kallikratis" amalgamation reform in Greece, which we should keep in mind that took place amid the Greek sovereign debt crisis. The implementation of the reform amid economic instability raises crucial questions about the timing and context of such policy interventions. While the amalgamation of Greek municipalities may have been aimed at reducing costs and improving efficiency, it did not deliver the anticipated

benefits as revealed by our study. This indicates that the economic pressure of the 2009 crisis may have overridden the potential efficiency gains expected from the amalgamation process.

Chapter 2

The rise of universities and city growth in medieval and early modern Europe (700–1800)

Abstract

This study explores the long-term impact of medieval and early modern European universities on urban growth, focusing on the period from 700 to 1800. Universities, being new institutions at the time, played a crucial role in the commercial and industrial revolutions by enhancing legal frameworks and disseminating knowledge. I analyse a rich dataset to assess urbanisation as a proxy for city development, employing a staggered Difference-in-Differences methodology and a modified Poisson model to account for data skewness and potential biases. My findings indicate a significant positive impact of universities on city population between 1200-1500, with less precise positive estimates, thereafter, primarily driven by early university cohorts while the results withstand robustness checks. Methodologically, I address the possibility of violation of the parallel trend assumption , which, when neglected, imply a significant positive impact across all centuries.

2.1   Introduction

Over the past millennium, the urban landscape in Europe has undergone substantial changes, with population settlements experiencing significant growth. Urbanisation was one of the key characteristics of social change during this period. One of the key drivers of urbanisation has been the evolution of human capital, which is closely linked to the presence of higher education institutions such as universities (E. L. Glaeser et al., 1995). As centres of knowledge and innovation, universities have the potential to drive growth and expansion of cities, attracting skilled labour and fostering economic development (Florida, 2005). This study seeks to explore the spatiotemporal effects of human capital evolution, as proxied by the establishment of universities, on the urbanisation of 2,262 European cities from 700 to 1800, using a staggered difference-in-differences (DiD) econometric framework.

The role of human capital in urbanisation and city development has been widely recognized and studied in various contexts (G. S. Becker, 1964; E. L. Glaeser et al., 1995; Lucas, 1988). The impact of universities on regional development and city growth in modern times has also been examined in numerous studies (Drucker & Goldstein, 2007; E. L. Glaeser & Saiz, 2004; Valero & Van Reenen, 2019). These studies also highlight the lasting influence of historical universities. Glaeser et al. (1995) for instance, emphasised the importance of understanding the historical evolution of cities and their relationship with higher education institutions, highlighting the need for a long-term perspective on urbanisation.

European cities have been shaped by diverse historical, cultural, and political factors, which have influenced their growth patterns and the development of their higher education systems. Boschma & Fritsch (2009) noted that the establishment of universities in European cities was often driven by political and economic interests, as well as the desire to foster cultural and intellectual exchange. The presence of universities has, in turn, attracted skilled labour, promoted innovation, and

stimulated economic growth (Florida, 2005; E. L. Glaeser & Saiz, 2004). However, the relationship between universities and urban development is complex, and the factors which have contributed to the growth of European cities over the past millennium are multifaceted and interrelated.

Furthermore, from a historical perspective, the 13th and 14th centuries witnessed a remarkable synergy between the foundation of universities and population growth in European cities. The confluence of economic prosperity, intellectual curiosity, and the promise of social mobility fuelled the rise of universities as powerful magnets, attracting individuals from diverse backgrounds and contributing significantly to the growth and development of urban centres (Bramwell & Wolfe, 2008). Additionally, the 1500-1800 period witnessed a complex interplay between universities and population growth. While their direct impact on population growth may have decreased, universities continued to be crucial centres of learning, shaping intellectual discourse and contributing to the overall cultural and economic development of European cities in various ways (Valero & Van Reenen, 2016). The specific dynamics of this relationship, however, were significantly influenced by the evolving historical and social context. Nevertheless, the 17th century observed a resurgence in the impact of universities on population growth due to the scientific revolution, the increased demand for skilled labour, the changing perceptions of higher education, the increased patronage and funding as well as the international collaboration and exchange (Altbach, 1991).

This study stands out in its innovation and uniqueness in several ways. First and foremost, by adopting a long-term perspective and examining a large sample of European cities over a millennium, my research offers a thorough and historically rich analysis of urbanisation and the impact of human capital. This enables me to capture the complex and evolving interplay between universities and city growth, providing a more holistic understanding of urban development in Europe.

Second, I construct a comprehensive dataset for Europe, combining the population data of Buringh (2021) enriched with information from multiple sources covering the period 700-1800. I use urbanisation as a proxy for city growth. My study incorporates thorough details on university establishment, along with time-invariant characteristics, such as geography (first nature characteristics) and pre-existing infrastructure (second nature characteristics). In the absence of a clear natural experiment similar to the one in Cantoni and Yuchtman (2014), I adopt a staggered Difference-in-Differences (DID) identification strategy. I allow the university effect to vary by cohort (group of universities founded the same time period) and over time (century) by estimating various versions of an appropriately modified Poisson model, given that population data are heavily skewed towards zero. I incorporate city fixed effects to account for the impact of unobservable characteristics, while I also control for differential trends that might be associated with predetermined characteristics such as geographical location and infrastructure. I am careful to estimate models that are robust to possible violations of the parallel trend assumption by: a) allowing for cohort-specific linear time trends; b) including either NUTS1 or NUTS2 linear trends; c) including interactions of predetermined characteristics with century fixed effects. Inference is based on spatially robust standard errors due to spatial error dependence. My methodological approach allows for a robust identification of causal effects, addressing potential endogeneity concerns and accounting for unobservable factors that may influence urban development.

In addition to examining the overall impact of universities on urbanisation, this study also explores potential heterogeneity in the effects of human capital across different European cities and historical periods. As Boschma and Fritsch (2009) and Florida (2005) have noted, the relationship between human capital and urbanisation may be influenced by a range of factors, including the size and characteristics of the city, the type and quality of higher education institutions, and the broader economic, political, and cultural context.

While my study may not have the strong internal validity found in Cantoni and Yuchtman (2014), it nevertheless holds significant external validity due to its expansive, pan-European sample. The application of the staggered DID methodology, along with careful consideration of model specifications and error structures, ensures a robust identification of causal effects, thereby addressing potential endogeneity concerns and accounting for unobservable factors that may affect urban development. The thorough application of counterfactual methods across diverse settings not only mitigates the limitations of my study but also enhances its relevance and applicability across various European contexts.

My findings reveal a consistently positive and substantial ATT of university presence on city population during the period 1200-1500, and positive but not statistically significant afterwards. My results are also consistent with the relevant historical literature. I also assess the robustness of the findings by extending the distance threshold for spatial robust standard errors to 100 km and the results do not vary. Methodologically, I highlight the importance of dealing with violation of parallel trends; when the cohort linear time trends are omitted, a positive and sizable ATT is evident across all centuries, which could lead researchers to incorrect conclusions due to misleading estimates.

The structure of the paper is as follows. Section 2.2 presents the literature review while section 2.3 describes the historical framework; Section 2.4 gives an overview of the data used in this study, while Section 2.5 illustrates the empirical strategy. Section 2.6 present and discuss the results and robustness checks and the channels that rationalise the finding. Finally, Section 2.7 concludes.

2.2   Literature review

The emergence of universities in medieval and early modern Europe marked a significant shift in higher education, introducing a new paradigm characterized by academic freedom, corporate autonomy, and a blend of teaching and scholarship (Maierù & Pryds, 1994; Välimaa, 2019). These

institutions, such as the universities of Paris, Oxford, and Bologna, played a crucial role in the socio-economic and cultural fabric of urban centres, fostering a vibrant intellectual community (Janin, 2009). The influence of universities extended beyond their immediate surroundings, contributing to the economic vitality of their cities and serving as the birthplace of some of the era's most effective minds, laws, and discoveries (Janin, 2009). This transformative impact is still evident today, as higher education institutions continue to evolve and adapt, drawing inspiration from the medieval universities (Byrd, 2001).

Specifically, universities emerged as magnets for scholars, students, and traders, elevating the intellectual and economic stature of their host cities. The University of Bologna, established in 1088, exemplifies this phenomenon, attracting a diverse student body from across Europe and contributing to Bologna's transformation into a bustling urban centre (Hogan & Trotter, 2013). These institutions not only spurred economic growth but also engendered a new socio-economic class of intellectuals and professionals (Hogan & Trotter, 2013; Macfarlane, 2012). This class played pivotal roles in governance, legal administration, and economic ventures, enriching the urban culture with diversity and dynamism (Macfarlane, 2012).

Furthermore, universities were instrumental in the Commercial Revolution, with their establishment aligning with a surge in market activities and economic expansion in medieval Europe. The legal education they provided was central to these developments , reducing trade uncertainties and laying the groundwork for the legal and administrative institutions necessary for trade facilitation during this period (Cantoni & Yuchtman, 2014).

In addition, the role of universities in knowledge dissemination extended their impact beyond economic spheres, contributing to the intellectual climate that fostered the Renaissance and subsequent scientific revolutions. They were pivotal in reviving classical learning and introducing new scientific methodologies, profoundly influencing European thought and society (Eknoyan, 2012). The methodological approaches of these universities and their contemporary investigators,

which were crystallised and formulated by Francis Bacon (1561-1626), opened the gates of the Scientific Revolution that followed in the 17th century, beginning with the description of circulation in 1628 by William Harvey (1564-1657) (Eknoyan, 2012).

Indeed, according to Mokyr (2016), universities were not just centres of learning but pivotal in creating a vibrant intellectual environment that allowed for the critical questioning of established norms and the pursuit of new knowledge. This culture of competitive scholarship, deeply rooted in the Enlightenment ideals of rationality and progress, was instrumental in nurturing the scientific and technological innovations that drove the Industrial Revolution. Mokyr highlights the role of the Republic of Letters, a transnational intellectual community facilitated by academic networks centred around universities, which played a crucial role in the diffusion of scientific and technological knowledge across Europe (Mokyr, 2016).

Moreover, Mokyr underscores the importance of institutions in protecting and promoting intellectual property, a function that medieval and early modern universities fulfilled by providing an infrastructure for intellectual discourse protected from external censorship. This institutional support for intellectual freedom was vital for the incubation of ideas that later proved revolutionary to European economic and social structures. In The Enlightened Economy (2009), Mokyr further explores how Enlightenment thinking, disseminated through universities, fostered a fertile ground for economic development by emphasizing the utility of scientific knowledge and advocating for an economy based on innovation and reason (Mokyr, 2009). Additionally, in The Gifts of Athena (2002), he elaborates on how universities contributed to the "stock of preservable knowledge", facilitating the long-term growth of what has become known as the knowledge economy (Mokyr, 2002). This expansive role of universities in nurturing a culture of growth underscores their foundational impact on the modern economic landscape (Mokyr, 2002, 2009).

On the contrary, the influence of universities on urban development varied across Europe, shaped by the socio-political and economic contexts of different regions. In the fragmented political

landscapes of medieval Germany and Italy, for instance, universities thrived as neutral grounds for intellectual exchange. Conversely, in more centralized monarchies like England and France, universities aligned more closely with royal or papal policies, serving as instruments of the State (Crow et al., 2020; Rasmussen et al., 2020).

This symbiotic relationship between universities and urban centres drove mutual growth, with cities providing a conducive environment for academic pursuits and universities contributing to urban vibrancy and economic activity. The establishment of universities catalysed legal scholarship, particularly in centres like Bologna and Paris, which became instrumental in the revival and dissemination of Roman law. This revival underpinned the legal systems of many European countries and facilitated the development of legal codes and judicial procedures essential for complex urban societies (Cantoni & Yuchtman, 2014).

Universities have also played a crucial role in economic transformation, particularly in the context of globalisation and the knowledge-based economy (Brennan et al., 2004; Hagen, 2002). They have been instrumental in fostering a vibrant urban environment conducive to commercial activity and innovation, and have attracted economic actors, contributing to the emergence of a new urban elite. Furthermore, universities have been key in the development of civil society and social transformation, providing professional training and education necessary for personality development (Sharma, 2015). Their role in economic development is also evident in their contribution to scientific breakthroughs and the advancement of citizens (Mapuranga, 2016).

Besides these, the architectural and spatial development of cities was significantly influenced by universities. The construction of university buildings, libraries, and student quarters contributed to the physical expansion of cities and the development of distinct urban quarters centred around academic institutions. This not only transformed the cityscape but also influenced urban planning and the allocation of resources (Melhuish & Bletter, 2015).

Moreover, universities fostered cultural and intellectual exchange, contributing to the advancements in arts, literature, and science which characterized the Renaissance. The confluence of scholars and students from various backgrounds created an intellectually vibrant environment, furthering cultural efflorescence (Eamon & Paheau, 1984). Moreover, the Renaissance period saw a shift in the dissemination of knowledge, with new institutions such as princely courts and informal academies playing a significant role in the advancement of science and the arts (Eamon & Paheau, 1984). Nevertheless, universities, particularly in Italy, were crucial in this cultural efflorescence, with a focus on law, medicine, philosophy, and the humanities (Grendler, 2004).

The emergence of new humanistic art forms was furthered by academies dedicated to literature, language, opera, ballet, art, and design (McNeely, 2009). Additionally, the Renaissance university served as a training ground for students in the craft of books, with a shift towards the production and use of books in print (Oosterhoff, 2019).

Furthermore, the historical impact of universities on modern outcomes is evident, with studies highlighting their causal effect on economic activity and regional development. The establishment of universities has been linked to significant urban expansion, marked by the rise of fairs, increased book production, and population growth, reflecting the growing role of education (Bairoch et al., 1988; Buringh & van Zanden, 2009; Cantoni & Yuchtman, 2014; Drucker & Goldstein, 2007; Huggins et al., 2008; Prazeres et al., 2017).

This expansion underscores the interconnection between human capital and development, further evidenced by the role of liberal arts education in cultivating essential skills for business and trade, such as mathematics, rhetoric, and logic (Goddard & Kempton, 2016). The enhancement of legal institutions through university education also played a transformative role in the urbanisation processes and the formation of human capital, making education more accessible and enabling a larger portion of the population to acquire advanced training (Addie, 2017; Fallah et al., 2014; Goddard et al., 2014).

The work of Bosker et al. (2013) further identifies the dominant role of geography, political institutions, and religious interactions in urban development across Europe and the Islamic world from 800 to 1800, noting the European advantage in long-distance trade facilitated by technological innovations in ship design and navigation, and the dominance of capital cities post-1600.

The impact of universities in still evident in the modern world. For instance, the evolution of Italian cities between 1950 and 2000 provides a case study in the significance of geography in explaining spatial population distribution and migration patterns, illustrating the impact of universities in these dynamics (Accetturo & Mocetti, 2019). Amendola et al. (2020) reveal a positive correlation between university degree production and the economic development of regions, highlighting the beneficial effects of human capital on local economies.

At a global scale, Valero and Van Reenen (2019) offer a macroscopic view of the relationship between the proliferation of universities and economic indicators for the period between 1950 and 2010, demonstrating that a 10% increase in the number of universities corresponds to a 0.4% higher future GDP per capita Their research suggests that the benefits of universities spill over to neighbouring regions and contribute to the promotion of democracy.

While the existing literature provides insights into the influence of universities, it is important to acknowledge that our understanding of their broader impact remains somewhat limited. Much of the evidence, though detailed and informative, often relies on anecdotal evidence or case studies that, while valuable, do not always allow for generalisable conclusions. This underscores the necessity of a cautious approach when extrapolating these findings to understand the full scope of universities' effect to societal and economic development. In fact, there is a clear need for more systematic and empirical research to verify and expand upon the historical narratives and to quantify the enduring effects of these educational institutions with greater precision. This gap in empirical understanding actually highlights the added value of my current study. By employing a

systematic empirical approach on a pan-European sample to examine the impacts of universities on urban growth, this research aims to provide more definitive conclusions that extend beyond the anecdotal evidence traditionally cited in historical analyses.

2.3   Historical framework

The medieval city was a bustling mosaic composed of threads of economic activity, political organization, and religious faith (Braudel, 1982). Surrounding the city centre, the "periphery" pulsed with life, acting as a vital source of resources and manpower for the thriving urban centre (Verger, 1992). It was from this periphery that individuals, often driven by the allure of improved living conditions and opportunities, migrated towards the burgeoning urban centres (Chartier, 1989). Fuelled by this influx, cities grew in size and complexity, fostering a unique environment where economic exchange, political power, and cultural exchange converged.

Within this evolving urban landscape, the establishment of universities marked a pivotal moment. These institutions functioned as more than just centres of learning; they served as "institutional instruments", fulfilling diverse societal functions (Clark, 1986). Universities fostered the advancement of knowledge, played a vital role in training elites, and helped maintain the existing social order. Their magnetic pull, attracting students from various regions, contributed significantly to population growth within the cities and served as a catalyst for economic activity (Ben-David, 1977). This interrelationship, with universities both shaping and being shaped by the evolving urban landscape, deserves closer examination.

2.3.1   A Flourishing Symbiosis: Universities as Intellectual Magnets

The 13th and 14th centuries witnessed an exceptional surge in the establishment of universities across Europe. This phenomenon can be attributed to several interconnected factors. The flourishing of trade routes spurred economic growth, creating a fertile ground for intellectual pursuits and fostering the rise of the merchant class (Verger, 1992). As new social groups gained

prominence, the demand for higher education, particularly in fields like law, medicine, and theology, flourished. Additionally, the intellectual landscape blossomed, witnessing significant advancements in philosophy and science. This confluence of economic prosperity, social change, and intellectual curiosity fuelled the growth of universities in cities like Bologna, Paris , and Oxford, attracting students from all corners of Europe.

These universities not only contributed to an intellectual renaissance within the city walls but also played a crucial role in driving population growth. The influx of students, often accompanied by their families and support staff, led to a rise in demand for housing, food, and various services. This stimulated the local economy and created new employment opportunities, further attracting individuals from the surrounding regions. Additionally, the presence of a diverse and intellectually vibrant population fostered cultural exchange and innovation, enriching the overall fabric of the city (Verger, 1992).

Furthermore, this period witnessed a rise in social mobility, as universities offered individuals, particularly those from aspiring social classes, the opportunity to elevate their social standing through education (Clark, 1986). The prospect of upward mobility through academic achievement served as a powerful motivator, drawing individuals from diverse backgrounds to university cities. These young scholars, fuelled by ambition and a thirst for knowledge, contributed to the intellectual and cultural dynamism of the cities.

However, it is crucial to acknowledge that the impact of universities on population growth during this period was not solely driven by student migration, but also attracted scholars, theologians, and renowned intellectuals to the cities (Bramwell & Wolfe, 2008; Glasson, 2003; Lazzeroni & Piccaluga, 2015; Williams et al., 2008). These individuals, drawn by the opportunity to engage in intellectual discourse and contribute to the advancement of knowledge, further enriched the cultural and intellectual life of university cities, contributing indirectly to population growth by

enhancing the city's attractiveness as a centre of learning and innovation (Lazzeroni & Piccaluga, 2015).

2.3.2   Shifting Dynamics and Evolving Influences

The period from 1500 to 1800 witnessed a shift in the relationship between universities and population growth in European cities. While universities continued to exert a positive influence, their impact on population growth became less significant compared to previous centuries (Kwiek, 2006). Several factors contributed to this transformation such as the homogenization of religion, the rise of nation-States, the printing press and the democratization of knowledge, the diversification of educational institutions and the evolving economic landscape (Kwiek, 2006). The role of universities in society has been redefined, with a focus on their contribution to economic growth and competitiveness (Kwiek, 2006). The European university's global reach has increased, leading to a questioning of its relationship with modernity (P. Scott, 1998). Market forces played a significant role in shaping the distribution of scholars and the rise of universities during this period (De La Croix et al., 2023). The higher education system in Europe has seen a convergence towards a more uniform model, influenced by internationalization and globalization (Teichler, 1998).

The earlier centuries observed a diverse religious landscape in Europe, with universities catering to different religious groups and denominations. However, the rise of the Reformation and subsequent religious conflicts led to the homogenization of religion within specific regions. This reduced the need for diverse universities serving specific religious communities, impacting their appeal to students from other regions (Anderson, 1983).

The emergence of nation-states during this period, on the other hand, led to the implementation of various policies aimed at strengthening national identity and controlling social mobility (Anderson, 1983). These policies often limited the movement of students and scholars across national borders, reducing the international appeal of universities and consequently impacting their

contribution to population growth. (Anderson, 1983). This, in turn led to the rise of the number of universities within the new national borders to cater for the higher national demand for advanced education.

Furthermore, the invention of the printing press in the 15th century marked a significant shift in the dissemination of knowledge. Previously, universities held a monopoly on access to knowledge due to their control over the production and circulation of texts. However, the printing press facilitated the wider circulation of knowledge beyond the confines of universities (Eisenstein, 1979). While this development democratized access to information, it also reduced the exclusive appeal of universities as the sole source of higher learning, potentially limiting their influence on large-scale migration patterns.

This period also witnessed the emergence and expansion of other educational institutions, such as academies and colleges, offering specialized knowledge and training in specific fields. This diversification of educational options provided students with more choices beyond traditional universities, potentially reducing the pull factor of university cities for individuals seeking particular types of education (Verger, 1992). The economic landscape also underwent significant changes during this period. While trade continued to play a vital role, new industries emerged, often located outside university cities. This shift in economic focus may have drawn individuals towards these new industrial centres, potentially affecting the population growth solely attributed to universities (Verger, 1992).

However, it is essential to avoid an oversimplified interpretation of this shift. While the impact of universities on population growth may have become less significant in the 16th to 18th centuries compared to the earlier period, it is crucial to acknowledge several subtleties.

Firstly, universities continued to attract students from diverse backgrounds, albeit from more geographically limited areas due to the above-mentioned factors . This can be observed in the

changing demographics of student populations documented by Jacques Verger (1992) in his chapter, "Patterns," within "A History of the University in Europe: Vol 1. Universities in the Middle Ages" (pp. 35-76). Verger details how various historical forces, including the Reformation and the rise of nation-states, influenced student migration patterns towards regional universities. Despite this, universities continued to serve as centres of intellectual exchange, attracting individuals from various social and religious groups within their geographical reach (Verger, 1992).

Secondly, the presence of established universities remained a source of prestige and intellectual vibrancy for the cities, contributing to their overall appeal even if not directly leading to large-scale population growth. This enduring appeal is evident in historical accounts of urban planning strategies, where cities actively sought to leverage the presence of universities to attract talent and investments. For instance, Edward Glaeser, in his work, Triumph of the City (2011) (pp. 221-222), discusses how cities like Heidelberg and Uppsala strategically positioned themselves as centres of learning to attract scholars and students, fostering cultural and economic development. Additionally, the cultural and intellectual offerings associated with universities continued to enrich the urban environment, making these cities attractive destinations for individuals beyond just those seeking higher education.

Finally, the focus shifted from sheer population growth to the quality of the student population. Universities began attracting individuals with specific talents and capabilities, fostering advancements in specific fields of knowledge, and enriching the intellectual capital of the cities This shift towards a focus on quality aligns with the changing needs of the time, as the rise of nation-states and the scientific revolution created a demand for specialized skills and expertise (Anderson, 1983; Jardine, 2000). By attracting and nurturing talented individuals, universities played a crucial role in driving innovation and economic development in their respective cities.

These variations highlight the complex relationship between universities and population growth in European cities during the 1500-1800 period. While their direct impact on population growth

may have diminished, their influence on the social, cultural, and intellectual landscape of these urban centres remained significant, shaping their long-term development and character.

2.3.3 Resurgence and the New Intellectual Landscape

Nevertheless, the 17th century observed a resurgence in the impact of the oldest and well-established universities on population growth. This can be attributed to several key factors such as the scientific revolution, the increased demand for skilled labour, the changing perceptions of higher education, the increased patronage and funding as well as the international collaboration and exchange (Abramo et al., 2011; Leydesdorff & Sun, 2009; Wright & Horta, 2018).

The scientific revolution, with its emphasis on experimentation and empirical evidence, ushered in a new era of scientific exploration and technological advancement (Jardine, 2000). This paradigm shift created a demand for specialized knowledge and skilled workers in various scientific fields. In response to this demand, new universities and academies dedicated to these burgeoning disciplines were established, such as the Royal Society in London (1660) and the French Academy of Sciences (1666) (Verger, 1992). The rapid progress in scientific fields and technological advancements created a growing demand for skilled workers, such as scientists, engineers, and technicians. Universities equipped individuals with the necessary knowledge and skills to fill these new roles, making them attractive destinations for individuals seeking upward mobility and career opportunities (Verger, 1992).

The influence of the Scientific Revolution also led to a shifting perception of higher education. While universities previously focused primarily on theological and legal studies, the 17th century witnessed a growing emphasis on the practical applications of knowledge and the importance of scientific inquiry (D. C. Lindberg & Numbers, 1983; Shapin, 1996). This shift made universities more relevant to a broader range of individuals, attracting not only those seeking traditional professions but also those with an interest in scientific advancement and technological progress.

Moreover, the growing awareness of the economic and societal benefits of scientific advancements led to increased patronage and funding for universities from governments and private individuals (Verger, 1992). This financial support allowed universities to expand their facilities, hire renowned scholars, and offer specialized programs in various scientific fields, further enhancing their appeal and attracting a wider pool of students (Bender, 1988).

The scientific revolution fostered a spirit of international collaboration and exchange. Universities across Europe established connections and facilitated the exchange of ideas and knowledge between scholars. This international dimension made these institutions even more attractive, drawing students from various countries seeking to learn from the latest discoveries and advancements in specific scientific fields.

It is crucial to acknowledge that the resurgence of universities' impact on population growth during the 17th century was not solely driven by the Scientific Revolution. The factors mentioned above - such as the demand for skilled labour, changing perceptions of higher education, and increased funding - all played a part in this phenomenon (Verger, 1992). Additionally, the rise of universities specializing in scientific disciplines did not diminish the importance of established universities with traditional curricula. These institutions continued to attract students interested in other fields of study, contributing to the overall population growth in university cities (Verger, 1992).

2.4   Data

For this study, I constructed a comprehensive dataset for Europe by combining the population data provided by Buringh (2021) with additional information from multiple sources spanning the period 700-1800. Specifically, Buringh (2021) dataset includes information for the population of 2,262 cities in Europe along with the longitude and latitude, elevation and water catchment area. Buringh's data offer an in-depth view of demographic shifts over an extensive timeframe, which allows for longitudinal analysis of population dynamics. For the purposes of this study, I focus on

human settlement in Europe, spanning from 700 to 1800, which had a population of more than 1,000 inhabitants at any given time.

Map 2. 1 European cities from 700 to 1800
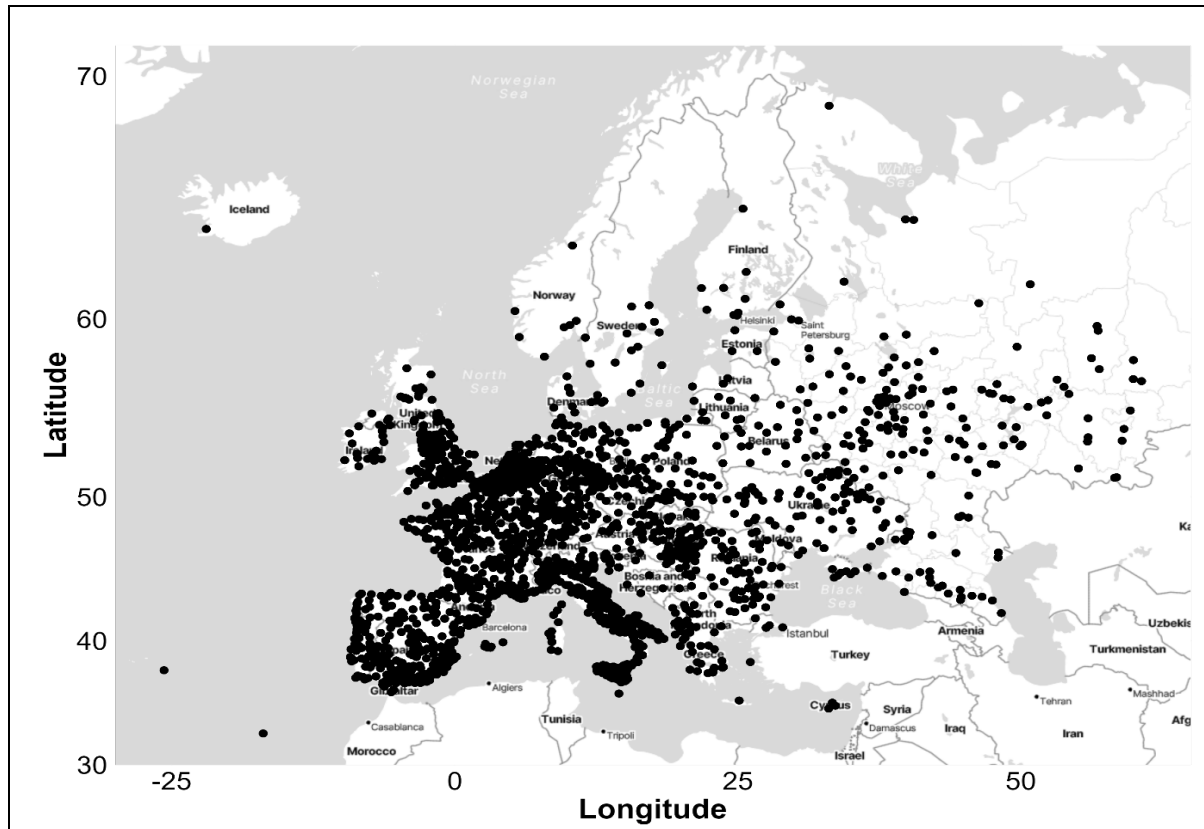
To better understand the influence of academic institutions on urban development, I collected data that capture the establishment and evolution of universities across European cities., including the presence of a university within a city, its founding year, and any periods of suspension, providing insight into the historical role of universities in urban growth and intellectual advancement. The inclusion of university-related variables is primarily based on the comprehensive historical accounts provided by de Ridder-Symoens (1992) in "A History of the University in Europe: Volume 1, Universities in the Middle Ages" and, "Universities in Early Modern Europe (1500-1800)" edited by Rüegg & de Ridder-Symoens (1996). These works offer a detailed chronology and analysis of the development of universities during the medieval and early modern periods. Figure 2. 1 presents the number of universities existing in each century

throughout the study period. For clarity, each century label corresponds to the entirety of that century (i.e., 700 refers to 700-799 etc.)

Figure 2. 1 Cumulative number of universities over time
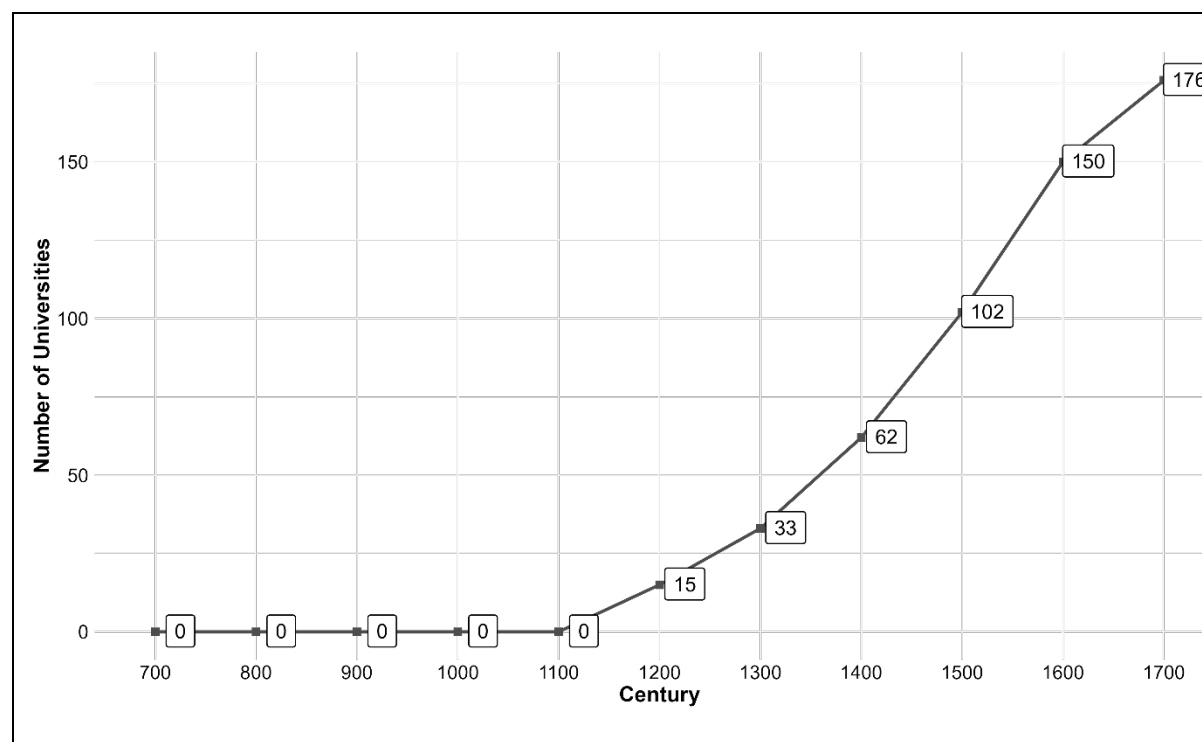
Finally, in this analysis, the first three universities established in Europe—namely in Bologna, Paris, and Oxford—are excluded due to their unique historical roles and significant influence that set them apart from later institutions. These universities, being pioneers in higher education, not only predate the standardised model of university education that followed but also had a broader, more profound impact on European intellectual life and societal structures(de Ridder-Symoens, 1992; Verger, 1992). Their exclusion from the dataset allows for a more focused examination of the broader pattern of university influence on urban development, without the disproportionate weight these foundational institutions might otherwise impart to the analysis. This approach ensures that the study captures the effects of universities on cities in a manner that is representative of the more general expansion of higher education across Europe from the late medieval period onwards. Map 2. 2 showcases the precise geographical locations of the cities included in this study, alongside the specific sites of the universities.

Map 2. 2 Geographical Distribution of European Cities and Universities (1200-1800)
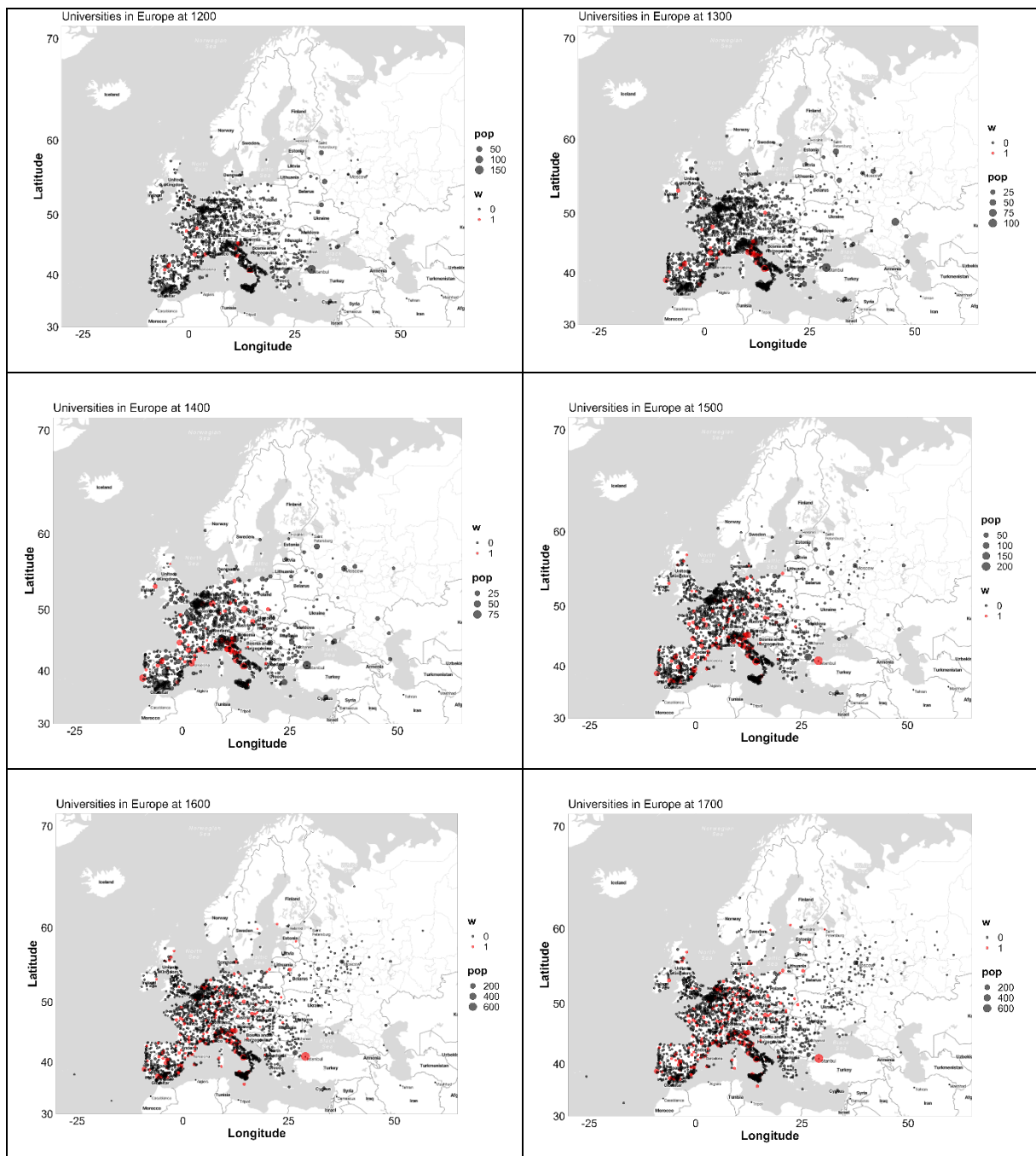
To further enrich the analysis, I have created several variables using geographical information system (GIS) shapefiles, leveraging the GIS technology to overlay historical city maps onto contemporary geographical representations. Through this process, I created several variables to represent proximity to the Atlantic Ocean to assess the impact of transatlantic trade routes; coastal and river proximity to capture the economic and strategic advantages of coastal access for cities and understand the economic benefits of navigable waters, as well as to reflect the importance of

river transport and water resources for urban centres; distance to Mainz, a key historical centre renowned for its early adoption of the printing press, thereby assessing its potential radiating effect on the diffusion of printed materials and ideas in nearby areas; distance to Wittenberg, famously associated with Martin Luther and the genesis of the Reformation, to evaluate its impact on the spread of Reformation ideas and the development of educational institutions in the vicinity; and the proximity to Roman roads, thermal baths, bridges, and castles to explore the historical infrastructure's role in urban development.

The construction of these variables was manually validated, ensuring that the variables are not only contextually relevant but also robust in capturing the essence of urban expansion and educational influence on socio-economic development. The resulting dataset, a synthesis of Buringh's (2021) population data and the newly created variables from shapefiles, forms the informational foundation upon which this research is based.

Ensuring the integrity of the data has been essential throughout the processing stages. The shapefiles, sourced from the Menestrel database[8] and Harvard Dataverse[9], contain precise location data for the sites of interest. Utilizing these exact locations, I calculated the minimum distance from each city to the nearest site of interest. In subsequent analyses, these variables will be instrumental in dissecting the relationship between the presence of universities and urban growth, with a particular focus on the role that these educational institutions have played in shaping the demographic and economic landscapes of European cities from the medieval period to the onset of the modern era. This investigation is aimed at untangling the complex web of factors that

---

[8]   https://www.menestrel.fr/?-Ressources-&lang=en

[9]   DARMC Scholarly Data Series Citation: McCormick, M. et al. 2013. "Roman Road Network (version 2008)," DARMC Scholarly Data Series, Data Contribution Series #2013-5. DARMC, Center for Geographic Analysis, Harvard University, Cambridge MA 02138.

contributed to the historical development patterns and their enduring impact on contemporary urban structures and economic conditions.

Table 2. 1 presents a chronological distribution of universities across Europe, from 8th to 18th century, highlighting the gradual increase in the number of universities from the 12th century onwards. It is important to clarify here that for a city to be considered as having an established university within a specific century, the university must have been operational for a minimum of 50 years within that century. Otherwise, it will be classified under the subsequent century. For example, University of Cambridge was established in 1209 so was operational for more than 50 years within the 13th century (1200-1299). Thus, it is included in the 13th century cohort. In contrast, University of Vienna was established in 1365, operated less than 50 years in the 14th century and hence, it is classified to the next cohort i.e., 15th century (1400-1499).

Table 2. 1 Chronological distribution of universities across Europe

Century	No of cities without a university	No of cities with university (new)	Total
700-799	2,262	0	2262
800-899	2,262	0	2262
900-999	2,262	0	2262
1000-1099	2,262	0	2262
1100-1199	2,262	0	2262
1200-1299	2,247	15 (15)	2262
1300-1399	2,229	33 (18)	2262
1400-1499	2,200	62 (29)	2262
1500-1599	2,160	102 (40)	2262
1600-1699	2,112	150 (48)	2262
1700-1799	2,086	176 (26)	2262

Table 2. 2, It is evident that the cities with a university exhibit a significantly higher average population size with a greater standard deviation, suggesting more variability compared to the overall dataset. The distances to various geographical features are generally shorter on average,

which indicates that cities in which universities where established are more likely to be located in geographically advantageous areas. The skewness and kurtosis values are generally lower than in the overall city dataset, indicating a less extreme distribution in these measurements.

Table 2. 3 and Table 2. 4 provide descriptive statistics for all the variables included in the analysis, namely distance to the Atlantic, coast, rivers, and historical sites such as Mainz, Wittenberg, Roman Roads, thermae (thermal baths), bridges, and castles, for different groups of cities, distinguished by the presence or absence of a university.

Table 2. 2 Descriptive statistics

Variables	Obs	Mean	Std.Dev.	Min	Max	p1	p99	Skew.	Kurt.
pop	24882	3.08	11.51	0.00	700.00	0.00	30.00	31.27	1511.83
Distance from:									
Atlantic	24882	671.53	690.37	0.00	7979.26	0.20	2715.60	1.47	8.62
coast	24882	172.55	208.55	0.00	1244.61	0.10	936.04	1.76	6.47
river	24882	48.79	126.14	0.00	4912.95	0.13	212.31	27.52	998.45
Mainz	24882	1037.40	669.25	0.00	8210.30	79.45	3064.00	1.35	9.18
Wittenberg	24882	1128.82	617.43	0.00	7855.70	97.22	2813.89	1.08	8.99
roman roads	24882	260.40	483.92	0.03	7916.80	0.41	2172.04	3.98	35.84
thermae	24882	250.22	424.49	0.02	6886.39	0.68	1826.39	3.88	34.02
bridges	24882	303.32	464.47	0.08	5123.12	1.16	2028.15	2.73	12.93
castles	24882	922.83	715.47	0.57	8351.31	28.07	3128.15	1.55	9.032

It is evident that the cities with a university exhibit a significantly higher average population size with a greater standard deviation, suggesting more variability compared to the overall dataset. The distances to various geographical features are generally shorter on average, which indicates that cities in which universities where established are more likely to be located in geographically advantageous areas. The skewness and kurtosis values are generally lower than in the overall city dataset, indicating a less extreme distribution in these measurements.

Table 2. 3 Descriptive statistics for cities with a university (treated)

Variables	Obs	Mean	Std.Dev.	Min	Max	p1	p99	Skew.	Kurt.
pop	1936	10.93	31.44	0.00	700.00	0.00	125.00	12.78	240.93
Distance from:									
Atlantic	1936	455.89	389.53	0.34	1853.61	0.49	1586.53	1.01	3.57
coast	1936	150.08	153.61	0.09	636.05	0.12	625.34	0.99	3.15
river	1936	46.55	107.99	0.02	1294.60	0.03	415.09	9.17	102.70
Mainz	1936	1025.10	667.31	0.00	8210.23	71.92	2869.90	1.45	9.95
Wittenberg	1936	1108.67	610.61	0.00	7855.67	74.94	2573.72	1.16	10.34
roman roads	1936	145.54	230.21	0.05	1358.41	0.16	1334.99	3.06	13.92
thermae	1936	160.14	246.92	0.26	1546.35	0.36	1378.83	3.51	16.53
bridges	1936	167.56	261.54	0.08	1616.07	0.20	1397.55	3.20	14.37
castles	1936	673.07	447.75	0.72	2831.73	2.07	1933.44	1.06	5.13

Table 2. 4 detailing cities without a university (never treated), shows these tend to have smaller populations on average compared to cities with universities, as evidenced by both a lower mean and a lower maximum value. The distance metrics are similar to those observed in the overall city dataset but show slightly more extremity in the distribution tails (skewness and kurtosis), which suggests a greater range of isolation among these cities.

Table 2. 4 Descriptive statistics for cities without a university (never treated)

Variables	Obs	Mean	Std.Dev.	Min	Max	p1	p99	Skew.	Kurt.
pop	22946	2.41	7.40	0.00	575.00	0.00	20.00	40.38	2641.43
Distance from:									
Atlantic	22946	689.73	706.95	0.00	7979.26	0.15	2726.41	1.42	8.33
coast	22946	174.45	212.43	0.00	1244.61	0.08	955.54	1.76	6.40
river	22946	48.98	127.55	0.00	4912.95	0.16	210.65	28.40	1030.92
Mainz	22946	1038.44	669.42	0.00	8210.23	89.80	3085.57	1.34	9.19
Wittenberg	22946	1130.52	618.00	0.00	7855.70	98.04	2830.92	1.07	8.89
roman roads	22946	270.09	498.26	0.03	7916.80	0.41	2279.79	3.89	34.24
thermae	22946	257.82	435.33	0.02	6886.40	0.80	1827.36	3.81	32.97
bridges	22946	314.77	475.90	0.15	5123.12	1.45	2112.68	2.66	12.40
castles	22946	943.90	729.71	0.57	8351.31	31.78	3164.14	1.51	8.81

2.5 Empirical strategy

One of the challenges in analysing the impact of universities on urbanisation is the potential endogeneity of university establishment decisions. As Glaeser and Saiz (2004) argued, universities may be more likely to be established in cities that are already experiencing rapid growth, which could bias the estimated effects of universities on urbanisation. To address this issue, my study employs a two-way fixed effects strategy, following Wooldridge (2021), which allows us to control for time-invariant city-specific factors and potential common shocks that could be correlated with both the establishment of universities and urban growth.

In the absence of a natural experiment, as in Cantoni and Yuchtman (2014), I employ a staggered DiD econometric framework, which allows for the identification of causal effects by exploiting the variation in the establishment of universities over time and across European cities. This approach builds on previous research that has utilised similar methodologies to examine the relationship between human capital and city growth, such as the studies by Acemoglu et al. (2001); Bosker et al. (2013) and Moretti (2004). The use of a staggered DiD framework enables me to capture the dynamic relationship between universities and urbanisation, accounting for the fact that the establishment of universities may have had different effects on cities depending on the specific historical and geographical context. Importantly, this method addresses the potential biases that can arise with conventional two-way fixed effects models in the presence of staggered treatment. Specifically, the standard fixed effect model could produce a weighted average of treatment effects that includes possible negative weights, leading to biased results. This occurs because the conventional model may incorrectly attribute changes in the dependent variable to periods before the actual treatment, especially when the timing of the treatment varies across entities.

Moreover, the skewed nature of the data, characterised by a large number of cities with small populations[10] (below a thousand inhabitants) and a few cities with very large populations, made the use of linear regression models inappropriate for my study. To accommodate the overdispersion and non-negative count nature of the population data, a Poisson regression model was utilized.

Following the adoption of a Poisson regression model to address the skewed distribution of population data, another significant econometric challenge encountered was the violation of the parallel trends assumption, which is fundamental to the validity of the Difference-in-Differences (DiD) approach. This assumption posits that in the absence of treatment, the treated and untreated groups would have followed parallel paths over time. The presence of diverging pre-treatment trends between treated and untreated cities could bias the estimated treatment effects of university establishments on urbanisation.

To rectify this issue and ensure the robustness of the findings, I have incorporated heterogeneous linear time trends into the model. According to Wooldridge (2021) the inclusion of cohort specific linear time trend is a relatively simple way to address possible violations of the common trend assumption. This adjustment accounts for unobserved, cohort-specific factors that might influence urban growth independently of the establishment of universities. This methodological refinement mitigates potential biases arising from pre-existing differential trends among cities, thereby enhancing the credibility of the causal inferences drawn from the staggered DiD analysis.

Amidst various estimators designed to address staggered treatment timing and treatment effect heterogeneity, such as those by Borusyak et al., (2024); Callaway & Sant'Anna (2021); de Chaisemartin & D'Haultfoeuille (2023); Gardner (2022); Goodman-Bacon (2021) and Sun &

---

[10] The population figures sourced from Buringh (2021) are presented in units of thousands. Consequently, population values less than 1,000 are recorded as zero thousand in the dataset.

Abraham (2021) among others[11], I adopted the methodological framework proposed by Wooldridge (2021). In fact, despite the diversity of available estimators, I have chosen to employ the methodological framework of Wooldridge (2021; 2023) due to its compatibility with a Poisson regression model for addressing the skewed distribution of my population data. Furthermore, this framework allows for the inclusion of heterogeneous linear time trends, effectively addressing potential violations of the parallel trends' assumption. While alternative estimators offer valuable insights and methodologies for handling staggered treatment effects, Wooldridge's (2021) approach provides a tailored solution that effectively addresses the unique combination of analytical challenges presented by this study.

In addition, the analysis had to account for spatial dependence, a common feature in geographic data where observations in close proximity tend to exhibit similar characteristics. Ignoring this spatial autocorrelation could lead to biased and inefficient estimates due to the violation of the independence assumption of classical regression models. To address this issue, spatial robust standard errors were introduced to correct for potential spatial autocorrelation in the residuals following Bertanha and Moser (2016). The baseline correction employed a distance of 50 km, under the assumption that cities within this radius could influence each other's urbanisation processes due to geographical, economic, or historical linkages.

Digging into the methodological framework, Wooldridge (2021) proposes that the effect should vary by cohort and time period, meaning that it can differ across groups that receive the treatment at different times (cohorts) and also across various points in time (time periods). This specification allows for the disaggregation of the intervention's effects, facilitating a granular understanding of its impact over time and across different cohorts (or group) effects. This methodology enables a

---

[11] For a detailed list of available estimators see Roth et al. (2023).

detailed analysis of how the intervention's effects might evolve over time and differ across cohorts that experience the intervention at different stages. Essentially, it allows the estimated effects to reflect the temporal dynamics and heterogeneous responses of the cohorts to the intervention, acknowledging that the impact of an intervention is not static but can vary significantly depending on the timing and duration of exposure.

To operationalize my empirical strategy, and account for the potential endogeneity of university establishments, I incorporate the two-way fixed effects model as proposed by Wooldridge (2021), which can be represented as:

$$E(y_{it}|d_i f_i) = exp(\eta + \sum_{q=700}^{1700} \lambda_q w_{iq} d_{iq} f_{iq} + \sum_{r=700}^{1700} \omega_r f_{ir} + \sum_{s=700}^{1700} \omega_s f_{is} X_{is} + \sum_{u=700}^{1700} \theta_u d_{iu} t_t + \mu_c) \quad (2.1)$$

where, $E(y_{it}|d_i f_i)$ is the expected value of the outcome y for city i at time t, conditioned on cohorts d and century dummies f, η is a constant term, d_{iq} is a binary variable for different cohorts, f_i represents century time dummies, w_{iq} denotes the treatment dummy, X_{it} is set of all demeaned time invariant covariates, t_t indicates the heterogenous linear time trends, $\lambda_q, \tau_r, \omega_s, \theta_u$ are the coefficients to be estimated and μ_c captures city-specific fixed effects, accounting for unobserved heterogeneity that may influence the outcome y across cities.

Moreover, I specifically address the violation of the parallel trend assumption, which is foundational to the validity of the Difference-in-Differences (DiD) estimation technique. The parallel trend assumption requires that, in the absence of treatment, the unobserved differences between treated and control groups would evolve similarly over time. Any violation of this assumption can introduce bias into the estimates of the Average Treatment effect on the Treated (ATT). In addition, I interacted century dummies with predetermined characteristics, so as to capture long-term variations and the impact of historical context that might influence the development trajectories of these regions. These characteristics include the proximity to the

Atlantic Ocean; coastal and river proximity; distance to Mainz; distance to Wittenberg and the proximity to Roman roads, thermal baths, bridges, and castles.

In addition, I have interacted century dummies with predetermined characteristics to capture long-term variations and the enduring impact of historical context on cities growth. These characteristics, which include proximity to the Atlantic Ocean, coastal and river locations, distance to historically significant cities like Mainz and Wittenberg, and proximity to Roman roads, thermal baths, bridges, and castles, carry historical significance and presumed influence on regional economic and social dynamics over the centuries.

To ensure the robustness of my model and to avoid potential biases that could arise from endogenous time-varying controls, I have deliberately excluded such variables from the analysis. Time-varying controls could potentially be influenced by both the treatment and the outcome, thereby violating the key assumption of exogeneity required for causal inference. Including such controls could lead to a "bad controls problem", where the introduction of endogenous variables into the regression model distorts the estimated effect of the treatment.

In addition, to enhance the credibility of the parallel trend assumption but also account for unobservable region-specific characteristics that could influence urban growth, I incorporate interactions between NUTS 2 (Nomenclature of Territorial Units for Statistics) regions and linear time trends. Such characteristics might stem from economic, social, or historical factors inherent to each region. This approach serves as a pragmatic solution to the lack of direct historical data, using present-day administrative boundaries as proxies for past geopolitical entities such as kingdoms and provinces. This method is grounded in the observation that many of today's administrative borders, such as the Region of Liguria in Italy, closely mirror the territorial extents of historical entities like the Republic of Genoa. By leveraging the current administrative structure to approximate the geographical and political landscapes of earlier centuries, the model aims to capture the enduring influence of regional characteristics on city development over time.

Finally, ϵ_{it}, is the error term, clustered at the city level. It is important to note at the outset that in this estimating framework, the coefficients λ represent my DiD estimates of the effect of the establishment of a university on the respective city's population.

To further refine the analysis of universities' impact on urban development, I employ a threshold criterion for including a university within a specific century. A university must have been operational for a minimum of 50 years within a century to be counted within that timeframe; otherwise, it is allocated to the subsequent century. This approach ensures that only institutions with a significant and enduring presence contribute to the analysis of that period, thereby enhancing the accuracy of assessing the universities' long-term effects on cities.

Recognizing the importance of assessing the sensitivity of the results to the chosen spatial dependence parameter, a robustness check was conducted by extending the distance threshold for spatial robust standard errors to 100 km. This adjustment aimed to explore whether the influence of spatial dependence extended beyond the initial 50 km radius and to ensure that the findings remained consistent under different assumptions about the spatial reach of inter-city interactions.

2.6   Results

2.6.1   Baseline results

In this section, I present the findings from the analysis conducted on the impact of university establishments on urban growth. Following the methodology outlined in Section 2.5, the outcomes of the first set of six regressions, which use the city's population (in thousands) as the dependent variable, are displayed in Table 2. 5. The models, labelled Model 1a through Model 3b, vary based on different specifications. Model 1a, 2a and Model 3a do not include covariates, offering a baseline comparison, while Models 1b, 2b, and 3b incorporate only time-invariant covariates, which control for unchanging characteristics over time. In fact, by 'time-invariant covariates' I refer to the interactions of predetermined, time-invariant characteristics -as described in section 2.4- with

century dummies. Each model variation incorporates distinct control variables and spatial trends at the NUTS1 (model 2a and 2b) and NUTS2 (model 3a and 3b) levels, in addition to city fixed effects and heterogeneous linear trends.

Table 2. 5 ATT by century - Simple Poisson FE models

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	0.212	0.242	**0.195**	0.180	0.157	0.142
	(0.135)	(0.148)	**(0.117) ***	(0.122)	(0.115)	(0.116)
By century						
1200-1299	**0.108**	0.269	**0.125**	0.227	**0.129**	**0.195**
	(0.062) *	(0.211)	**(0.063) ***	(0.140)	**(0.061) ***	**(0.112) ***
1300-1399	**0.323**	**0.438**	**0.395**	**0.471**	**0.385**	**0.432**
	(0.104) *	**(0.158) ***	**(0.001) ****	**(0.124) ****	**(0.099) ****	**(0.113) ****
1400-1499	**0.256**	**0.344**	**0.320**	**0.364**	**0.291**	**0.329**
	(0.098) *	**(0.134) ***	**(0.104) ***	**(0.12) ***	**(0.103) ***	**(0.114) ***
1500-1599	0.154	0.202	0.135	0.146	0.095	0.113
	(0.145)	(0.161)	(0.132)	(0.14)	(0.130)	(0.135)
1600-1699	0.286	0.266	0.212	0.147	0.157	0.103
	(0.180)	(0.167)	(0.147)	(0.138)	(0.144)	(0.134)
1700-1799	0.149	0.129	0.104	0.034	0.060	-0.004
	(0.191)	(0.175)	(0.148)	(0.136)	(0.144)	(0.13)
Observations	23,848	23,848	23,221	23,221	20,394	20,394
Number of cities	2,168	2,168	2,107	2,107	1,851	1,851
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Robust standard errors in parentheses.

I observe a consistently positive Average Treatment Effect (ATT) across all models, albeit with minor variations in magnitude, suggesting a generally positive impact of the treatment. However,

these effects are not statistically significant. In contrast, a notably robust and statistically significant effect is observed from the 13th to the 15th century across all models, underscoring this period as one of pronounced treatment efficacy. The incorporation of control variables appears to enhance the ATT estimates, highlighting the importance of considering additional factors that may influence the outcomes. Nevertheless, from the 1500s onward, there is a noticeable decline in both the magnitude and the statistical significance of the treatment effects, suggesting a potential reduction in the treatment's impact over time or the influence of other mitigating factors in these later centuries. Indeed, these findings are consistent with the historical context discussed in Section 2.4.

Following the analysis presented in the previous paragraph, the subsequent examination involves the Wald test for heterogeneous linear trends, as delineated in Table 2. 6. The outcome of this test is pivotal, as it indicates a violation of the parallel trends' assumption, a cornerstone for causal inference in this context. The violation of this assumption suggests that the trends for the treated and untreated groups were diverging, thereby complicating the interpretation of the treatment effects.

To address this critical issue, I incorporated heterogeneous linear trends as an alternative approach, in line with the methodology proposed by Wooldridge (2021). This adjustment allows for the modelling of distinct temporal trajectories for each unit in the analysis, thereby accounting for the observed violation of parallel trends. The inclusion of these trends represents a rigorous attempt to mitigate the bias introduced by the violation of the parallel trends' assumption, thereby enhancing the credibility and robustness of the findings.

Table 2. 6 Wald tests

	X²	p-value
Model 1a	22.880	0.001
Model 1b	22.420	0.001
Model 2a	18.190	0.006
Model 2b	19.650	0.003
Model 3a	18.680	0.005
Model 3b	19.110	0.004

Furthermore, the output presented in Table 2. 7 underscores the significance of accounting for heterogeneous trends when analysing the Average Treatment Effect (ATT) by century through fixed effects Poisson models with spatially robust standard errors at 50km, in the absence of heterogeneous linear trends. The ATT across all models demonstrates a generally statistically significant positive effect.

Table 2. 7 ATT by century - Baseline Models with spatial robust S.E. 50km with no het. lin. trends

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	**0.173**	**0.286**	**0.251**	**0.283**	**0.227**	**0.257**
	(0.088) *	**(0.109) ****	**(0.066) ******	**(0.071) ******	**(0.06) ******	**(0.066) ******
By century						
1200-1299	**0.289**	**0.473**	**0.258**	**0.342**	**0.248**	**0.310**
	(0.091) **	**(0.218) ****	**(0.075) ****	**(0.106) ****	**(0.083) ****	**(0.091) ****
1300-1399	**0.279**	**0.435**	**0.317**	**0.409**	**0.295**	**0.372**
	(0.168) *	**(0.173) ****	**(0.152) ****	**(0.130) ****	**(0.140) ****	**(0.125) ****
1400-1499	**0.305**	**0.438**	**0.309**	**0.386**	**0.304**	**0.377**
	(0.120) **	**(0.126) ****	**(0.099) ****	**(0.095) ******	**(0.091) ****	**(0.091) ******
1500-1599	0.033	0.176	**0.196**	**0.257**	**0.171**	**0.238**
	(0.091)	(0.111)	**(0.083) ****	**(0.091) ****	**(0.078) ****	**(0.087) ****
1600-1699	**0.198**	**0.292**	**0.283**	**0.28**	**0.246**	**0.248**
	(0.096) **	**(0.105) ****	**(0.075) ******	**(0.074) ******	**(0.071) ****	**(0.071) ****
1700-1799	0.124	**0.198**	**0.210**	**0.201**	**0.182**	**0.170**
	(0.113)	**(0.115) ***	**(0.077) ****	**(0.072) ****	**(0.075) ****	**(0.071) ****

Observations	23,848	23,848	23,221	23,221	20,394	20,394
Number of cities	2,168	2,168	2,111	2,111	1,854	1,854
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	No	No	No	No	No	No

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

However, the absence of heterogeneous linear trends in these models is a critical point of discussion. In fact, the necessity of incorporating heterogeneous linear trends in the models comes from the potential violation of the common trend assumption. This assumption, critical for the unbiased estimation of treatment effects in a difference-in-differences (DiD) framework, stipulates that in the absence of treatment, the units (cities) have similar growth trajectories prior to the intervention. Specifically, if cities with a university established there (treatment group) were already experiencing higher growth rates due to factors unrelated to the treatment, failing to adjust for these unique trajectories can lead to an overestimated treatment effect. The inclusion of heterogeneous linear trends, as suggested by Wooldridge (2021), corrects for this by allowing each city's counterfactual trajectory to reflect its unique characteristics and historical growth pattern and allows for a more accurate representation of these diverse temporal trajectories, enhancing the robustness and credibility of the estimated treatment effects.

Moving further, the series of graphs presented in Figure 2. 2 illustrate the estimated coefficients from the baseline regression models, examining the effects across different cohorts and centuries. Notably, the model includes spatially robust standard errors within a 50km radius, clustered at city level.

Figure 2. 2 Baseline models – the effect varies by cohort and century.

Model 1a. Coefficients by cohort and century (no cov.)

Model 1b. Coefficients by cohort and century (only time invariant cov.)

Model 2a. Coefficients by cohort and century (no cov.)

Model 2b. Coefficients by cohort and century (only time invariant cov.)

Model 3a. Coefficients by cohort and century (no cov.)

Model 3b. Coefficients by cohort and century (only time invariant cov.)
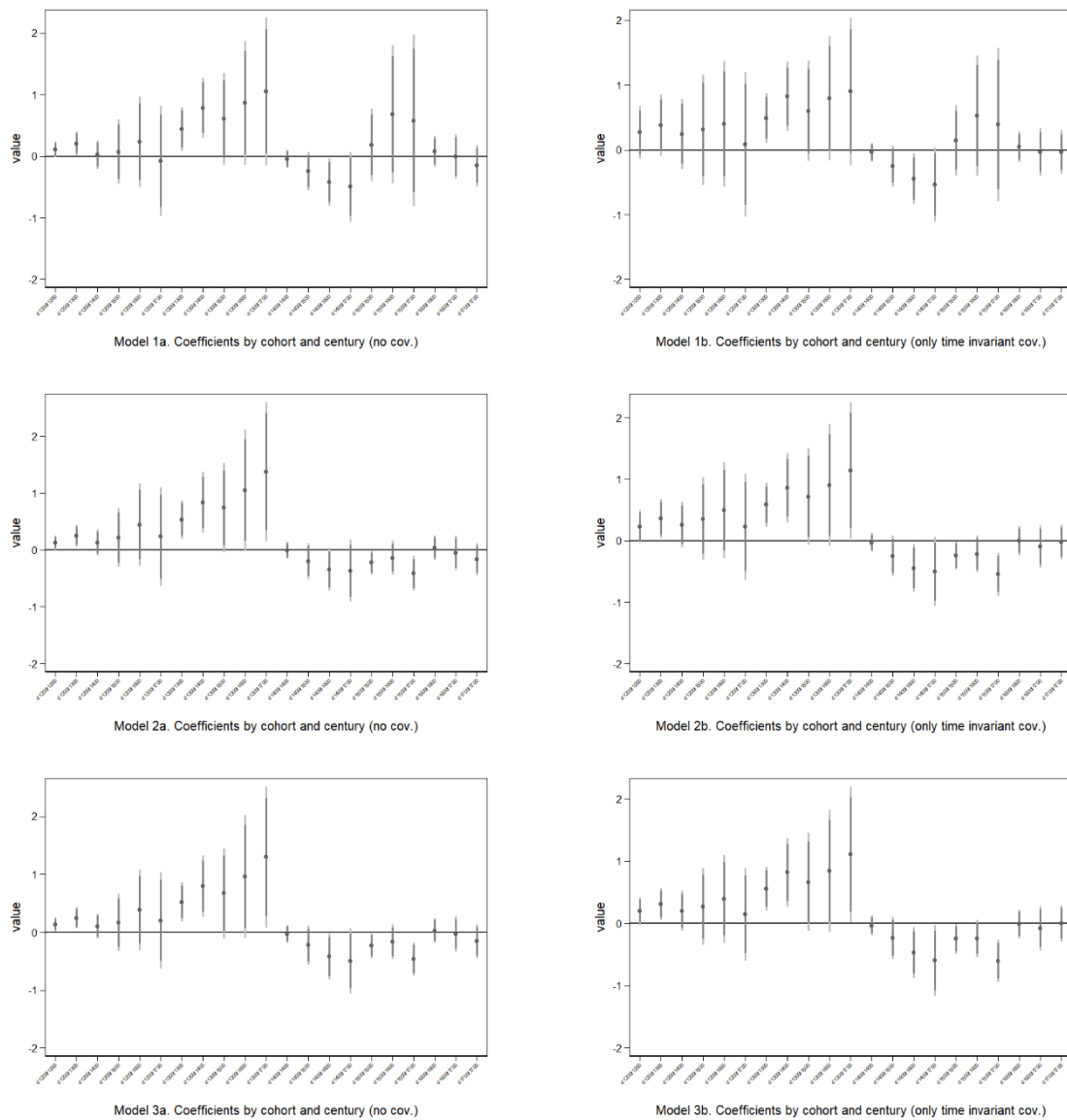
Table 2. 8 presents the Average Treatment Effects (ATT) on the Treated from baseline models across different centuries. The treatment effect is generally positive but varies in magnitude and significance by century. A glance at the table suggests that the 13th to 15th centuries consistently show a strong and significant effect across all models, with the effects somewhat diminishing in the later centuries. This finding suggests that the establishment of universities had the most substantial impact during the early centuries. The baseline models without time-invariant covariates (Model 1a, Model 2a, Model 3a) have generally lower ATT estimates than their counterparts with time-invariant covariates (Model 1b, Model 2b, Model 3b), suggesting that

controlling for other variables increases the estimate of the treatment effect. The inclusion of linear trends at different geographical levels appears to influence the magnitude of the ATT but does not alter the overall pattern of significance across the centuries.

Table 2. 8 ATT by century – Baseline models (Spatial robust S.E. 50km)

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	0.212	0.242	**0.195**	0.18	0.157	0.142
	(0.135)	(0.148)	**0.117) ***	(0.122)	(0.115)	(0.116)
By century						
1200-1299	**0.108**	0.269	**0.125**	0.227	**0.129**	**0.195**
	(0.062) *	(0.208)	**(0.062) ****	(0.139)	**(0.061) ****	**(0.112) ***
1300-1399	**0.323**	**0.438**	**0.395**	**0.471**	**0.385**	**0.432**
	(0.104) **	**(0.157) ****	**(0.1) *****	**(0.124) *****	**(0.1) *****	**(0.113) *****
1400-1499	**0.256**	**0.344**	**0.32**	**0.364**	**0.291**	**0.329**
	(0.097) **	**(0.134) ****	**(0.103) ****	**(0.119) ****	**(0.103) ****	**(0.114) ****
1500-1599	0.154	0.202	0.135	0.146	0.095	0.113
	(0.144)	(0.16)	(0.13)	(0.139)	(0.129)	(0.134)
1600-1699	0.286	0.266	0.212	0.147	0.157	0.103
	(0.179)	(0.167)	(0.146)	(0.138)	(0.144)	(0.135)
1700-1799	0.149	0.129	0.104	0.034	0.06	-0.004
	(0.191)	(0.175)	(0.148)	(0.136)	(0.145)	(0.131)
Observations	23,848	23,848	23,221	23,221	20,394	20,394
Number of cities	2,168	2,168	2,111	2,111	1,854	1,854
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

Table 2. 9 presents the Average Treatment Effects (ATT) by cohort. The findings for the 1200-1299 cohort across all models reveal positive coefficients, suggesting a potential beneficial impact

of the intervention on urban growth, though none of these results achieve statistical significance. In stark contrast, the 1300-1399 cohort displays statistically significant positive outcomes in all models, indicating a robust positive influence of the intervention during this century. The subsequent century, 1400-1499, flips the narrative with negative coefficients across all models, some reaching statistical significance, hinting at a possible detrimental effect of the intervention on urban expansion during this period.

The 1500-1599 cohort presents mixed results, with some models indicating positive impacts and others pointing towards negative ones. Only a couple of models, specifically Model 2a and Model 3a, show statistically significant negative effects, suggesting a potential adverse impact of the intervention on urban growth, albeit under certain specifications. The 1600-1699 cohort's results are minimal and lack statistical significance across all models, implying an insignificant influence of universities on urban growth for this period. A similar narrative unfolds for the 1700-1799 cohort, where the effects are negligible and fail to reach statistical significance, indicating a minimal impact of the intervention on urban development.

Table 2. 9 ATT by cohort – Baseline models (Spatial robust S.E. 50km)

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
By cohort						
1200-1299	0.095	0.283	0.235	0.320	0.207	0.252
	(0.215)	(0.364)	(0.212)	(0.269)	(0.202)	(0.233)
1300-1399	**0.749**	**0.723**	**0.910**	**0.842**	**0.849**	**0.797**
	(0.360) *	**(0.367) ***	**(0.376) ***	**(0.369) ***	**(0.374) ***	**(0.364) ****
1400-1499	**-0.302**	**-0.316**	-0.227	-0.306	**-0.291**	**-0.332**
	(0.163) *	**(0.164) ***	(0.160)	(0.165) *	**(0.171) ***	**(0.174) ***
1500-1599	0.481	0.354	**-0.258**	-0.334	**-0.288**	**-0.364**
	(0.523)	(0.446)	**(0.115) ***	(0.130)	**(0.116) ****	**(0.130) ****
1600-1699	0.035	0.007	-0.006	-0.049	-0.002	-0.045
	(0.153)	(0.152)	(0.129)	(0.145)	(0.131)	(0.148)
1700-1799	-0.155	-0.035	-0.162	-0.022	-0.158	-0.001
	(0.170)	(0.170)	(0.145)	(0.145)	(0.151)	(0.150)

Observations	23,848	23,848	23,221	23,221	20,394	20,394
Number of cities	2,168	2,168	2,111	2,111	1,854	1,854
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

2.6.2 Robustness checks

In this section, the validity of previous results is confirmed by a battery of robustness checks that are intended to address possible issues related to the research design and could bias the baseline estimates.

Table 2. 10 presents the Average Treatment Effects (ATT) by century, employing spatial robust standard errors within a 100km range. The overall ATT as well as the effect by century align closely with those from the baseline models, suggesting a consistent pattern in the treatment's impact across different centuries and under varying model specifications.

Table 2. 10 ATT by century - Spatial robust S.E. 100km

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	**0.212**	0.242	**0.195**	0.180	0.157	0.142
	(0.135)	(0.148)	**(0.115) ***	(0.121)	(0.114)	(0.115)
By century						
1200	**0.108**	0.269	**0.125**	**0.227**	**0.129**	**0.195**
	(0.061) *	(0.210)	**(0.061) ***	**(0.140)**	**(0.061) ***	**(0.115) ***
1300	**0.323**	**0.438**	**0.395**	**0.471**	**0.385**	**0.432**
	(0.105) *	**(0.156) ***	**(0.100) ****	**(0.122) ****	**(0.100) ****	**(0.112) ****
1400	**0.256**	**0.344**	**0.320**	**0.364**	**0.291**	**0.329**
	(0.096) *	**(0.133) ***	**(0.103) ***	**(0.118) ***	**(0.103) ***	**(0.114) ***
1500	0.154	0.202	0.135	0.146	0.095	0.113

	(0.143)	(0.16)	(0.128)	(0.137)	(0.128)	(0.133)
1600	0.286	0.266	0.212	0.147	0.157	0.103
	(0.180)	(0.168)	(0.145)	(0.138)	(0.144)	(0.134)
1700	0.149	0.129	0.104	0.034	0.06	-0.004
	(0.190)	(0.175)	(0.147)	(0.136)	(0.144)	(0.131)
Observations	23,848	23,848	23,221	23,221	20,394	20,394
Number of cities	2,168	2,168	2,111	2,111	1,854	1,854
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

2.6.3   Channels of university impact on urban growth

While the significance of universities in urban development has been extensively studied, it is equally important to highlight the underlying mechanisms or channels driving this influence. According to Mille (2005) universities are public institutions that carry out missions of higher education, training, and knowledge dissemination that contribute to the local accumulation of human capital. In fact, universities serve as multifaceted incentives, affecting cities through complex channels that include human capital formation, knowledge spillovers, urbanisation and market development, and legal institution development. Several potential mechanisms have been proposed in the literature to explain the relationship between universities and urban growth.

Firstly, universities can directly contribute to the local economy by creating jobs, attracting skilled labour, and stimulating demand for goods and services (Goldstein & Renault, 2004). In fact, the presence of a university could help define the urban identity of a city (Blizek & Simpson, 1978; Harris & Holley, 2016). In addition, the establishment of universities often led to the growth and development of surrounding cities (Yusuf & Nabeshima, 2007). The influx of students and

scholars created a demand for goods and services, which stimulated economic activity and urbanisation (Schäfer & Wulf, 2014). Finally, as Fernández-Esquinas and Pinto (2014) state, universities are crucial actors in urban regeneration initiatives while universities attracted merchants and traders, leading to the establishment of markets and the growth of trade networks.

Secondly, universities can foster innovation and the diffusion of knowledge, which can, in turn, promote economic growth and urban development (E. L. Glaeser, 1994; Valero & Van Reenen, 2019). Universities are important players in the global development of knowledge economy (Benneworth et al., 2010) and act as complements to private-sector collaborative R&D are attractive to both incumbent firms and startup entrepreneurs (Leyden & Link, 2013).

Thirdly, universities can enhance the quality of human capital by providing education and training, which can increase labour productivity and support the growth of knowledge-intensive industries (G. S. Becker, 1964; Lucas, 1988). The establishment of universities led to an increase in the number of educated individuals (Tanzharikova, 2012), which in turn contributed to the development of skilled labour and the spread of knowledge and expertise (Rodnyansky et al., 2020). This human capital formation had positive effects on productivity and innovation. According to Figueroa (2015) the higher human capital implies higher labour productivity and higher incomes for workers. Additionally, the quality of basic education was associated with both workers' productivity and firms' R&D processes (Cinnirella & Streb, 2017). Besides, Valero and Van Reenen (2019) observed that increases in the number of universities are positively associated with future growth of GDP per capita.

In addition, universities can play a role in the development of social capital and civic engagement, which may contribute to the long-term sustainability and resilience of cities (Putnam, 2000).

The presence of universities attracted scholars, students, and intellectuals, creating an environment conducive to the exchange of ideas and the diffusion of knowledge (Rodnyansky et al., 2020). This,

in turn, facilitated technological advancements and innovation, leading to economic growth (Kantor & Whalley, 2014).

Finally, the legal institutions associated with universities, such as the development of legal codes and the training of legal professionals, played a role in fostering economic development (Beck, 2012; Potter, 2001). These legal institutions provided a framework for commercial transactions, property rights, and contract enforcement, which were essential for economic activity. Moreover, Cantoni & Yuchtman (2014) proposed that training in the law was an important channel linking universities and greater economic activity in medieval Germany.

2.7   Concluding remarks

My study examines the relationship between the foundation of universities and population growth in European cities from the 8th to the 18th centuries. By dissecting three key periods (1200-1400, 1500-1800, and 1600-1700), I uncover multifaceted dynamics, characterized by periods of significant influence followed by shifts and adaptations. This analysis underscores the importance of recognizing the historical context, acknowledging the evolution of social and intellectual landscapes, and appreciating the nature of this intricate relationship. By embracing a holistic approach that transcends purely quantitative data and incorporates the richness of qualitative perspectives, I gain a deeper understanding of how universities have shaped the physical and social fabric of European cities over many centuries.

The findings underscore a generally positive impact of universities on urban growth, particularly pronounced from the 13th to the 15th centuries. In fact, this period stands out as a time when the establishment of universities had a notably robust, statistically significant and quantitatively important on urban populations, highlighting the important role these institutions played in urban development during the late medieval period. This detailed analysis delves beyond numerical data,

incorporating the interplay of diverse historical and social factors, including trade, social mobility, wealth, temporal shifts, burgeoning ideas, and the evolving landscape of knowledge dissemination.

However, the analysis also reveals a decline in the magnitude and statistical significance of this impact from the 1500s onward, suggesting that over time, the direct influence of universities on urban growth may have diminished, or been influenced by other emerging factors that mitigated this effect. This changing dynamic underscores the importance of considering broader historical and socio-economic contexts when evaluating the impact of universities on urban growth.

The resurgence of the treatment effect in the 17th century, likely driven by the Scientific Revolution and the evolving role of universities in knowledge creation, highlights a significant historical shift. This period marks a renewed influence of universities on urban growth, reflecting the changing intellectual landscape and the adaptation of higher education institutions to new societal and economic demands.

The violation of the parallel trends' assumption, and the subsequent incorporation of heterogeneous linear trends to address this issue, are critical methodological considerations. These adjustments ensure a more accurate estimation of the treatment effects by accounting for divergent underlying trends between treated and untreated cities , thereby enhancing the robustness and credibility of the findings. The robustness checks, particularly when employing spatial robust standard errors within a 100km range, confirm the validity of the baseline estimates, reinforcing the consistency of the treatment's impact across different model specifications and centuries.

Overall, this exploration through time reveals the interconnected destinies of universities and cities. The establishment of universities not only fuelled population growth but also fostered intellectual and cultural flourishing, attracting scholars, artists, and individuals from diverse backgrounds. In turn, cities provided universities with a fertile ground for intellectual exchange, access to resources, and a potential pool of talented students. This symbiotic relationship has

continued to shape the development of both universities and cities for centuries, solidifying their enduring place within the European landscape.

While this exploration provides a comprehensive foundation, it is vital to acknowledge the limitations of analysing solely population data and expand upon the presented findings. Incorporating additional dimensions enriches our understanding of this intricate relationship.

Examining the social backgrounds and aspirations of individuals who migrated towards university cities offers valuable insights into the social mobility opportunities associated with universities. Investigating the role of factors such as class, gender, and geographic origin in shaping university access and migration patterns can reveal important aspects. Research by Broady (2000) demonstrates the complex interplay between these factors, highlighting how universities could simultaneously reinforce existing social hierarchies while offering avenues for upward mobility for certain individuals. Examining student letters and memoirs (as explored by Verger, 1992) can further shed light on the lived experiences of students and their motivations for migrating.

While population growth is a key indicator, a deeper examination of the broader economic impact that universities have on cities offers valuable insights. Analysing the creation of jobs within various sectors, the development of skilled labour markets, and the fostering of innovation and entrepreneurship within urban environments can paint a more complete picture (Marginson, 2011). In fact, Marginson (2011) investigates these aspects, highlighting how universities can contribute to economic diversification and the creation of vibrant knowledge economies within cities. Examining city economic records and analysing the rise of specific industries alongside university expansions can provide concrete evidence of these economic contributions.

Exploring how the establishment of universities influenced urban planning, infrastructure development, and the spatial organization of cities offers further insights into the interconnectedness of these institutions with their surrounding environments. Tweedt (2009)

examines how universities have shaped the physical fabric of cities, from the development of dedicated university districts to the creation of transportation networks and cultural spaces. Analysing urban planning documents and historical maps can reveal the deliberate efforts made by city authorities to leverage the presence of universities and foster the development of thriving academic and cultural hubs. Additionally, examining the impact of university expansions on housing development and the surrounding communities can be crucial in understanding the full scope of urban transformation linked to academic institutions.

The impact of universities transcends the immediate period of their establishment and population growth. These institutions continue to play a crucial role in shaping the long-term development and identity of cities. Examining the ongoing influence of universities on urban renewal projects, cultural programming, and the shaping of city branding strategies can reveal the enduring impact of these knowledge centres. Additionally, exploring the ways universities contribute to addressing contemporary urban challenges, such as sustainability initiatives or social inclusion projects, highlights their evolving role in shaping the future of cities.

By acknowledging the limitations of solely analysing population data, expanding upon the analysis through diverse sources and incorporating broader social, economic, and spatial dimensions, I gain a more comprehensive understanding of the multifaceted relationship between the foundation of universities and population growth in European cities. This multi-dimensional perspective allows us to appreciate the intricate ways in which universities have shaped and continue to shape the physical and social fabric of cities across Europe, influencing their development and character over centuries. Additionally, acknowledging the long-term legacies and ongoing contributions of universities underscores their vital role as partners in shaping the future of European cities in a rapidly evolving world.

This study provides a foundational understanding, but further research can delve deeper into specific aspects of this complex relationship. Analysing the impact of specific universities on

individual cities, investigating the experiences of diverse student populations, and exploring the long-term economic and social consequences of university expansions are all avenues for further exploration. Additionally, examining the evolving relationship between universities and cities in the contemporary world, particularly in the context of globalization and technological advancements, can offer valuable insights into the future of this dynamic partnership.

By continuing to explore the multifaceted relationship between universities and cities, I gain a deeper understanding of their interconnected histories and pave the way for informed decision-making regarding their future development and contributions to a vibrant and sustainable urban landscape in Europe and beyond.

Chapter 3

Religions in Europe: Revealing the impact of Reformation on economic development

Abstract

This study investigates the long-term impact of the Reformation on economic development, using urbanisation as a proxy, across Europe between 1500 and 1800, focusing on the transition from Catholicism to Protestantism while also considering the effect of the Counter-Reformation period. I map the religious affiliations of more than 2,100 cities over the study period through historical maps, providing a detailed account of religious shifts across Europe, adopt a staggered Difference-in-Differences methodology and a modified Poisson model to address data skewness and potential biases. My findings reveal that cities converting to Protestantism in the early years experienced no significant effects on urban growth, while later converters faced mildly positive impact. Short exposure to Protestantism generally resulted in modest but positive urban growth, whereas prolonged exposure led to no significant consequences. Additionally, I find evidence of negative spillover effects on nearby cities after the conversion to Protestantism, i.e. the population of cities close to predominantly protestant urban centres shrunk across all periods, suggesting that the economic advances in Protestant cities occurred at the expense of neighbouring cities. Further analysis suggests that geography and past infrastructure, such as proximity to rivers and Roman roads, as well as the printing revolution within the broader context of the age of discoveries, moderated the impact of the Reformation and Counter-Reformation.

Keywords: Urbanisation, Economic development, Reformation, Protestantism, Staggered Difference-in-Differences, Spillovers

JEL Classifications: N03, N04, N10, N13, N30, N31, N90, N93, O11, O18, R11, Z12

3.1   Introduction

The Protestant Reformation, which began in 1517 when Martin Luther posted his Ninety-Five Theses, profoundly altered the religious and cultural landscape of Europe. It not only initiated a widespread theological reform within Christianity but also had deep and lasting effects on various other aspects of life, including politics, society, and economics (MacCulloch, 2017). This period, stretching from the early 16th century to the dawn of the 18th century, witnessed significant changes in economic development across Europe, a process influenced by the concurrent religious transformations(Cantoni, 2015).

This study aims to explore the spatiotemporal effects of this religious shift from Catholicism to Protestantism on economic development in Europe from 1500 to 1800. Employing a staggered difference-in-differences (DiD) approach, I analyse how this shift has influenced economic development proxied by urban growth over time.

The Reformation was not a uniform or monolithic movement, but rather a complex and dynamic process that involved multiple actors, regions, and doctrines (MacCulloch, 2017). The expansion of Protestantism across Europe was uneven and contingent on various factors, such as political alliances, wars, social movements, and cultural diffusion (Ryrie, 2018). Moreover, the Reformation did not result in a simple binary division between Catholics and Protestants, but rather gave rise to a diversity of denominations and sects within both branches of Christianity, such as Lutherans, Calvinists, Anabaptists, Anglicans, and others (MacCulloch, 2017). These differences had implications for the economic behaviour and institutions of the regions and cities that adopted them.

The shift from Catholicism to Protestantism was not a one-time event, but rather a gradual and cumulative process that spanned over two centuries. In fact, the Reformation initially spread mainly in northern and central Europe, where the Holy Roman Empire was dominant, and later

reached other parts of the continent, such as Scandinavia, the British Isles, France, and Switzerland (C. Lindberg, 2021). By 1800, Protestantism had become the majority religion in most of northern Europe, while southern Europe remained predominantly Catholic or Orthodox (MacCulloch, 2017). However, there were also significant variations and heterogeneities within regions and countries, reflecting the local and historical contingencies of the religious change. For instance, some parts of Germany, the Netherlands, and Switzerland remained Catholic or mixed, while some parts of France, Poland, and Hungary became Protestant or mixed (Kaplan, 2007). Moreover, some cities, such as Geneva, Amsterdam, and London, became prominent centres of Protestantism and influenced the religious and economic development of their surroundings (Kaplan, 2007).

Urban centres during the early modern period were not merely places of economic transactions but also the focal points of intellectual and cultural exchange (Burke, 2013). The Reformation introduced new ideas of governance, social responsibility, and individualism, which permeated the economic life of cities (Witte, 2007). This period coincided with the rise of merchant classes and the proliferation of trade and manufacturing, shifts that were both influenced by and contributory to the spread of Reformation ideas (Pomeranz & Topik, 2014). The scholarly inquiry into the economic implications of the Reformation has produced a rich body of literature, exploring how these religious changes influenced economic behaviour and urban growth (S. O. Becker & Woessmann, 2009). The central question that arises is whether the Reformation can be seen as a catalyst for the economic development observed in European cities during this period. To what extent did the religious upheavals and the establishment of Protestant ethics contribute to the economic prosperity of urban centres?

The broader socio-economic and political contexts, such as the rise of the merchant class and the establishment of new trade routes, also played crucial roles in shaping the economic outcomes of the period (Cipolla, 2004; Pomeranz, 2000). The interaction between these broader economic

changes and the Reformation's religious and ethical shifts created a complex mosaic of factors contributing to urban economic development (T. Scott, 2012; Spufford, 2006). In fact, the transformative power of religious reform is both shaped by and shapes the economic realities of its time (McCloskey, 2010; Weber, 1904). The ongoing academic debate underscores the need for continued investigation into this fascinating aspect of European history, promising further insights into how major ideological shifts influence economic development (Acemoglu et al., 2005; Mokyr, 2016).

This study contributes to the existing body of literature on the economic impacts of the Reformation on economic development in Europe in several ways. Firstly, the deployment of a uniquely extensive dataset comprising the dominant religion in 2,168 cities across Europe represents an unprecedented scale in the study of the Reformation's economic impact. This comprehensive dataset not only allows for a detailed analysis at a granular level but also facilitates a robust comparative study across different regions and time periods.

The extensive dataset used in this study covers a wide array of cities, from major urban centres to smaller towns, providing a panoramic view of the urban landscape of Europe from 1500 to 1800. This broad coverage is crucial, as it captures the diverse urban experiences and economic trajectories during the Reformation. By mapping the religion of each city using historical maps, the study provides a thorough understanding of the geographical spread and intensity of Protestant and Catholic influences, which is essential for analysing the socio-economic changes that accompanied the Reformation.

The integration of historical maps into the dataset adds another layer of depth to the analysis. This approach not only enriches the historical accuracy of the data but also enhances the spatial analysis capabilities of the study. By precisely locating the religious affiliations and their changes over time, the research can more effectively isolate the impact of the Reformation from other contemporaneous socio-economic factors. This spatial and temporal mapping is crucial for

understanding how religious changes influenced economic development patterns and how these patterns varied across different parts of Europe.

Methodologically, I employ a staggered difference-in-differences (DID) approach as outlined by (Wooldridge, 2021b, 2023). This approach is particularly adept at handling data where treatment exposure (in this case, the adoption of Protestantism or continuation of Catholicism) varies over time and space. The staggered DID method allows for a dynamic analysis of the impact of the Reformation, accounting for both the immediate and delayed economic effects of religious shifts. This method enhances the causal inference of the study, providing a robust framework for understanding the direct and indirect economic impacts of the Reformation.

Furthermore, this study bridges the historical divide between religious history and economic development, providing insights into how profound ideological shifts can influence economic structures and growth. By correlating religious affiliations with economic data, the research sheds light on the transformative power of the Reformation, beyond the theological and cultural domains into the realm of economic development. This interdisciplinary approach not only enriches my understanding of the Reformation but also illustrates the complex interactions between religion and economics in shaping the urban landscapes of Europe.

In summary, the added value of this study lies in its large-scale, detailed dataset, its integration of historical and spatial data for enhanced accuracy, and its application of advanced econometric techniques to address complex questions about the past. This research not only contributes to my historical knowledge but also provides tools and frameworks that can be applied to the analysis of other significant historical and contemporary transformations.

My findings show that cities adopting Protestantism early (1550-1600) experienced notable negative effects on urban growth. In contrast, cities that converted later saw more neutral or modestly positive impacts, though these effects often lacked statistical significance. Spatial analysis

uncovers initial negative spillover effects on nearby cities within 50-100 km of Protestant centres, likely due to resource reallocation and trade disruptions. Over time, these negative spillovers diminished, and some economic benefits emerged as Protestant institutions matured. The study further highlights that prolonged exposure to Protestantism generally led to adverse economic outcomes, while short-term exposure occasionally spurred modest growth. Robustness checks, including spatially robust standard errors and historical covariates, confirm the validity of these results and underscore the importance of considering spatial and temporal heterogeneity.

The structure of the chapter is as follows. Section 3.2 presents the relevant literature review, section 3.3 describes the historical framework; Section 3.4 gives an overview of the data used in this study, while Section 3.5 illustrates the empirical strategy. Section 3.6 presents and discusses the results and robustness checks, as well as the channels that rationalise the findings. Finally, Section 3.7 concludes.

3.2   Literature review

The literature on the economic impact of the Reformation on urban centres in Europe is extensive and varied, drawing from multiple disciplinary perspectives and employing a range of methodologies. At the heart of this discussion is Max Weber's (1904) "The Protestant Ethic and the Spirit of Capitalism", which posits that Protestant values such as hard work, frugality, and a focus on individual achievement fostered the development of capitalism. This foundational theory has been both supported and challenged by subsequent scholars (S. O. Becker & Woessmann, 2009; Cantoni, 2015; Delhey & Newton, 2005; Ekelund et al., 2002; Guiso et al., 2003; Iannaccone, 1998).

3.2.1 Economic Growth and Human Capital: Protestantism's Educational and Economic Impacts

Building on Weber's ideas, empirical studies have extensively explored the relationship between Protestantism and economic growth, focusing on the critical roles of education and social trust in driving productivity and urban development. For instance, Becker and Woessmann (2009), conducted econometric analyses to explore the relationship between Protestantism and economic growth. Their research in the Holy Roman Empire shows a positive correlation between Protestant education reforms and increased productivity, suggesting that Protestantism's emphasis on literacy significantly contributed to urban economic development. Expanding on the role of education, James (1986) provides a comparative perspective, analysing non-profit educational institutions in Japan and showing a similar positive impact on economic development, akin to the outcomes observed in Protestant regions.

Building on the importance of education, Gallego and Woodberry (2010) examine how competition among Christian missionaries influenced education in former African colonies, claiming that competition led to better educational outcomes and economic development. Similarly, Mantovanelli (2014) looks at the Protestant legacy in India, highlighting the role of missions in promoting literacy and economic development. The study finds that regions with Protestant missions experienced higher literacy rates and better economic outcomes.

The benefits of Protestant-led education are further supported by McCleary (2013), who compares Protestantism's impact on human capital in Guatemala and South Korea, finding significant educational and economic benefits. The results show that Protestant regions invested more in education, leading to long-term economic growth. Finally, Nunziata and Rocco (2016) study the Protestant ethic and entrepreneurship, providing evidence from religious minorities in the former Holy Roman Empire. Their findings suggest that Protestant values promoted entrepreneurial activities and economic development.

3.2.2 Social and Institutional Impacts: Trust, Capital, and Institutional Change

The influence of Protestantism extended beyond education to social trust and cooperation. Glaeser et al. (2000) measure the impact of social trust on economic performance, noting that the Reformation significantly influenced levels of trust and cooperation within societies. The results indicate that higher trust levels in Protestant regions were associated with better economic outcomes. In a similar vein, Delhey and Newton (2005) compare cross-national levels of social trust, highlighting how Protestant regions tend to exhibit higher trust and better economic outcomes. Their findings support the idea that social trust is a key factor in economic development. Interestingly, Lam (2002) studies how religion affects voluntary association participation, noting higher levels of civic engagement in Protestant regions. The results indicate that higher civic participation contributed to better economic outcomes.

Further extending the focus on social trust, Inglehart (1999) explores the relationship between social trust, well-being, and democracy, emphasizing the economic benefits of trust in Protestant regions. The findings suggest that social trust is a key driver of economic growth. North et al. (2013) discuss the relationship between religion, corruption, and the rule of law. They demonstrate how the Reformation helped establish stronger legal and economic institutions, which in turn fostered economic growth.

Additionally, Fukuyama (2001) discusses the role of social capital in economic development, underscoring the Reformation's impact on civil society and trust networks. The study highlights the importance of social capital in driving economic growth. Building on this, La Porta et al. (1996) investigate trust in large organizations, finding that Protestant regions exhibit higher levels of trust and better economic performance. Their analysis supports the idea that trust is a crucial factor in economic success.

This interplay between religion and social trust is further analysed by Lambert (2010), who provides a historical perspective on the role of religion in America, offering insights into the long-term economic impacts of the Reformation. The study shows that religious transformations had lasting effects on economic development. The enduring influence of Protestant values is further reflected in Grim and Finke (2010) explore the relationship between religious freedom and economic development, showing how the Reformation's promotion of religious liberty spurred economic growth. Their findings indicate that religious freedom is positively correlated with economic performance.

The economic underpinnings of the Reformation are further complicated by Ekelund et al. (2002), who argue that the Catholic Church's monopolistic practices, such as doctrinal control and price discrimination, created dissatisfaction among its members, paving the way for Protestant reformers. The authors explain that Protestantism succeeded in societies with declining feudalism and wealth distribution instability but struggled in homogenous, rent-seeking societies. By framing the Reformation as a response to market inefficiencies, the study offers a unique economic perspective on religious change, emphasizing the interplay between religious and economic incentives.

This market-based analysis continues in The Marketplace of Christianity (Ekelund et al., 2008), where the authors apply economic theories to the development of organized religion, particularly analysing the emergence of Protestantism. The paper argues that the Protestant Reformation can be seen as a successful market disruption, where Protestant reformers challenged the Catholic Church's religious monopoly, resulting in increased competition within Christianity. The study uses economic principles to explain how Christianity evolved over time to meet the changing demands of worshippers, suggesting that religious institutions are subject to economic forces similar to those affecting traditional markets.

3.2.3 Regional Variations and Historical Case Studies: Heterogeneous Impacts of the Reformation

The economic effects of the Reformation were not uniform across regions, as varying local conditions significantly mediated its outcomes, highlighting the need for a regionally comprehensive understanding of its economic legacy. Becker et al. (2016) analyse the socio-economic factors that both led to and resulted from the Protestant Reformation. By examining political, economic, and technological changes, the authors argue that the Reformation was instrumental in altering Western Europe's economic landscape, spurring human capital development, and influencing socio-political institutions. This work provides a comprehensive look at the Reformation's enduring impact on European development.

In a similar vein, Cantoni (2015) investigates the economic effects of the Reformation in Germany, testing the Weber Hypothesis. The study finds mixed evidence, with some regions experiencing economic growth while others did not, highlighting the complex impact of the Reformation on economic development. The evidence suggests a more comprehensive view of the Reformation's economic effects, undermining the idea of a uniform economic benefit across all Protestant regions. This regional complexity is further elaborated by Buggle (2016), who explores the broader institutional changes brought about by the Reformation, such as legal reforms like the Napoleonic Code. The study concludes that these reforms had long-term positive effects on economic development by improving governance and legal frameworks.

Complementing these economic perspectives, historians like Rublack (2017) and Blickle (1992) have highlighted the varied impact of the Reformation across different European regions, showing that local conditions significantly influenced economic outcomes. Rublack's (2017) study in particular, provides insight into how in some regions the Reformation aligned with urban economic interests to foster growth, whereas in others it led to economic disruption and decline.

Curuk and Smulders (2016) extend this analysis by presenting an economic rationale for the adoption of Protestantism. They argue that regional authorities used the Reformation to secularize governance and eliminate inefficiencies under the Catholic regime. The study finds that economically disadvantaged regions with greater agricultural potential were more likely to adopt Protestantism, as regional rulers were incentivized to exploit economic opportunities by restructuring institutional frameworks, offering a new perspective on the economic motivations behind religious change.

Additionally, Tittler (1999) focuses on the impact of the Reformation on English towns between 1540 and 1640, emphasizing the changes in urban land, resources, and political culture. He argues that the Reformation allowed towns to gain financial and political autonomy, consolidating power in the hands of local elites. These elites used various means, such as architectural projects and religious reforms, to legitimize their authority, fundamentally altering the governance and social structure of towns. The study provides a detailed account of how urban landscapes and political dynamics were reshaped during this period.

Following the broader societal implications of the Reformation, Brady (1998) provides a comprehensive examination of its multifaceted effects, including its influence on community dynamics, gender relations, and social conflict. The paper explores how the Reformation reshaped early modern European society, examining the accommodation and resistance that characterized various communities' responses. By analysing the intersection of politics, religion, and social structures, Brady offers a comprehensive understanding of the Reformation's multifaceted effects, contributing to historiographical debates about its legacy. Complementing this analysis, Kasper von Greyerz and Thomas Dunlap (2007) provide an overview of religious and cultural transformations in Europe during the Reformation and Counter-Reformation. The book adopts a social and cultural perspective, exploring the emergence of radical religious movements and the marginalization of religious minorities. It also investigates the early signs of secularization, arguing

that religious changes had lasting effects on European cultural and social landscapes, shaping the religious diversity and secular trends observed in later centuries.

In terms of institutional change and political incentives, Pfaff & Corcoran (2012) develop a general theory of religious disestablishment and apply it to the Reformation in the Holy Roman Empire. They identify three key factors—changes in demand, entry control mechanisms, and political incentives—that explain the variation in religious reform across different regions. The study finds that political incentives were the most significant driver of religious change, offering empirical support for the idea that secular authorities played a crucial role in shaping the Reformation's trajectory.

The economic ramifications of these religious shifts are further explored by Cantoni et al. (2018), in Religious Competition and Reallocation: The Political Economy of Secularization in the Protestant Reformation. He examines how the Reformation led to a significant reallocation of resources from religious to secular purposes. The research highlights the transfer of wealth from monasteries to secular authorities and a shift in higher education away from theology to secular subjects. This economic reallocation shifted the power balance in Protestant regions, resulting in greater investment in secular infrastructure, such as administrative buildings and palaces, thus reshaping the economic landscape of early modern Europe.

From a technological perspective, Rubin (2011) investigates the role of the printing press in facilitating the spread of Protestant ideas, finding a significant correlation between cities with printing presses by 1500 and the adoption of Protestantism by 1530, 1560, and 1600. The study suggests that the success of the Reformation was partly due to technological advancements, like the printing press, which enabled widespread dissemination of Protestant literature. Rubin's analysis implies that economic interpretations of the Reformation's impact may overestimate the role of religious ideology, instead highlighting the importance of technological infrastructure.

Expanding on the economic shifts within Reformation-era Germany Cantoni et al. (2016) provide evidence of a rapid reallocation of resources from religious to secular sectors in regions that adopted Protestantism. The closure of monasteries and the redirection of wealth toward secular uses marked a significant economic shift. The study also shows that university graduates in Protestant regions increasingly pursued secular occupations rather than religious vocations, reflecting broader changes in human capital allocation and economic focus after the Reformation.

3.2.4 Contemporary Implications of Religious Shifts: Modern Economic and Social Outcomes

The Reformation's legacy continues to influence modern economic and social structures, with contemporary studies revealing its lasting impact on areas such as military conflict, social policy, and political resilience. Sauer's (2023) work explores the economic implications of religious institutions and behaviours, proposing that religious organizations act as both economic agents and social influencers. Through a comprehensive economic analysis, the study assesses how religious affiliations impact individual and societal economic decisions, including consumption, labour, and wealth accumulation. It sheds light on the economic benefits and constraints posed by religious commitments and community networks.

Barber et al. (2023) examine the influence of religious structures on military conflict prior to the Enlightenment. By analysing the role of religious motivations in historical conflicts, the authors argue that religiosity often fuelled wars, as religious authorities leveraged beliefs to unify and motivate groups. The findings highlight the interplay between religious fervour and war efforts, showing a strong correlation between heightened religiosity and increased pre-Enlightenment conflict.

Becker et al. (2021) provide a survey of research on the historical economic impact of religion, highlighting the roles religious institutions and beliefs play in shaping economic structures and

behaviours. By examining case studies from various periods and regions, Becker and colleagues outline how religious doctrines have historically influenced economic policies, labour markets, and social norms, contributing to differences in development trajectories across societies.

Expanding on the connection between religion and economic outcomes, Becker et al. (2023) explore the relationship between religious adherence and economic growth, arguing that specific religious beliefs and institutional characteristics can either inhibit or foster economic development. The authors analyse cross-country data to assess how religious doctrines and church-state dynamics affect innovation, education, and economic policies, concluding that the impact of religion on growth is complex and context-dependent.

In a more politically oriented study, Becker and Voth (2023) examine how the decline in traditional religiosity may have contributed to the rise of totalitarian movements, using Nazi Germany as a case study. They suggest that weakened Christian beliefs left a void that pseudo-religious ideologies, like National Socialism, could exploit. The study emphasizes the role of shallow religiosity in increasing susceptibility to authoritarianism and highlights the political appeal of quasi-religious leadership figures.

Brad (2015) argues that the Protestant Reformation had numerous unintended consequences that significantly influenced Western society's economic and cultural landscape. Rather than simply advancing a Christian vision, the Reformation fragmented religious unity, creating a hyperpluralism of beliefs and diminishing the overarching sense of a common good. This fragmentation facilitated the triumph of capitalism and consumerism, as secular institutions became more dominant in intellectual and social life, driving an economic ethos centred on material gain and consumerist values.

Sheremeta and Smith (2017) outline several causal pathways through which the Protestant Reformation positively influenced Western Europe's economic development. The study highlights

religious freedom, education, social values, and the Protestant work ethic as critical factors contributing to economic success. It also emphasizes the institutional changes set in motion by the Reformation, which fostered innovation and economic growth. While the paper supports the connection between the Reformation and economic advancement, it also notes ongoing debates about the specific mechanisms through which these effects occurred.

3.3   Historical framework

The Reformation and Counter-Reformation were transformative events that reshaped Europe's religious, political, and socioeconomic structures between the 16th and 18th centuries. These movements, while originating as theological debates, extended their influence into every facet of society, particularly within urban centres. As bastions of commerce, governance, and education, cities became the epicentres of religious innovation and conflict, where Protestant and Catholic ideologies intersected with economic and social realities.

The Reformation began in 1517 with Martin Luther's publication of his Ninety-Five Theses, a critique of Catholic practices such as the sale of indulgences. This act catalysed a broader movement advocating for the decentralization of religious authority, the primacy of scripture, and the democratization of faith. However, the Reformation was not a monolithic phenomenon but rather a collection of diverse movements that evolved across Europe, including Lutheranism, Calvinism, and more radical expressions such as Anabaptism (MacCulloch, 2017).

In response to these challenges, the Catholic Church initiated the Counter-Reformation, a multifaceted effort to reaffirm its authority through doctrinal clarification, institutional reform, and cultural renewal. The Council of Trent (1545–1563) served as the centrepiece of this movement, laying the groundwork for the Jesuit Order's educational missions and the flourishing of Baroque art and architecture (Rublack, 2017). Together, the Reformation and Counter-

Reformation transformed Europe's cities, driving population shifts, economic innovation, and new patterns of governance.

3.3.1 The Protestant Reformation: A Catalyst for Urban Growth and Economic Change

Literacy, Printing, and Economic Growth

The Protestant Reformation's emphasis on scripture reading catalysed a literacy revolution, particularly in urban areas. Luther's calls for the democratization of scripture were met with an unprecedented demand for religious texts, driving the rapid expansion of printing presses in cities such as Wittenberg, Geneva, and Strasbourg (MacCulloch, 2017). These cities became intellectual and economic hubs, benefiting from the synergies between reformist ideas and industrial growth. For example, Wittenberg, as Luther's home base, saw its population increase by 15% between 1517 and 1550, supported by the proliferation of publishing houses that exported books across Europe (Pettegree, 2015).

Strasbourg, strategically located on the Rhine, became a printing powerhouse, producing over 100,000 copies of Protestant texts by 1550. This output not only spread Reformation ideas but also generated employment and trade opportunities, increasing the city's per capita income by 10% over the same period (Rubin, 2014). The ripple effects of such urban growth extended into surrounding regions, as rural populations migrated to cities in search of economic opportunities.

Educational Reforms and Urban Competitiveness

Education reforms were central to Protestant efforts to build literate and engaged communities. Cities such as Geneva established schools that integrated religious instruction with practical skills, fostering an educated workforce capable of driving economic innovation. Calvin's Geneva, often called the "Protestant Rome," became a centre for theological and intellectual training, attracting students from across Europe (Kaplan, 2007). Basel, home to one of the oldest universities in Europe, expanded its curriculum during the Reformation to include subjects such as mathematics

and natural sciences, preparing its citizens for roles in commerce and governance (Burnett, 2023, pp. 1500–1550). This investment in human capital contributed to the city's economic resilience and long-term competitiveness.

3.3.2 Redistribution of Wealth and Economic Innovation

The Dissolution of Monasteries

The dissolution of monasteries under Protestant reforms had transformative economic consequences. Monasteries, which had historically managed large tracts of land and provided social services, were dismantled, and their wealth was redirected to urban projects and private enterprises. Cities like Hamburg and Augsburg became focal points for these redistributions, using former monastic lands to build marketplaces, workshops, and civic institutions (S. O. Becker et al., 2016). Augsburg's Fugger family, for instance, acquired significant monastic properties, reinvesting them into trade and banking enterprises that solidified the city's position as an economic powerhouse in the 16th century (Häberlein, 2012).

Protestant Work Ethic and Trade Expansion

The Protestant ethos of thrift, discipline, and reinvestment created fertile ground for capitalist practices. Calvinist cities like Amsterdam exemplify this synergy, with merchants prioritizing efficiency and reinvestment in shipping, finance, and infrastructure. By the early 17th century, Amsterdam's Stock Exchange was the financial nucleus of Europe, enabling the Dutch Republic to dominate global trade networks (Weber, 1904). This economic expansion was facilitated by urban governance reforms that standardized trade laws, reduced tariffs, and fostered competition (Gelderblom, 2015).

3.3.3 Counter-Reformation: Urban Resilience and Economic Renewal

Baroque Urban Renewal

The Catholic Counter-Reformation sought to reassert its influence through cultural and economic strategies, particularly in urban centres. Rome's transformation under Pope Sixtus V exemplifies this approach, with large-scale projects such as the construction of public squares, monumental churches, and aqueducts. These initiatives not only reinforced the city's status as the heart of Catholicism but also stimulated its economy by creating jobs and attracting religious pilgrims (Rublack, 2017). Vienna similarly benefitted from Baroque urbanism, using architectural grandeur to solidify its position as a Catholic stronghold and regional economic centre (Parsons, 2008).

Jesuit Education and Economic Stability

The Jesuit Order played a central role in the Counter-Reformation's urban strategy, founding educational institutions that combined rigorous religious instruction with scientific and humanistic studies. These colleges, such as the Collegio Romano, became hubs of intellectual and economic activity, contributing to literacy rates and civic engagement in Catholic cities (O'Malley, 1995). This educational focus not only preserved Catholic influence but also enhanced the human capital essential for sustaining economic stability (Burke, 2019).

3.3.4 Migration and Demographic Impacts

Protestant Refugees and Urban Prosperity

Religious persecution during the Reformation spurred significant migrations, reshaping urban demographics and economies. Protestant refugees, particularly the Huguenots, brought skills in textiles, finance, and printing to cities like Berlin, Amsterdam, and Geneva. The influx of Huguenots into Amsterdam between 1590 and 1650 increased the city's population by 20%, with textile exports growing by 30% over the same period (Kaplan, 2007). Geneva similarly benefitted, becoming a hub for watchmaking and other artisanal industries introduced by Protestant migrants (Kaplan, 2007; Rublack, 2017)

Spillover Effects and Economic Disparities

The proximity of Protestant and Catholic cities created complex economic dynamics, including negative spillover effects. Mainz, for example, suffered an 8% population decline between 1540 and 1600 due to its proximity to emerging Protestant trade centres like Frankfurt (Cantoni, 2015; Kaplan, 2007).

3.3.5 Diverging Urban Trajectories: Long-Term Socioeconomic Impacts

Protestant Cities and Global Trade Dominance

By the 18th century, Protestant cities had firmly established themselves as global trade leaders. Hamburg, with its advanced port facilities and mercantile networks, epitomized the success of Protestant urbanisation.

Catholic Cities and Economic Stability

While less dynamic in adopting capitalist practices, Catholic cities maintained stability through religious tourism and hierarchical governance. Santiago de Compostela and Rome sustained steady population growth by leveraging pilgrimage traffic, preserving their cultural prominence and economic resilience (Cantoni, 2015; Rublack, 2017).

This framework demonstrates how the Reformation and Counter-Reformation reshaped the socioeconomic landscapes of European cities. By integrating historical narratives with quantitative data, it establishes clear links between religious transformations and urban growth, population trends, and economic performance. These divergent trajectories highlight the complex interplay between Protestant innovation and Catholic resilience, providing a robust context for the findings of this study.

3.4 Data

For this study, I have built on the comprehensive dataset for Europe that I created in the previous Chapter 2, where I combined the population data provided by Buringh (2021) with additional information from multiple sources spanning the period 700-1800 resulting on an in-depth view of

demographic shifts over an extensive timeframe, allowing for a longitudinal analysis of population dynamics. For the purposes of this study, I focus on human settlement in Europe spanning from 1550 to 1800, with a population of more than 1,000 inhabitants at any given point in time.

Map 3. 1 European cities from 1550 to 1800
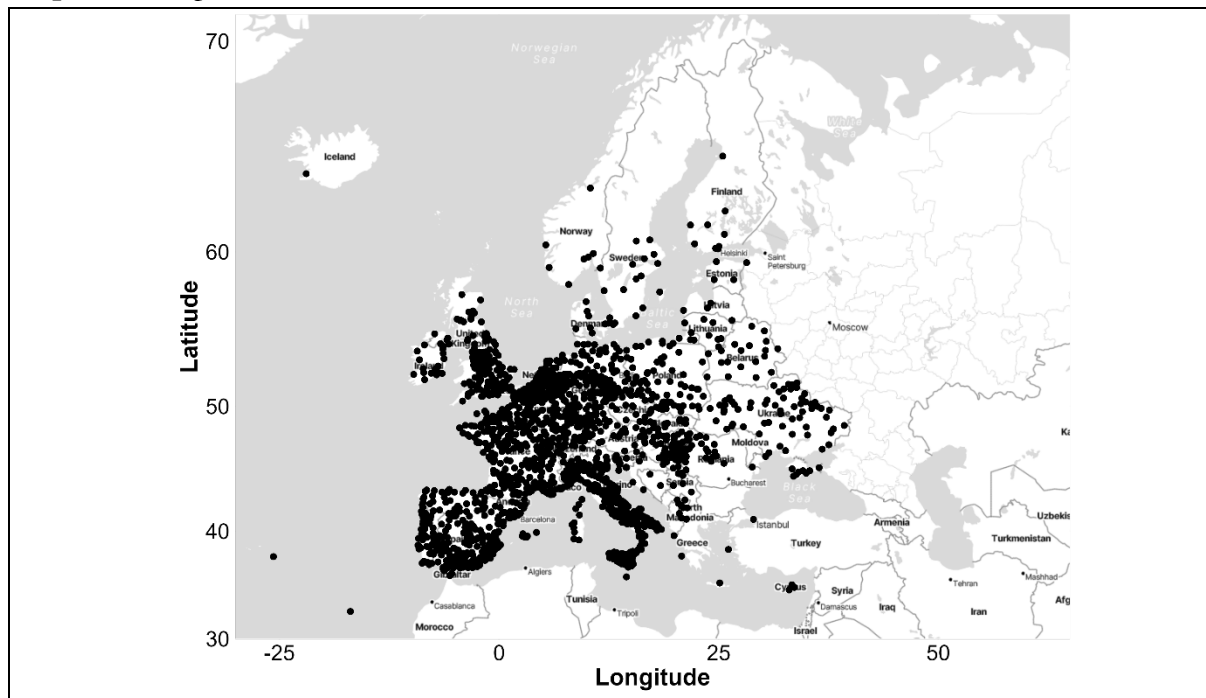
To map the dominant religions across Europe over the period from 700 to 1700, a rigorous and systematic approach was implemented. The first step involved sourcing historical maps that detailed the spread and influence of various religions over time. Key resources included the Atlas of the Historical Geography of the Holy Land by George Adam Smith (1915) and other maps from scholarly works and reliable historical archives[12], which depicted critical religious transitions, such as the Great Schism of 1054 and the spread of the Reformation between 1530 and 1650.

---

[12] In particular I used the following sources: **a)** Expansion of Christianity at *Smith, George Adam (1915). Atlas of the historical geography of the Holy Land. Hodder & Stoughton.* Map available at: https://upload.wikimedia.org/wikipedia/commons/a/a8/Expansion_of_christianity.jpg; **b)** Development of Christianity to 1300 at *Smith, George Adam (1915). Atlas of the historical geography of the Holy Land. Hodder & Stoughton.* Map available at: https://upload.wikimedia.org/wikipedia/commons/7/7c/Shepherd-c-046-047.jpg; **c)** The Great Scism 1054 available at:

These historical maps were digitised and transformed into shapefiles using Geographical Information System (GIS) software. The conversion process involved several stages: identifying the original map images, cleaning and georeferencing them to align accurately with existing coordinate systems and matching them with the exact geolocation of the cities sample. This procedure was conducted thoroughly to ensure that the historical regions matched the geographical locations of the cities in my sample, as closely as possible.

To enhance the precision of this historical-geographical matching, the converted shapefiles were manually cross-validated. Special attention was given to areas that underwent significant religious shifts, like parts of Germany, France, and Switzerland, where the impact of the Reformation and the Reconquista introduced substantial religious changes over time.

---

https://upload.wikimedia.org/wikipedia/commons/5/5e/Great_Schism_1054.svg; **d)** Al-Andalus and Christian kingdoms circa 1000, at *the apogee of Almanzor.* Map available at:

https://commons.wikimedia.org/wiki/File:Califato_de_C%C3%B3rdoba_-_1000-en.svg; **e)** Euskara: Al-Andalusen_mapa_eta_Iruñea. Map_available_at: https://upload.wikimedia.org/wikipedia/commons/3/33/Al-Andalus_eu.png; **f)** The officially recognised religions in the territories of Europe 1500-1648. Map available at: https://retopea.eu/s/en/item/7585; **g)** Religious Divisions about 1600 at *Donald Kagan et al. The Western Heritage Since 1300. (p. 408).* Map_available_at: https://commons.princeton.edu/mg/religious-divisions-about-1600/; **h)** Prevailing Forms of Religion in Europe at *Moral & statistical chart showing the geographical distribution of man according to religious belief, with the principal Protestant mission stations in the middle of the 19th century. By A. Keith Johnston.* Map available at: https://www.davidrumsey.com/luna/servlet/detail/RUMSEY~8~1~24721~940060; **i)** Spread of the Reformation to 1530. Map available at:

https://pages.uoregon.edu/dluebke/WesternCiv102/Protestantism1530.jpg; Spread of the Reformation, 1530 to 1560. Map available at: https://pages.uoregon.edu/dluebke/WesternCiv102/Protestantism1560.jpg; **g)** Spread of the Reformation, 1560 to 1600. Map available at:

https://pages.uoregon.edu/dluebke/WesternCiv102/Protestantism1600.jpg; **k)** Spread of the Reformation, 1600 to 1650 available at: https://pages.uoregon.edu/dluebke/WesternCiv102/Protestantism1650.jpg

The manual validation process was crucial in reducing errors and ensuring the reliability of the dataset. By comparing the GIS outputs with historical narratives and cartographic evidence, the overall matching error was minimized to approximately 5-8%. This relatively low error rate enhances the robustness of my analysis, especially in regions where religious affiliations changed frequently due to political or social upheaval.

The historical maps used include several pivotal depictions of religious territories over the centuries. For instance, maps detailing the spread of Christianity in the Holy Land and the development of Christianity up to 1300 provided foundational insights into early religious distributions. Maps illustrating the Great Schism, the extent of Al-Andalus, and the spread of the Reformation at different intervals (1530, 1560, 1600, and 1650) captured the dynamics of religious transitions that shaped European society. The data from these sources were carefully integrated into the GIS system to reflect the geographical and temporal complexity of religious changes.

Map 3. 2 presents visually the precise geographical locations of the cities included in this study, alongside their specific religions by semi-centennial.

Map 3. 2 The religions in Europe by century (700 AD-1400 AD)

1500 AD

1550 AD

1600 AD

1650 AD

1700 AD

- ● Catholicism
- ● Eastern Orthodox
- ● Islamism
- ● Protestantism
- ● Christianism
- ● Islamism
- ● Paganism
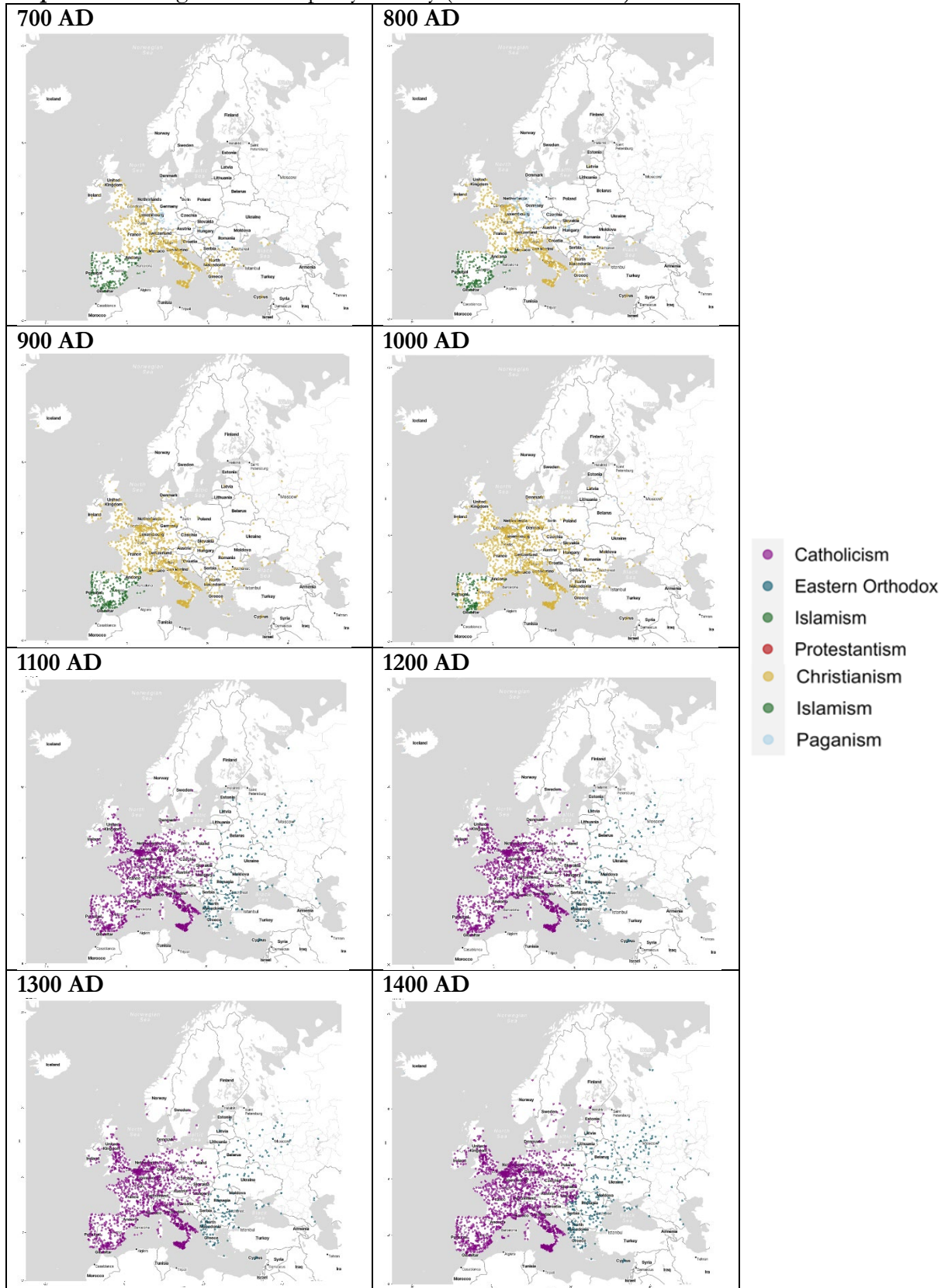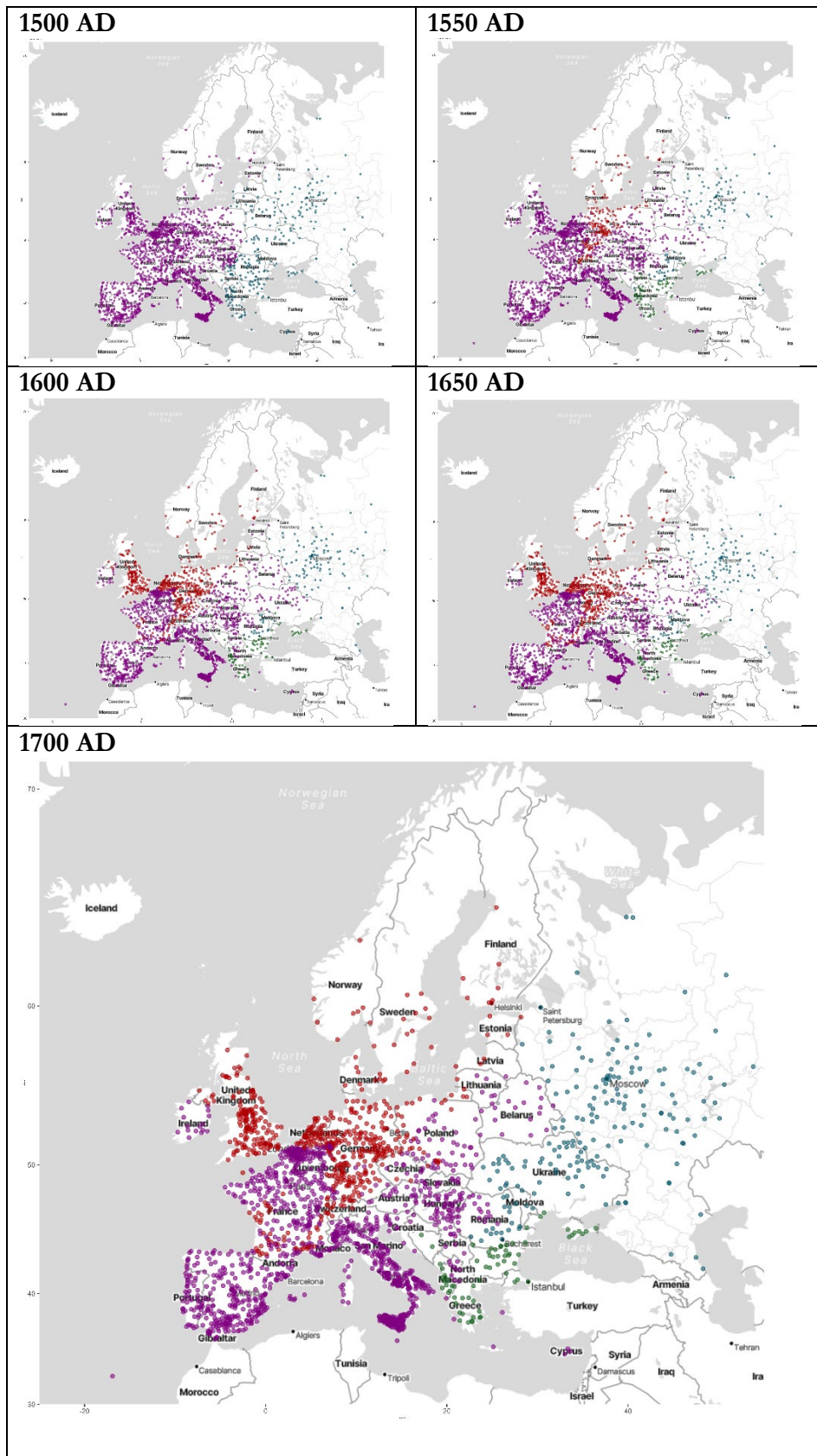
Figure 3. 1 Cumulative number of protestant cities over time presents a chronological distribution of protestant cities across Europe, from 1550 to 1700, highlighting the gradual expansion of Protestantism from the 16th century onwards. For clarity, each semi-centennial label corresponds to the entirety of that semi-centennial (i.e., 1550 refers to 1550-1600 etc.)

Figure 3. 1 Cumulative number of protestant cities over time
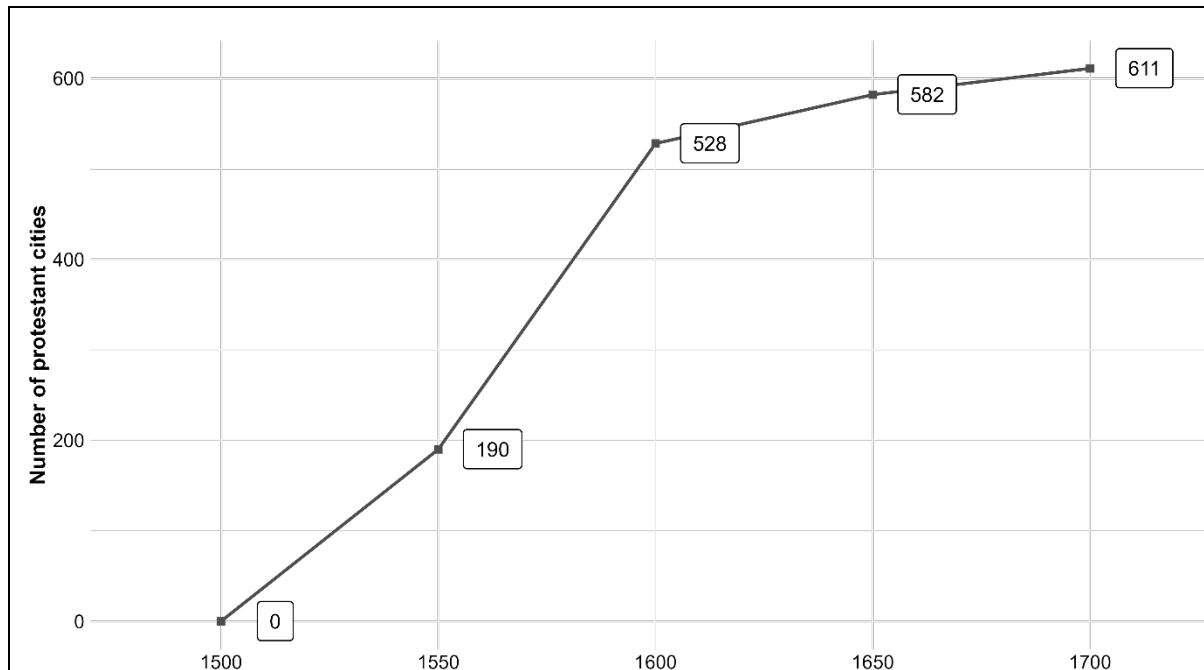
The data in Table 3. 1 presents the number of observations categorized by country and dominant religion, illustrating the religious composition across 17 modern European countries during the study period. Catholicism has a stronger representation, with 6,513 observations compared to 1,911 for Protestantism. France and Germany emerge as key contributors, with France having the highest number of Catholic observations (2,449) and Germany presenting a significant mix of Catholic (1,213) and Protestant (739) observations. This distribution highlights the diverse religious landscape of Europe, crucial for understanding the Reformation's impact on urban development.

Table 3. 1 Number of observations by country and dominant religion

Country	Catholicism	Protestantism	Total
Austria	125	3	128
Belgium	505	15	520
Czech rep.	130	14	144
Denmark	36	36	72
Estonia	28	4	32
Finland	41	31	72
France	2,449	143	2,592
Germany	1,213	739	1,952
Iceland	7	1	8
Latvia	23	9	32
Lithuania	53	3	56
Netherlands	320	160	480
Norway	38	26	64
Poland	466	78	544
Russia	16	16	32
Sweden	63	57	120
Switzerland	93	75	168
UK	907	501	1,408
Total	**6,513**	**1,911**	**8,424**

The descriptive statistics in Table 3. 2 provide an overview of the main variables for the cities in the sample. The mean population is 4.66, with considerable variability (standard deviation of 13.06), and a highly skewed distribution indicated by a skewness value of 24.53. Distance metrics from geographical and historical features, such as the Atlantic, rivers, Mainz, and Wittenberg, show notable differences in proximity, with skewness values pointing to non-uniform distributions. The skewed nature of distances to Roman roads, thermae, bridges, and castles suggests diverse city characteristics, relevant for understanding their economic and social dynamics both pre- and post-Reformation.

Table 3. 2 Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
population	8424	4.66	13.06	0.00	575.00	0.00	40.00	24.53	865.11
Distance from:									
Atlantic	8424	214.83	217.70	0.00	1035.75	0.10	844.74	1.08	3.50
coast	8424	151.39	141.82	0.01	575.02	0.10	492.56	0.73	2.38
river	8424	43.18	40.23	0.03	275.08	0.11	177.50	1.50	6.35
Mainz	8424	1034.34	698.61	0.00	8210.22	74.89	3054.32	1.67	12.29
Wittenberg	8424	1135.28	638.62	0.00	7855.69	98.31	2769.86	1.43	12.60
roman roads	8424	141.01	238.45	0.01	1897.09	0.28	1252.32	3.15	14.88
thermae	8424	156.59	248.75	0.02	1805.96	0.38	1359.59	3.20	14.58
bridges	8424	194.21	251.93	0.15	1816.21	2.26	1384.39	2.95	13.28
castles	8424	435.10	329.09	0.57	2211.87	13.05	1644.94	1.50	6.20

To assess the pre- and post-Reformation characteristics of cities transitioning to Protestantism, Table 3. 3 summarizes the key baseline features of these treated urban centres. Panel A details the status of cities before the shift, where the mean population was modest at 2.89 with a substantial standard deviation of 4.90, highlighting notable variability. Additionally, geographical distances from critical landmarks such as the Atlantic, coastlines, and rivers demonstrate a wide range of positioning, reflecting that these cities were not uniformly situated in strategic locations.

Table 3. 3 Summary statistics for protestant cities before and after the religious change (treated)

Panel A. Treated cities before the religious change to Protestantism								
Variables	**Obs**	**Mean**	**Std.Dev.**	**Min**	**Max**	**p1**	**p99**	**Skew.**	**Kurt.**
population	2985	2.89	4.90	0.00	100.00	0.00	25.00	7.03	87.23
Distance from:									
Atlantic	2985	176.88	204.07	0.02	1035.75	0.10	829.12	1.42	4.67
coast	2985	132.50	138.37	0.01	480.23	0.10	463.37	0.86	2.39
river	2985	44.51	39.36	0.04	275.08	0.14	162.83	1.19	5.18
Mainz	2985	1041.63	686.70	0.00	8210.23	96.53	3170.51	1.62	11.36
Wittenberg	2985	1140.24	637.17	0.00	7855.69	88.14	2861.27	1.28	10.86
roman roads	2985	183.35	277.48	0.28	1897.09	0.73	1335.00	2.77	11.53
thermae	2985	180.03	292.77	0.11	1805.96	0.38	1443.30	2.88	11.62
bridges	2985	228.84	289.01	0.34	1816.21	0.89	1476.60	2.73	11.16
castles	2985	497.54	332.57	13.06	2211.87	35.26	1724.670	1.79	7.60
Panel B. Treated cities <u>after</u> the religious change to Protestantism									
Variables	**Obs**	**Mean**	**Std.Dev.**	**Min**	**Max**	**p1**	**p99**	**Skew.**	**Kurt.**
population	1911	6.18	18.03	0.00	575.00	1.00	43.00	21.213	592.09
Distance from:									
Atlantic	1911	188.53	199.01	0.02	1035.75	0.10	819.94	1.23	4.12
coast	1911	143.57	142.04	0.01	480.23	0.10	455.39	0.68	2.04
river	1911	43.63	41.06	0.04	275.08	0.13	182.02	1.42	6.01
Mainz	1911	1023.98	689.84	0.00	8210.23	71.93	3085.57	1.95	15.46
Wittenberg	1911	1129.81	638.60	0.00	7855.69	85.74	2769.86	1.64	15.19
roman roads	1911	205.15	285.27	0.28	1897.09	0.73	1335.00	2.49	9.97
thermae	1911	199.72	294.66	0.11	1805.96	0.46	1437.55	2.57	10.06
bridges	1911	245.53	289.67	0.34	1816.21	1.45	1460.30	2.45	9.84
castles	1911	496.89	324.97	13.06	2211.87	36.36	1690.87	1.59	6.56

3.5   Empirical strategy

The empirical strategy employed in this study, inspired by Benos et al. (2024), is designed to address the inherent challenges of measuring the Reformation's economic impact on urban centres across Europe. One of the main obstacles in this analysis is the potential endogeneity in the establishment of religious institutions and urban development. Cities that adopted Protestantism or witnessed

significant religious reform may have already been predisposed to urban growth, potentially biasing the estimation of the true effects of the Reformation on economic outcomes.

To mitigate this concern, I implement a staggered Difference-in-Differences (DiD) framework that exploits the temporal and regional variation in the adoption of Protestant reforms. This approach allows us to assess the dynamic and heterogeneous impacts of the Reformation over time and across different cohorts of cities. The staggered DiD methodology is particularly well-suited for historical analyses, as it accounts for variations in treatment timing and provides more accurate causal estimates compared to conventional two-way fixed effects models, which may produce biased results due to negative weighting.

A key feature of my methodology is the use of a Poisson regression model, following the recommendations of Wooldridge (2023), to handle the skewed distribution of urban population data. Given that many cities in my sample had small populations, including some with zero growth in certain years, linear regression models would be inappropriate. The Poisson specification not only addresses the non-linear nature of the data but also facilitates the interpretation of results as percentage changes, making the findings more meaningful in the context of urban growth.

The model incorporates several layers of control to ensure robustness. I include city-specific fixed effects to account for unobservable characteristics that are constant over time and could influence economic outcomes. Additionally, I introduce interactions between cohort dummies and linear time trends to address potential violations of the parallel trends assumption. This adjustment captures the differential growth trajectories of cities based on historical and geographical factors, such as proximity to trade routes, major rivers, or strategic locations. By allowing for heterogeneous trends, I reduce the risk of biased estimates that could arise from pre-existing differences between treated and untreated cities.

Furthermore, I consider spatial dependence, a critical aspect of historical economic geography. Cities in close proximity often shared economic and cultural linkages, making it likely that shocks affecting one city could spill over to neighbouring areas. To correct for spatial autocorrelation in the residuals, I employ spatially robust standard errors, following the methodology outlined by Benos et. al., (2024). My baseline analysis uses a 50 km distance threshold, with additional robustness checks extending this radius to 100 km to test the sensitivity of my results to different assumptions about spatial influence.

I also address the potential spillover effects that could violate the Stable Unit Treatment Value Assumption (SUTVA). Specifically, I investigate whether cities located near Reformation hubs experienced population changes due to their proximity to religious reforms, even if they did not directly adopt Protestantism. By reclassifying nearby non-Reformation cities the treated group and comparing them to more distant control cities, I assess the extent of positive or negative externalities generated by the Reformation. In other words, we drop the original Protestant hubs from the spillover analysis and reclassify non-Protestant cities within a 50 km radius of these hubs as treated.

Finally, to account for the historical context and ensure the relevance of my findings, I interact century dummies with predetermined city characteristics, such as proximity to significant landmarks like Mainz and Wittenberg, historical infrastructure like Roman roads, and features like thermal baths, bridges, and castles. These interactions allow us to control for historical economic and social factors that could influence urban growth independently of religious reforms. I also examine the impact of religious shifts by interacting century dummies with the dominant religion variable, capturing the broader socio-religious transformations of the era.

To operationalize my empirical strategy, and account for the potential endogeneity of Protestantism, I incorporate the two-way fixed effects model as proposed by Wooldridge (2023), which can be represented as:

$$E(y_{it}|d_i f_i) = exp(\eta + \sum_{q=700}^{1700} \lambda_q w_{iq} d_{iq} f_{iq} + \sum_{r=700}^{1700} \omega_r f_{ir} + \sum_{s=700}^{1700} \omega_s f_{is} + \sum_{u=700}^{1700} \theta_u d_{iu} t_t + \mu_c) \quad (3.1)$$

where, $E(y_{it}|d_i f_i)$ is the expected value of the outcome y for city i at time t, conditioned on cohorts d and century dummies f, η is a constant term, d_{iq} is a binary variable for different cohorts, f_i represents century time dummies, w_{iq} denotes the treatment dummy, X is set of all demeaned time invariant covariates, t_t indicates the heterogenous linear time trends, $\lambda_q, \tau_r, \omega_s, \theta_u$ are the coefficients to be estimated and μ_c captures city-specific fixed effects, accounting for time-invariant unobserved heterogeneity that may influence the outcome y across cities.

It is important to note at the outset that in this estimating framework, the coefficients λ represent my DiD estimate of the average treatment effect of the shift to the Protestantism on the respective city's population, that varies by cohort and century, and that can be interpreted as a percentage effect of the baseline mean, i.e. the percentage change in the average outcome for the Protestant towns in the post-treatment period (Chen & Roth, 2024).

3.6   Results

In this section, I present the results of my empirical analysis, examining the long-term impact of Protestantism on urban development in Europe between 1500 and 1800. Using a Difference-in-Differences approach with multiple model specifications, I estimate the Average Treatment Effect on the Treated (ATT) across different periods, geographic regions, and city cohorts. The analysis includes six baseline models (Model 1a to Model 3b), with variations in the inclusion of time-invariant covariates, regional linear trends at the NUTS1 and NUTS2 levels, and cohort-specific linear trends. Additionally, spatially robust standard errors account for potential spatial autocorrelation among nearby cities.

The results are presented across various time cohorts, allowing us to observe the heterogeneous effects of Protestantism on urban growth. I begin by analysing the overall ATT across all cities in the sample, followed by a more granular examination of the effects by cohort and semicentennial periods. This approach enables us to explore how the timing of Protestantism adoption influences economic outcomes and whether the length of exposure to Protestantism plays a significant role in shaping urban development.

3.6.1   Baseline results

Table 3. **4** presents the Average Treatment Effect on the Treated (ATT) for Protestant cities, analysed by cohort and semicentennial periods. The ATT estimates are derived from six model specifications (Model 1a to Model 3b), with variations that account for different covariates and linear time trends at the NUTS1 and NUTS2 levels, as well as cohort-specific linear trends. All models include city and century fixed effects, with spatially robust standard errors calculated within a 50km radius to account for potential spatial autocorrelation.

The overall ATT results show a positive but generally imprecise impact of Protestantism on urban growth. Model 2b, which includes time-invariant covariates and NUTS1 linear trends, displays a highly significant positive effect (0.161), indicating that when controlling for these factors, Protestantism had a favourable impact on urban growth. The other models, however, show more mixed results. In Model 1b and Model 3b, the estimates are significant at the 10% level, suggesting some variation in the effect of Protestantism across different model specifications.

Looking at the results by cohort and semicentennial periods, cities that adopted Protestantism in the earlier periods generally exhibit negative effects on urban growth. Notably, cities that shifted to Protestantism in the cohort of 1500 display a significant negative impact across multiple models in 1700, with coefficients reaching as low as -0.347 in Model 2a. This suggests that early adopters of Protestantism experienced slower urban growth compared to their counterparts. Conversely,

cities that converted during the later semicentennial periods show more positive effects, with Model 3b reporting a highly significant positive impact of 0.526 for cities converting in 1700. This indicates that the economic effects of Protestantism were more favourable for cities that adopted the religion later in the period.

Overall, the most robust specification—Model 3b—provides clear evidence that the timing of Protestant adoption plays a critical role on urban growth. By incorporating NUTS2 linear time trends and interactions of time-invariant characteristics with period dummies, Model 3b controls effectively for both geographical and historical heterogeneity. Under this specification, cities that adopted Protestantism early (pre-1650) experienced no significant effect on urban growth, whereas later adopters (post-1650) exhibited a modest, mildly significant positive impact. These findings emphasize that, in the absence of a natural experiment, stringent exogenous controls are essential for identifying the causal effect of Protestantism on urban development, and they highlight the nuanced role of timing in shaping the long-term economic consequences of the Reformation.

Table 3. 4 ATT by cohort and semicentennial - Baseline models (Spatial robust S.E. 50km)

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	0.020	**0.123***	-0.013	**0.161***	0.026	**0.098***
	(0.070)	**(0.066)**	(0.063)	**(0.060)**	(0.060)	**(0.055)**
By cohort and semicentennial						
d1550f1550	**-0.079****	0.046	**-0.077****	0.071	0.002	0.001
	(0.036)	(0.056)	**(0.035)**	(0.061)	(0.057)	(0.062)
d1550f1600	**-0.149***	0.060	**-0.147***	0.105	-0.067	0.002
	(0.081)	(0.080)	**(0.076)**	(0.081)	(0.086)	(0.086)
d1550f1650	**-0.248****	0.074	**-0.261*****	0.125	-0.161	-0.007
	(0.102)	(0.094)	**(0.090)**	(0.093)	(0.106)	(0.104)
d1550f1700	**-0.319****	0.112	**-0.347*****	0.141	**-0.231***	-0.021
	(0.129)	(0.116)	(0.110)	(0.115)	**(0.134)**	(0.133)
d1600f1600	0.094	0.064	0.063	0.072	0.030	0.054
	(0.073)	(0.072)	(0.062)	(0.047)	(0.049)	(0.043)
d1600f1650	0.158	0.110	0.094	**0.110***	0.028	0.052
	(0.121)	(0.112)	(0.098)	**(0.066)**	(0.062)	(0.051)
d1600f1700	0.174	0.135	0.067	0.109	-0.055	-0.010
	(0.180)	(0.167)	(0.146)	(0.106)	(0.070)	(0.065)
d1650f1650	0.073	**0.142****	0.074	**0.225*****	**0.145*****	**0.208*****
	(0.080)	**(0.072)**	(0.076)	**(0.051)**	**(0.054)**	**(0.048)**
d1650f1700	0.032	0.068	0.029	**0.191****	0.130	**0.177****
	(0.130)	(0.105)	(0.125)	**(0.080)**	(0.080)	**(0.075)**
d1700f1700	**0.461***	**0.417****	0.371	0.461	0.443	**0.526***
	(0.259)	**(0.212)**	(0.308)	(0.323)	(0.319)	**(0.312)**
Observations	8,272	8,272	8,128	8,128	7,760	7,760
No. of cities	1,034	1,034	1,016	1,016	970	970
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

Table 3. 5 provides the Average Treatment Effects (ATT) by semicentennial periods for Protestant cities. The analysis is conducted across six models (Model 1a to Model 3b), with varying model specifications that include city and century fixed effects, cohort-specific linear trends, and linear time trends at the NUTS1 and NUTS2 levels. The standard errors are spatially robust within a 50km radius, accounting for potential spatial autocorrelation among cities.

For cities converting to Protestantism between 1550 and 1600, the ATT estimates reveal consistently negative and statistically significant impacts across multiple models. Model 1a reports an ATT of -0.079 ($p < 0.05$), while Model 2a also highlights a significant reduction in urban growth (-0.077; $p < 0.05$). This suggests that early adoption of Protestantism disrupted economic structures, likely due to institutional realignments and sociopolitical instability during this transitional period. Models incorporating additional covariates (e.g., Model 1b) show no significant effects, indicating potential heterogeneity in these early impacts.

The results for the 1600-1650 period, on the other hand exhibit mixed outcomes, with ATT estimates mostly insignificant across the models. Model 2b is an exception, indicating a positive ATT (0.088; $p < 0.10$) for this period. The lack of consistent findings suggests that the initial disruptive effects of Protestantism began to stabilize, leading to more neutral economic outcomes. Cities adopting Protestantism between 1650 and 1700 show a more varied impact. Model 2b presents a significant positive ATT (0.153; $p < 0.05$), while Model 3b indicates a weaker but still significant positive effect (0.084; $p < 0.10$). These results imply that cities in this period started to recover, possibly benefiting from institutional and cultural reforms initiated by Protestant governance. However, the lack of consistent significance across models highlights the continued heterogeneity in outcomes.

In the 1700-1750 semicentennial, the ATT estimates generally turn positive, with Models 1b (0.183; $p < 0.10$) and 2b (0.226; $p < 0.05$) reporting statistically significant results. These findings indicate that cities adopting Protestantism in this later period experienced favourable economic conditions,

potentially driven by the maturation of Protestant institutional frameworks and their alignment with economic growth dynamics.

The findings underscore a temporal dimension to the economic effects of Protestantism on urban growth. Early adopters (1550-1600) faced significant economic challenges, while later adopters (1700-1750) benefited from evolving institutional and cultural reforms. The mixed results for intermediate periods (1600-1650 and 1650-1700) highlight the complexity of the transition, with outcomes influenced by varying local conditions and timing.

Overall, the findings of the most robust specification—where NUTS2 linear time trends and interactions between time-invariant covariates and period dummies are employed— underscore the critical role of conversion timing: while early adoption appears to yield no discernible benefit in terms of urban growth, later conversion is associated with modest economic gains, reflecting the maturation of Protestant institutions and the evolving socio-cultural and economic context over time.

Table 3. 5 ATT by semicentennial - Baseline models (Spatial robust S.E. 50km)

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
By semicentennial						
1550-1600	**-0.079****	0.046	**-0.077****	0.071	0.002	0.001
	(0.036)	(0.056)	**(0.035)**	(0.061)	(0.057)	(0.062)
1600-1650	-0.027	0.062	-0.042	**0.088***	-0.019	0.028
	(0.063)	(0.059)	(0.057)	**(0.051)**	(0.056)	(0.051)
1650-1700	-0.006	0.109	-0.031	**0.153****	0.004	**0.084***
	(0.072)	(0.067)	(0.061)	**(0.05)**	(0.054)	**(0.045)**
1700-1750	0.087	**0.183***	0.030	**0.226****	0.071	**0.168***
	(0.103)	**(0.096)**	(0.101)	**(0.103)**	(0.097)	**(0.094)**
Observations	8,272	8,272	8,128	8,128	7,760	7,760
No. of cities	1,034	1,034	1,016	1,016	970	970
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

Table 3. 6 provides an overview of the Average Treatment Effects (ATT) by cohort for cities adopting Protestantism in four key periods (1550-1600, 1600-1650, 1650-1700, and 1700-1750), using a variety of model specifications. The models (1a to 3b) include time-invariant covariates, city fixed effects, and regional linear trends at both NUTS1 and NUTS2 levels, with spatially robust standard errors accounting for potential spatial autocorrelation.

The results reveal that cities converting to Protestantism during the early cohort of 1550-1600 faced significant negative effects on urban growth. Across the models, the ATT estimates are consistently negative, with coefficients ranging from -0.199 in Model 1a (significant at the 5% level) to -0.208 in Model 3a (significant at the 1% level). These findings suggest that early adopters

of Protestantism experienced notable economic disruptions, likely due to the instability and societal upheavals associated with the initial phases of religious transition. Interestingly, the inclusion of time-invariant covariates in certain models, such as Model 1b, mitigates the magnitude of the effect, rendering it statistically insignificant. This indicates that contextual factors, such as geographical or pre-existing institutional characteristics, may have moderated these early impacts.

For the 1600-1650 cohort, the ATT estimates shift directionally positive, with coefficients such as 0.142 in Model 1a and 0.103 in Model 1b. However, these effects are not statistically robust across specifications, reflecting a mixed economic outcome for cities transitioning during this period. The results imply that while the disruptive effects of Protestant adoption seen in earlier cohorts may have diminished, the economic benefits of conversion were not yet fully realized during this phase.

In contrast, cities adopting Protestantism between 1650 and 1700 demonstrate more consistent and positive impacts on urban growth. Several models report statistically significant effects, including Model 2b with an ATT of 0.208 (significant at the 1% level) and Model 3b with an ATT of 0.193 (also significant at the 1% level). These results indicate a turning point, where Protestant adoption aligns more closely with urban growth advantages, likely reflecting the stabilization of Protestant institutions and their integration into local economic frameworks.

Finally, for the 1700-1750 cohort, the ATT estimates are uniformly positive and notably larger in magnitude, such as 0.461 in Model 1a and 0.526 in Model 3b. Despite the large coefficients, these estimates are less precise due to substantial standard errors, resulting in a lack of consistent statistical significance. Nevertheless, the overall trend suggests that cities converting to Protestantism during this later period may have benefited from more favourable economic conditions and the cumulative effects of earlier institutional reforms.

In summary, the results from the most robust specification (Model 3b) of Table 3. 6 reveals clear heterogeneity in the economic impact of Protestantism when analysed by conversion cohort. For

cities converting in the earliest cohort (1550–1600), the estimated effect on urban growth is essentially null, indicating that early adopters did not benefit significantly—likely reflecting the persistent disruptions and institutional turbulence of the initial conversion phase. In contrast, cities converting during the mid-period (1650–1700) exhibit a moderate positive effect on urban growth, suggesting that by this time the institutional and cultural reforms had begun to stabilize. The most pronounced benefits are observed among late adopters (1700–1750), where the positive impact on urban growth is strongest, albeit with somewhat less precision. Overall, these findings underscore that the timing of Protestant conversion is crucial: while early conversion yielded little to no economic advantage, later adoption appears to have fostered modest, progressively greater urban growth, reflecting the maturation of Protestant institutions and associated cultural shifts over time.

Table 3. 6 ATT by cohort – Baseline models (Spatial robust S.E. 50km)

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
By cohort						
1550-1600	**-0.199****	0.073	**-0.208*****	0.111	-0.114	-0.006
	(0.083)	(0.080)	**(0.074)**	(0.082)	(0.092)	(0.092)
1600-1650	0.142	0.103	0.075	0.097	0.001	0.032
	(0.123)	(0.114)	(0.099)	(0.068)	(0.057)	(0.049)
1650-1700	0.053	0.105	0.052	**0.208*****	**0.137****	**0.193*****
	(0.104)	(0.086)	(0.100)	**(0.064)**	**(0.065)**	**(0.059)**
1700-1750	0.461	0.417	0.371	0.461	0.443	0.526
	(0.259)	(0.212)	(0.308)	(0.323)	(0.319)	(0.312)
Observations	8,272	8,272	8,128	8,128	7,760	7,760
No. of cities	1,034	1,034	1,016	1,016	970	970
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

Table 3. 7 presents the Average Treatment Effects (ATT) by semicentennials of exposure, analysing how cities' urban growth was affected by Protestantism over different periods of exposure. The table includes results from six model specifications (Models 1a through 3b), where varying covariates, city fixed effects, and regional trends (NUTS1 and NUTS2) are considered. Spatially robust standard errors account for spatial autocorrelation.

For cities with zero semicentennials of exposure, representing the immediate effects of Protestantism, the analysis indicates a modest positive impact on urban growth. Coefficients range from 0.137 in Model 1a to 0.167 in Model 1b, with statistical significance in models that include time-invariant covariates. These results suggest that early adopters of Protestantism experienced initial urban growth benefits, likely due to reforms emphasizing education, governance, and

economic activities. However, these positive effects are not consistent across all models, indicating variability in the short-term impacts.

When exposure extends to one semicentennial, the effects become negligible, with coefficients near zero across most model specifications. For instance, Model 1a shows an ATT of 0.014, while Model 2a reports -0.008. These findings suggest that the initial advantages associated with Protestantism dissipated relatively quickly, and one semicentennial of exposure had no significant impact on urban growth.

The analysis of cities exposed for two semicentennials reveals negative ATT estimates, with Model 3a reporting a coefficient of -0.176. Although these effects are not consistently statistically significant, the results point to the possibility that prolonged exposure to Protestantism began to have adverse effects on urban development, potentially due to resource reallocations or disruptions caused by religious and economic shifts.

The most pronounced negative impacts emerge for cities with three semicentennials of exposure. Models 1a, 2a, and 3a report statistically significant negative coefficients ranging from -0.319 to -0.372, underscoring the detrimental effects of sustained Protestant influence on urban growth over time. These findings highlight a clear trend where prolonged exposure appears to erode the early benefits of Protestantism, possibly due to institutional rigidity, resource constraints, or sociopolitical tensions that emerged in the long term.

Overall, the most robust specification (Model 3b) of Table 3. 7 underscores the time-sensitive nature of Protestantism's impact on urban growth. While short-term exposure provided modest growth benefits, these gains diminished over time and turned negative with extended exposure. This consistent pattern across models highlights the complex and evolving effects of Protestantism on economic development, emphasizing the importance of temporal dynamics in understanding the historical interplay between religion and urbanisation.

Table 3. 7 ATT by semicentennials of exposure – Baseline models (Spatial robust S.E. 50km)

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
By semicentennials of exposure						
0 semi-centennials	0.137	**0.167***	0.108	**0.207**	0.155	**0.197**
	(0.074)	**(0.064)**	(0.083)	**(0.085)**	(0.085)	**(0.082)**
1 semi-centennial	0.014	0.079	-0.008	**0.135***	0.030	**0.077***
	(0.075)	(0.067)	(0.065)	**(0.050)**	(0.052)	**(0.044)**
2 semi-centennials	-0.074	0.104	-0.097	0.117	-0.108	-0.009
	(0.224)	(0.107)	(0.092)	(0.081)	(0.071)	(0.063)
3 semi-centennials	**-0.319**	0.112	**-0.347***	0.141	**-0.231***	-0.021
	(0.129)	(0.116)	**(0.110)**	(0.115)	**(0.134)**	(0.133)
Observations	8,272	8,272	8,128	8,128	7,760	7,760
No. of cities	1,034	1,034	1,016	1,016	970	970
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

3.6.2 Robustness checks

To ensure the reliability of my findings, a series of robustness checks were conducted. These checks aim to test the consistency of the results under different assumptions, adjustments, and model specifications. One key element in this analysis is examining potential spillover effects, which account for the influence that nearby cities might have had on each other's development. I assess whether cities located within a 50km radius of Protestant cities experienced significant spillovers in urban growth. Spillover effects were examined by analysing the Average Treatment Effect on the Treated (ATT) by semicentennials and cohorts, as presented in Table 3. 8 and Table 3. 9, across six model specifications (Models 1a through 3b). These specifications include time-

invariant covariates, city fixed effects, and regional trends at the NUTS1 and NUTS2 levels, with spatially robust standard errors applied to account for spatial autocorrelation.

Table 3. 8 presents the ATT by semicentennial, analysing potential spillover effects from Protestant cities to nearby ones within a 50km range. The results across all model specifications (Models 1a through 3b) reveal notable temporal patterns. For the 1550-1600 semicentennial, the ATE estimates are generally positive but not statistically significant across all models. Coefficients range from 0.026 in Model 1a to 0.065 in Model 3b, suggesting that neighbouring cities' urban growth was not significantly influenced by early Protestant hubs during this period.

The 1600-1650 semicentennial shows a shift toward negative ATT values, though these remain statistically insignificant across all models. Coefficients range from -0.166 in Model 1a to -0.088 in Model 3b. While these results do not reach statistical significance, they hint at emerging adverse effects on neighbouring cities' growth during this period.

In contrast, the 1650-1700 semicentennial exhibits consistently negative and significant spillover effects in some models. For example, Model 1a reports a coefficient of -0.281, and Model 2a shows -0.243. These findings suggest that cities within 50km of Protestant hubs experienced measurable declines in urban growth during this period, potentially due to competition for resources or other disruptive effects.

By the 1700-1750 semicentennial, the negative spillover effects persist but weaken slightly. For instance, Model 1a reports a coefficient of -0.249, while Model 3a shows -0.122. Although these effects are less pronounced than in the previous semicentennial, they remain notable and underscore the lingering challenges faced by neighbouring cities during this time.

Overall, the most robust specification (Model 3b) of Table 3. 8 highlights a complex pattern of spillover effects. The early semicentennial (1550-1600) shows minimal impact, while subsequent periods reveal increasing negative but not significant effects on neighbouring cities' growth,

peaking in the 1650-1700 semicentennial. By the 1700-1750 period, these adverse effects begin to taper off. These findings emphasize the dynamic nature of Protestantism's regional influence on urban development over time.

Table 3. 8 ATT by semicentennial - Spillovers effect at 50km

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	**-0.214***	-0.158	-0.177	-0.134	-0.127	-0.094
	(0.130)	(0.137)	(0.128)	(0.141)	(0.126)	(0.136)
By semicentennial						
1550-1600	0.026	0.055	0.039	0.059	0.049	0.065
	(0.145)	(0.151)	(0.146)	(0.158)	(0.146)	(0.159)
1600-1650	-0.166	-0.111	-0.143	-0.097	-0.120	-0.088
	(0.127)	(0.145)	(0.127)	(0.148)	(0.126)	(0.143)
1650-1700	**-0.281****	-0.232	**-0.243***	-0.201	-0.198	-0.158
	(0.141)	(0.145)	**(0.140)**	(0.149)	(0.138)	(0.144)
1700-1750	**-0.249***	-0.180	-0.198	-0.151	-0.122	-0.090
	(0.146)	(0.148)	(0.142)	(0.149)	(0.137)	(0.142)
Observations	8,272	8,272	8,128	8,128	7,760	7,760
No. of cities	1,034	1,034	1,016	1,016	970	970
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

Table 3. 9 presents the Average Treatment Effect on the Treated (ATT) by cohort for cities within 50km of Protestant centres, examining potential spillover effects. For the 1550-1600 cohort, the spillover effects are consistently negative but statistically insignificant across all models. Coefficients range from -0.296 in Model 1a to -0.100 in Model 3b, indicating no robust evidence of significant growth effects for neighbouring cities during this early period. These results suggest

that proximity to early Protestant adopters did not yield meaningful urban growth impacts, either positive or negative, for nearby cities.

The 1600-1650 cohort presents the most consistent findings, with statistically significant and negative spillover effects across nearly all models. For instance, Model 1a estimates an ATT of -0.253 (p < 0.01), while Model 3b reports -0.192 (p < 0.01). These results indicate that cities within 50km of Protestant hubs experienced a notable decline in urban growth during this period. The consistent significance of these estimates suggests that the regional influence of Protestant hubs became more disruptive during this cohort.

In contrast, the 1650-1700 cohort reveals less pronounced and generally insignificant spillover effects. Coefficients range from -0.127 in Model 1a to -0.031 in Model 3b, with none achieving statistical significance. This lack of strong effects suggests a stabilization or reduction in the disruptive regional influence of Protestantism during this period.

The 1700-1750 cohort demonstrates a shift to positive spillover effects, with several coefficients achieving statistical significance. For example, Model 3a reports an ATT of 0.126 (p < 0.05), while Model 3b estimates 0.091 (p < 0.10). These findings imply that by this later period, proximity to Protestant hubs may have begun to confer economic benefits to neighbouring cities, potentially due to matured institutional frameworks, shared trade networks, or knowledge diffusion.

Overall, focusing on the most robust specification—Model 3b—Table 3. 9 reveals a dynamic evolution in the spillover effects of Protestantism. For the earliest cohort (1550–1600), the spillover effect is negligible, with an ATT statistically indistinguishable from zero. In the subsequent cohort (1600–1650), the effect becomes significantly negative, indicating that non-Protestant cities in close proximity to Protestant hubs experienced reduced urban growth relative to those further away. Moving to the 1650–1700 cohort, the negative spillover effect weakens and is no longer statistically significant. Finally, for the latest cohort (1700–1750), the spillover effect

turns positive, suggesting that over time the external benefits of Protestant development begin to extend to neighbouring cities. These findings highlight the temporal and contextual complexities of Protestantism's regional influence on urban growth.

Table 3. 9 ATT by cohort – Spillovers effect at 50km

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
By cohort						
1550-1600	-0.296	-0.134	-0.254	-0.118	-0.205	-0.100
	(0.300)	(0.327)	(0.304)	(0.339)	(0.302)	(0.332)
1600-1650	**-0.253***	**-0.260***	**-0.215**	**-0.234***	**-0.169**	**-0.192***
	(0.078)	**(0.074)**	**(0.072)**	**(0.071)**	**(0.071)**	**(0.069)**
1650-1700	-0.127	-0.170	-0.088	-0.120	-0.035	-0.031
	(0.115)	(0.130)	(0.109)	(0.114)	(0.106)	(0.096)
1700-1750	0.053	0.074	0.072	0.072	**0.126****	**0.091***
	(0.069)	(0.053)	(0.063)	(0.049)	**(0.057)**	**(0.053)**
Observations	8,272	8,272	8,128	8,128	7,760	7,760
No. of cities	1,034	1,034	1,016	1,016	970	970
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

3.6.3 Channels of Reformation impact on urban growth

To comprehensively understand the mechanisms through which the Protestant Reformation influenced urban economic development, this section delves into several channels that have emerged from the historical and economic analysis provided in this study.

Educational Reforms and Human Capital Development

One of the critical pathways through which Protestantism influenced economic development was through educational reforms. Protestant regions emphasized literacy and education, aligning with the belief that individuals should read and interpret religious texts independently. This emphasis on literacy facilitated the accumulation of human capital, which, in turn, spurred economic growth in urban centres. Empirical studies, such as those by Becker and Woessmann (2009), underscore the correlation between Protestantism's educational initiatives and increased   productivity educational push also extended beyond Europe, influencing education and economic outcomes in colonized regions, as shown by Gallego and Woodberry (2010) in Africa and Mantovanelli (2014) in India.

Institutional and Governance Reforms

The Reformation also prompted significant changes in governance and institutional structures. Protestant cities often developed more efficient and transparent administrative systems, fostering economic environments conducive to growth. Stronger legal frameworks and reduced corruption emerged as Protestant ethics emphasized accountability and moral governance. (D. C. North, 1973) and Thomas (1973) argue that the institutional reforms initiated during this period were pivotal in establishing stronger property rights and reducing corruption, which facilitated economic development. Additionally, Acemoglu et al. (2005) highlight how these institutional transformations provided a foundation for sustained economic progress by ensuring transparency and accountability.

Studies emphasize that institutional changes facilitated greater investment in infrastructure and urban development, further accelerating economic progress (Becker & Woessmann, 2009). The Protestant work ethic, with its emphasis on discipline and efficiency, played a crucial role in reshaping the organizational structures of cities, making them more attractive for commerce and trade. La Porta et al. (1999) provide evidence on how improved governance quality, which Protestant reforms promoted, is linked to better economic performance. Moreover, Ekelund,

Hébert, and Tollison (2002) explore how the Reformation led to a significant restructuring of economic and governance systems, viewing these changes as a direct response to the inefficiencies and monopolistic practices of the Catholic Church.

Social Capital and Trust Networks

Another important mechanism was the transformation of social capital. Protestant regions exhibited higher levels of social trust and civic engagement, which were essential for facilitating economic transactions and fostering community-based economic initiatives. High trust levels reduced transaction costs and encouraged investment in public goods. Research by Delhey and Newton (2005) and Glaeser et al. (2000) demonstrates the positive economic effects of enhanced social cooperation in Protestant areas. Moreover, the sense of individual responsibility promoted by Protestant teachings reinforced a societal framework that valued reliability and industriousness, further strengthening urban economies.

Cultural and Entrepreneurial Shifts

The Reformation instigated cultural changes that favoured entrepreneurial activities. By promoting individualism and a strong work ethic, Protestantism provided a cultural foundation for innovation and risk-taking. Nunziata and Rocco (2016) highlight how Protestant values fostered entrepreneurship and economic dynamism in various urban settings. This cultural transformation also had long-term effects, as cities with a Protestant heritage continued to exhibit higher levels of entrepreneurship and economic flexibility well into the modern era.

Technological Advancements and Knowledge Diffusion

The Reformation also contributed to the spread of technological advancements, most notably through the proliferation of the printing press. The mass production of religious texts catalysed information dissemination, transforming cities into hubs of knowledge exchange. (Rubin, 2014)

finds a significant association between the presence of printing presses and the spread of Protestantism, which facilitated economic development through increased access to information and communication technologies. This diffusion of knowledge not only advanced religious ideas but also economic operations, as informed and literate populations were better equipped to engage in trade, science, and governance.

Economic and Geographic Spillover Effects

Finally, the spatial analysis in this study identifies significant spillover effects of the Reformation. Cities located near Protestant hubs experienced economic growth over time, benefiting from shared trade networks, institutional practices, and knowledge transfers. Initially, however, some neighbouring regions suffered economic disruptions due to resource realignments and migration patterns. As Protestant economic principles and institutions matured, these spillover effects became more positive, enhancing urban development across wider geographic areas. Research by Becker and Woessmann (2009) supports this, demonstrating how educational and economic reforms in Protestant regions positively influenced nearby areas, spreading growth beyond their immediate borders.

3.7   Concluding remarks

This study investigates the long-term economic impact of the Protestant Reformation on urban development in Europe between 1500 and 1800, using urbanisation as a proxy for economic growth. I employed a staggered Difference-in-Differences (DID) methodology combined with a modified Poisson model to account for data skewness and biases. My approach allowed for varying impacts across cohorts and time while addressing parallel trend violations through the inclusion of cohort-specific time trends, NUTS1 and NUTS2 regional trends, and interactions between predetermined characteristics and century fixed effects. Spatially robust standard errors were also

utilized to control for spatial dependence between cities. This methodological rigor ensures that my findings are robust and credible.

The results show that cities adopting Protestantism in the earlier years experienced negative economic impacts, while those adopting later saw more moderate or even positive effects, although the latter were often not statistically significant. The duration of exposure to Protestantism was also key: short exposure led to limited but positive effects on urban growth, whereas prolonged exposure generally resulted in negative outcomes, indicating a diminishing benefit over time. Additionally, my findings reveal significant spatial spillovers. Cities within a 50 to 100 km radius of Protestant centres initially experienced negative spillovers, which gradually turned positive as distance and time progressed, suggesting a slow diffusion of economic benefits.

Overall, the methodology highlights the importance of accounting for both temporal and spatial heterogeneity in studying the economic effects of institutional changes. The findings contribute to the literature by providing a comprehensive understanding of how Protestantism influenced urban development, emphasizing that the Reformation's economic impact was neither uniform nor immediate across Europe. This study underscores the complex relationship between religion and economic growth, with implications for future research on the broader effects of religious and institutional transformations.

Conclusions

This dissertation investigates the multifaceted relationships between historical events, governance structures, education, and cultural transformations in shaping urban and regional economic development, through the lens of policy impact evaluation. Each of the three chapters provides empirical and theoretical insights into how governance, education, and cultural shifts influence urban and regional economic trajectories. By bridging the fields of urban and regional economics, economic history, and institutional analysis, this dissertation offers a comprehensive understanding of the long-term drivers of economic development and their policy implications based on unique datasets developed for this purpose.

In the first chapter, I investigate the economic impacts of Greece's "Kallikratis Plan," a large-scale municipal amalgamation reform implemented during a period of fiscal crisis. My analysis reveals that the reform significantly reduced per capita investments, likely due to pre-existing fiscal trends, while its effects on current costs and total revenues were negligible. These findings challenge the assumption that municipal consolidation inherently enhances fiscal efficiency and highlight the importance of tailoring governance reforms to local contexts. This chapter underscores the complexities of structural reforms, emphasizing that the success of such policies depends on careful implementation and consideration of regional differences.

In the second chapter, I explore the transformative role of universities in fostering urbanization and regional development over the long term in pre-industrial Europe. Using historical data and advanced econometric methods, I demonstrate that universities were catalysts for human capital formation, innovation, and economic activity in their host cities. This chapter highlights the dual nature of universities as engines of local growth and sources of regional disparities, providing valuable insights for policymakers seeking to balance educational investments with equitable regional development.

The third chapter focuses on the economic repercussions of the Protestant Reformation, examining how religious and cultural transformations shaped urban growth and economic behaviour. My findings show that early conversions to Protestantism often disrupted urban development due to social and institutional upheaval, while later conversions had more moderate impacts, benefiting from institutional and educational advancements. Protestant cities frequently attracted resources and talent from neighbouring regions, creating uneven economic outcomes. This chapter demonstrates the importance of timing, geography, and institutional capacity in determining the economic impacts of cultural shifts, offering lessons for understanding the intersection of ideology, governance, and economic development.

Together, these chapters highlight the interconnectedness of governance structures, educational institutions, and cultural transformations in shaping economic trajectories. By adopting a policy impact evaluation perspective, I provide empirical evidence that emphasizes the importance of local context, historical legacies, and institutional capacity in designing effective policies. These findings have significant implications for policymakers and scholars, demonstrating that structural reforms, educational investments, and cultural shifts must be carefully evaluated to account for their complex and often uneven effects.

Despite the strengths of this research, there are limitations that need to be acknowledged. The reliance on historical data, for instance, poses challenges in controlling for unobserved variables and potential measurement errors. Additionally, using urbanisation as a proxy for economic development may overlook other important economic activities, especially in rural areas. Methodologically, the assumptions inherent in the econometric models, such as parallel trends in Difference-in-Differences analysis, may not hold universally, particularly in the presence of spillover effects or spatial dependencies.

Future research could address these limitations by employing more granular and diverse datasets, exploring alternative measures of economic development, and incorporating contemporary

contexts. Investigating the role of universities in the digital age, analysing governance reforms across varied geopolitical settings, and studying the interplay between cultural shifts and technological advancements could yield valuable insights. Additionally, the use of advanced spatial models and network analysis could enhance our understanding of how economic and cultural transformations propagate across regions.

In conclusion, this dissertation contributes significantly to the understanding of how historical legacies, governance structures, and institutional reforms shape economic development, particularly through a policy evaluation lens. By linking education, governance, and cultural values to regional economic outcomes, I highlight the importance of evidence-based, context-sensitive approaches to fostering growth and prosperity. This work provides a foundation for future research and policy development, emphasizing the importance of understanding the historical and institutional drivers of economic growth and resilience.

References

Aaskoven, L. (2018). Polity age and political budget cycles: Evidence from a Danish municipal reform. *European Journal of Political Economy*, *52*, 75–84. https://doi.org/10.1016/j.ejpoleco.2017.05.002

Abramo, G., D'Angelo, C. A., & Solazzi, M. (2011). The relationship between scientists' research performance and the degree of internationalization of their research. *Scientometrics*, *86*(3), 629–643.

Accetturo, A., & Mocetti, S. (2019). Historical Origins and Developments of Italian Cities. *Italian Economic Journal*, *5*(2), Article 2. https://doi.org/10.1007/s40797-019-00097-w

Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, *91*(5), Article 5.

Acemoglu, D., Johnson, S., & Robinson, J. A. (2005). Institutions as a Fundamental Cause of Long-Run Growth. In *Handbook of Economic Growth* (Vol. 1, pp. 385–472). Elsevier. https://doi.org/10.1016/S1574-0684(05)01006-3

Addie, J.-P. D. (2017). From the urban university to universities in urban society. *Regional Studies*, *51*(7), 1089–1099.

Akai, N., & Sakata, M. (2002). Fiscal decentralization contributes to economic growth: Evidence from state-level cross-section data for the United States. *Journal of Urban Economics*, *52*(1), 93–108. https://doi.org/10.1016/S0094-1190(02)00018-9

Alesina, A., & Spolaore, E. (1997). On the number and size of nations. *Quarterly Journal of Economics*, *112*(4), 1026–1056. https://doi.org/10.1162/003355300555411

Allers, M. A., & Geertsema, J. B. (2016). The Effects of Local Government Amalgamation on Public Spending, Taxation, and Service Levels: Evidence From 15 Years of Municipal Consolidation. *Journal of Regional Science*, *56*(4), 659–682. https://doi.org/10.1111/jors.12268

Altbach, P. G. (1991). Patterns in higher education development: Toward the year 2000. *The Review of Higher Education*, *14*(3), 293–315.

Amendola, A., Barra, C., & Zotti, R. (2020). Does graduate human capital production increase local economic development? An instrumental variable approach. *Journal of Regional Science*, *60*(5), Article 5. https://doi.org/10.1111/jors.12490

Anderson, B. (1983). *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. Verso.

Angrist, J., & Pischke, J.-S. (2009). Mostly Harmless Econometrics: An Empiricist's Companion. In *Mostly Harmless Econometrics: An Empiricist's Companion*.

Autor, D. H. (2003). Outsourcing at Will: The Contribution of Unjust Dismissal Doctrine to the Growth of Employment Outsourcing. *Journal of Labor Economics*, *21*(1), 1–42. https://doi.org/10.1086/344122

Bairoch, P., Batou, J., & Pierre, C. (1988). *Population des villes européennes de 800 à 1850: Banque de données et analyse sommaire des résultats (la)* (Vol. 4). Librairie Droz.

Barber, L., Jetter, M., & Krieger, T. (2023). Foreshadowing Mars: Religiosity and Pre-Enlightenment Warfare. *CESifo Working Paper No. 10806*.

Beck, T. (2012). Legal institutions and economic development. In *The Oxford handbook of capitalism* (pp. 38–77). Oxford University Press Oxford.

Becker, G. S. (1964). *Human capital theory* (Vol. 1964). Columbia, New York.

Becker, S. O., Pfaff, S., & Rubin, J. (2016). Causes and consequences of the Protestant Reformation. *Explorations in Economic History*, *62*, 1–25. https://doi.org/10.1016/j.eeh.2016.07.007

Becker, S. O., Rubin, J., & Woessmann, L. (2021). Religion in economic history: A survey. In *The Handbook of Historical Economics* (pp. 585–639).

Becker, S. O., Rubin, J., & Woessmann, L. (2023). Religion and Growth. *CESifo Working Paper No. 10688*.

Becker, S. O., & Voth, H.-J. (2023). From the Death of God to the Rise of Hitler. *CESifo Working Paper No. 10730*.

Becker, S. O., & Woessmann, L. (2009). Was Weber wrong? A human capital theory of Protestant economic history. *The Quarterly Journal of Economics*, *124*(2), 531–596. https://academic.oup.com/qje/article-abstract/124/2/531/1905076

Bender, T. (1988). *The University and the City: From Medieval Origins to the Present*. Oxford University Press.

Benneworth, P., Charles, D., & Madanipour, A. (2010). Building localized interactions between universities and cities through university spatial development. *European Planning Studies*, *18*(10), Article 10.

Benos, N. (Nikos), Conti, M., Papazoglou, M., & Tsoumaris, S. (2024). *The Rise of Universities and Economic Development in Medieval and Early Modern Europe (700–1800)* (SSRN Scholarly Paper 4967505). Social Science Research Network. https://doi.org/10.2139/ssrn.4967505

Bertanha, M., & Moser, P. (2016). Spatial Errors in Count Data Regressions. *Journal of Econometric Methods*, *5*(1). https://doi.org/10.1515/jem-2014-0015

Besley, T., & Coate, S. (2003). Centralized versus decentralized provision of local public goods: A political economy approach. *Journal of Public Economic*, *87*, 2611–2637. https://doi.org/10.1016/S0047-2727(02)00141-X

Bhatti, Y., & Hansen, K. M. (2019). Voter turnout and municipal amalgamations—Evidence from Denmark. *Local Government Studies*, *45*(5), 697–723. https://doi.org/10.1080/03003930.2018.1563540

Blesse, S., & Baskaran, T. (2016). Do municipal mergers reduce costs? Evidence from a German federal state. *Regional Science and Urban Economics*, *59*, 54–74. https://doi.org/10.1016/j.regsciurbeco.2016.04.003

Blesse, S., & Roesel, F. (2019). Merging county administrations–cross-national evidence of fiscal and political effects. *Local Government Studies*, *45*(5), 611–631. https://doi.org/10.1080/03003930.2018.1501363

Blickle, P. (1992). *Communal reformation: The quest for salvation in sixteenth-century Germany* (Vol. 1). Brill.

Blizek, W. L., & Simpson, R. B. (1978). The urban university and urban culture. *The Urban Review*, *10*(4), Article 4.

Blom-Hansen, J. (2010). Municipal amalgamations and common pool problems: The danish local government reform in 2007. *Scandinavian Political Studies*, *33*(1), 51–73. https://doi.org/10.1111/j.1467-9477.2009.00239.x

Blom-Hansen, J., Houlberg, K., & Serritzlew, S. (2014). Size, democracy, and the economic costs of running the political system. *American Journal of Political Science*, *58*(4), 790–803. https://doi.org/10.1111/ajps.12096

Blom-Hansen, J., Houlberg, K., Serritzlew, S., & Treisman, D. (2016). Jurisdiction size and local government policy expenditure: Assessing the effect of municipal amalgamation. *American Political Science Review*, *110*(4), 812–831. https://doi.org/10.1017/S0003055416000320

Borusyak, K., Jaravel, X., & Spiess, J. (2024). *Revisiting Event Study Designs: Robust and Efficient Estimation* (arXiv:2108.12419). arXiv. http://arxiv.org/abs/2108.12419

Boschma, R., & Fritsch, M. (2009). Creative class and regional growth: Empirical evidence from seven European countries. *Economic Geography*, *85*(4), Article 4.

Bosker, M., Buringh, E., & Zanden, J. L. van. (2013). From Baghdad to London: Unraveling urban development in Europe, the middle East, and North Africa, 800-1800. *Review of Economics and Statistics*, *95*(4), Article 4. https://doi.org/10.1162/REST_a_00284

Brad, S. G. (2015). *The Unintended Reformation: How a Religious Revolution Secularized Society*. Harvard University Press.

Brady, T. (1998). Communities, Politics, and Reformation in Early Modern Europe. In *Communities, Politics, and Reformation in Early Modern Europe*. Brill. https://brill.com/display/title/852

Bramwell, A., & Wolfe, D. A. (2008). Universities and regional economic development: The entrepreneurial University of Waterloo. *Research Policy*, *37*(8), 1175–1187. https://doi.org/10.1016/j.respol.2008.04.016

Braudel, F. (1982). *The Structures of Everyday Life: The Limits of the Possible. 15th-18th Century. Translated by S. Reynolds*. Harper and Row, New York. The Wheels of Commerce: Civilization and ….

Brennan, J., King, R., & Lebeau, Y. (2004). The role of universities in the transformation of societies. *Synthesis Report. Centre for Higher Education Research and Information/Association of Commonwealth Universities, UK, 72*.

Brueckner, J. K. (2006). Fiscal federalism and economic growth. *Journal of Public Economics*, *90*(10–11), 2107–2120. https://doi.org/10.1016/j.jpubeco.2006.05.003

Brueckner, M., & Lederman, D. (2017). *Inequality and GDP per capita: The Role of Initial Income. September*, 1–50.

Buggle, J. C. (2016). Law and social capital: Evidence from the Code Napoleon in Germany. *European Economic Review*, *87*, 148–175. https://www.sciencedirect.com/science/article/pii/S0014292116300873

Buringh, E. (2021). The Population of European Cities from 700 to 2000. *Research Data Journal for the Humanities and Social Sciences*, *6*(1), 1–18. https://doi.org/10.1163/24523666-06010003

Buringh, E., & van Zanden, J. L. (2009). Charting the 'Rise of the West': Manuscripts and Printed Books in Europe, A Long-Term Perspective from the Sixth through Eighteenth Centuries. *The Journal of Economic History*, *69*(2), 409–445.

Burke, P. (2013). *Social history of knowledge: From Gutenberg to Diderot*. John Wiley & Sons.

Burke, P. (2019). *The Italian Renaissance: Culture and Society in Italy*. Princeton University Press.

Burnett, A. N. (2023). University Attendance and the Development of a Correspondence Network: The Case of Basel, ca. 1500–1550. *Acta Universitatis Carolinae Historia Universitatis Carolinae Pragensis*, *63*(1), 175–185. https://www.ceeol.com/search/article-detail?id=1233037

Byrd, M. D. (2001). Back to the future for higher education: Medieval universities. *The Internet and Higher Education*, *4*(1), 1–7. https://doi.org/10.1016/S1096-7516(01)00044-6

Calciolari, S., Cristofoli, D., & Macciò, L. (2013). Explaining the Reactions of Swiss Municipalities to The 'Amalgamation Wave': At the crossroad of institutional, economic and political pressures. *Public Management Review*, *15*(4), 563–583. https://doi.org/10.1080/14719037.2012.698852

Callaway, B., & Sant'Anna, P. H. C. (2021). Difference-in-Differences with multiple time periods. *Journal of Econometrics*, *225*(2), 200–230. https://doi.org/10.1016/j.jeconom.2020.12.001

Cantoni, D. (2015). The economic effects of the Protestant Reformation: Testing the Weber hypothesis in the German lands. *Journal of the European Economic Association*, *13*(4), 561–598. https://doi.org/10.1111/jeea.12117

Cantoni, D., Dittmar, J., & Yuchtman, N. (2016). Reformation and Reallocation: Religious and Secular Economic Activity in Early Modern Germany. *CESifo Working Paper Series*, Article 6218. https://ideas.repec.org//p/ces/ceswps/_6218.html

Cantoni, D., Dittmar, J., & Yuchtman, N. (2018). Religious Competition and Reallocation: The Political Economy of Secularization in the Protestant Reformation*. *The Quarterly Journal of Economics*, *133*(4), 2037–2096. https://econpapers.repec.org/article/oupqjecon/v_3a133_3ay_3a2018_3ai_3a4_3ap_3a2037-2096..htm

Cantoni, D., & Yuchtman, N. (2014). Medieval universities, legal institutions, and the commercial revolution. *The Quarterly Journal of Economics*, *129*(2), Article 2.

Card, D. (1999). The Causal Effect of Education on Earnings. In O. C. Ashenfelter & D. Card (Eds.), *Handbook of Labor Economics* (Vol. 3, pp. 1801–1863). Elsevier. https://doi.org/10.1016/S1573-4463(99)03011-4

Chartier, R. (1989). *The cultural uses of print in early modern France*. Princeton University Press.

Chen, J., & Roth, J. (2024). Logs with Zeros? Some Problems and Solutions. *The Quarterly Journal of Economics*, *139*(2), 891–936. https://doi.org/10.1093/qje/qjad054

Chortareas, G., & Logothetis, V. E. (2016). Economics and politics of local Greek government. *Multi-Level Finance and the Euro Crisis: Causes and Effects*, 133–147. https://doi.org/10.4337/9781784715113.00014

Cinnirella, F., & Streb, J. (2017). The role of human capital and innovation in economic development: Evidence from post-Malthusian Prussia. *Journal of Economic Growth*, *22*, 193–227.

Cipolla, C. M. (2004). *Before the industrial revolution: European society and economy 1000-1700*. Routledge.

Clark, B. R. (1986). *The Higher Education System: Academic Organization in Cross-National Perspective*. University of California Press.

Cobban, T. W. (2019). Bigger Is Better: Reducing the Cost of Local Administration by Increasing Jurisdiction Size in Ontario, Canada, 1995–2010. *Urban Affairs Review*, *55*(2), 462–500. https://doi.org/10.1177/1078087417719324

Council of Europe. (2013). *Structure and operation of local and regional democracy—Greece Situation in 2012*.

Crow, M., Zori, C., & Zori, D. (2020). Doctrinal and physical marginality in Christian death: The burial of unbaptized infants in medieval Italy. *Religions*, *11*(12), 678.

Curuk, M., & Smulders, S. (2016). *Malthus Meets Luther: The Economics Behind the German Reformation* (SSRN Scholarly Paper 2828615). Social Science Research Network. https://doi.org/10.2139/ssrn.2828615

Davoodi, H., & Zou, H. F. (1998). Fiscal Decentralization and Economic Growth: A Cross-Country Study. *Journal of Urban Economics*, *43*(2), 244–257. https://doi.org/10.1006/JUEC.1997.2042

de Chaisemartin, C., & D'Haultfoeuille, X. (2023). *Difference-in-Differences Estimators of Intertemporal Treatment Effects* (arXiv:2007.04267). arXiv. http://arxiv.org/abs/2007.04267

De La Croix, D., Docquier, F., Fabre, A., & Stelter, R. (2023). The Academic Market and The Rise of Universities in Medieval and Early Modern Europe (1000–1800). *Journal of the European Economic Association*, jvad061. https://doi.org/10.1093/jeea/jvad061

de Ridder-Symoens, H. (Ed.). (1992). *A history of the university in Europe: Volume 1, Universities in the Middle Ages* (Vol. 1). Cambridge University Press.

Delhey, J., & Newton, K. (2005). Predicting cross-national levels of social trust: Global pattern or Nordic exceptionalism? *European Sociological Review*, *21*(4), 311–327. https://academic.oup.com/esr/article-abstract/21/4/311/556895

Dimitropoulos, G. (2012). The 'Kallikratis Program:' The Influence of International and European Policies on the Reforms of Greek Local Government. In *Istituzioni del Federalismo* (3/2012, Vol. 3).

Drew, J., Kortt, M. A., & Dollery, B. (2016). Did the Big Stick Work? An Empirical Assessment of Scale Economies and the Queensland Forced Amalgamation Program. *Local Government Studies*, *42*(1), 1–14. https://doi.org/10.1080/03003930.2013.874341

Drew, J., Razin, E., & Andrews, R. (2019). Rhetoric in municipal amalgamations: A comparative analysis. *Local Government Studies* , *45*(5), 748–767. https://doi.org/10.1080/03003930.2018.1530657

Drucker, J., & Goldstein, H. (2007). Assessing the regional economic development impacts of universities: A review of current approaches. *International Regional Science Review*, *30*(1), Article 1.

Eamon, W., & Paheau, F. (1984). The Accademia Segreta of Girolamo Ruscelli: A sixteenth-century Italian scientific society. *Isis*, *75*(2), 327–342.

Eisenstein, E. L. (1979). *The Printing Revolution in Early Modern Europe*. Cambridge University Press.

Ekelund, R. B. J., Hébert, R. F., & Tollison, R. (2008). *The marketplace of Christianity*. Mit Press.

Ekelund, R. B. Jr., Hébert, R. F., & Tollison, R. D. (2002). An Economic Analysis of the Protestant Reformation. *Journal of Political Economy*, *110*(3), 646–671. https://doi.org/10.1086/339721

Eknoyan, G. (2012). The Renaissance kidney—Nephrology in and about the sixteenth century. *Seminars in Dialysis*, *25*(4), 451–459.

European Commission. (2011). *The Economic Adjustment Programme for Greece Fourth Review-Spring 2011 Directorate-General for Economic and Financial Affairs.*

Eurostat. (2021). *Government revenue, expenditure and main aggregates.* https://ec.europa.eu/eurostat/databrowser/view/GOV_10A_MAIN__custom_1963057/default/table?lang=en

Fallah, B., Partridge, M. D., & Rickman, D. S. (2014). Geography and high-tech employment growth in US counties. *Journal of Economic Geography*, *14*(4), 683–720.

Fernández-Esquinas, M., & Pinto, H. (2014). The role of universities in urban regeneration: Reframing the analytical approach. *European Planning Studies*, *22*(7), 1462–1483. https://doi.org/10.1080/09654313.2013.791967

Ferraresi, M., Migali, G., & Rizzo, L. (2018). Does intermunicipal cooperation promote efficiency gains? Evidence from Italian municipal unions. *Journal of Regional Science*, *58*(5), Article 5. https://doi.org/10.1111/jors.12388

Figueroa, A. (2015). Education and human capital formation. In *Growth, Employment, Inequality, and the Environment: Unity of Knowledge in Economics: Volume II* (pp. 11–27). Palgrave Macmillan US.

Florida, R. (2005). The world is spiky. *Atlantic Monthly*, *296*(3), Article 3.

Foged, S. K. (2014). The Relationship Between Population Size and Contracting Out Public Services: Evidence from a Quasi-experiment in Danish Municipalities. In *Urban Affairs Review* (Vol. 52, Issue 3). https://doi.org/10.1177/1078087415591288

Fritz, B., & Feld, L. P. (2019). Common pool effects and local public debt in amalgamated municipalities. In *Public Choice* (Issue 0123456789). Springer US. https://doi.org/10.1007/s11127-019-00688-2

Fukuyama, F. (2001). Social capital, civil society and development. *Third World Quarterly*, *22*(1), 7–20. https://doi.org/10.1080/713701144

Gallego, F. A., & Woodberry, R. (2010). Christian missionaries and education in former African colonies: How competition mattered. *Journal of African Economies*, *19*(3), 294–329. https://academic.oup.com/jae/article-abstract/19/3/294/725105

Gardner, J. (2022). Two-stage differences in differences. *arXiv Preprint arXiv:2207.05943*.

Gelderblom, O. (2015). *Cities of Commerce: The Institutional Foundations of International Trade in the Low Countries, 1250-1650*. Princeton University Press.

Glaeser, E. (2011). *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier* (Reprint edition). Penguin Books.

Glaeser, E. L. (1994). Cities, information, and economic growth. *Cityscape*, *1*(1), 9–47.

Glaeser, E. L., Laibson, D. I., Scheinkman, J. A., & Soutter, C. L. (2000). Measuring Trust. *Quarterly Journal of Economics*, *115*(3), 811–846. https://doi.org/10.1162/003355300554926

Glaeser, E. L., & Saiz, A. (2004). The rise of the skilled city. *Brookings-Wharton Papers on Urban Affairs*, *2004*(1), Article 1.

Glaeser, E. L., Scheinkman, J. A., & Shleifer, A. (1995). Economic growth in a cross-section of cities. *Journal of Monetary Economics*, *36*(1), Article 1.

Glasson, J. (2003). The widening local and regional development impacts of the modern universities-a tale of two cities (and north-south perspectives). *Local Economy*, *18*(1), 21–37.

Goddard, J., Coombes, M., Kempton, L., & Vallance, P. (2014). Universities as anchor institutions in cities in a turbulent funding environment: Vulnerable institutions and vulnerable places in England. *Cambridge Journal of Regions, Economy and Society*, *7*(2), 307–325.

Goddard, J., & Kempton, L. (2016). *The civic university*.

Goldstein, H. A., & Renault, C. S. (2004). Contributions of universities to regional economic development: A quasi-experimental approach. *Regional Studies*, *38*(7), 733–746.

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, *225*(2), 254–277.

Government Gazette 87A/2010, L. 3852. (2010). *New architecture of self-government and decentralized administration. (KALLIKRATIS PROGRAMME).*

Grendler, P. F. (2004). The universities of the Renaissance and Reformation. *Renaissance Quarterly*, *57*(1), 1–42. https://www.cambridge.org/core/journals/renaissance-quarterly/article/universities-of-the-renaissance-and-reformation/9D9081CFBA90663F3727DE01F550D182

Grim, B. J., & Finke, R. (2010). *The price of freedom denied: Religious persecution and conflict in the twenty-first century*. Cambridge University Press.

Guiso, L., Sapienza, P., & Zingales, L. (2003). People's opium? Religion and economic attitudes. *Journal of Monetary Economics*, *50*(1), 225–282. https://www.sciencedirect.com/science/article/pii/S0304393202002027

Häberlein, M. (2012). *The Fuggers of Augsburg: Pursuing Wealth and Honor in Renaissance Germany*. University of Virginia Press.

Hagen, R. (2002). Globalization, university transformation and economic regeneration: A UK case study of public/private sector partnership. *International Journal of Public Sector Management*, *15*(3), 204–218.

Hanes, N. (2015). Amalgamation Impacts on Local Public Expenditures in Sweden. *Local Government Studies*, *41*(1), 63–77. https://doi.org/10.1080/03003930.2013.869496

Hanes, N., & Wikström, M. (2008). Does the local government structure affect population and income growth? An empirical analysis of the 1952 municipal reform in Sweden. *Regional Studies*, *42*(4), 593–604. https://doi.org/10.1080/00343400701281311

Hansen, S. W. (2019). Exploiting the common pool or looking to the future? A study of free-riding leading up to the 2007 municipal amalgamations in Denmark. *Local Government Studies*, *45*(5), 676–696. https://doi.org/10.1080/03003930.2019.1586673

Harris, M., & Holley, K. (2016). Universities as anchor institutions: Economic and social potential for urban development. In *Higher education: Handbook of theory and research*.

Haruaki, H., & Hideo, Y. (2016). Evaluation of the fiscal effect on municipal mergers: Quasi-experimental evidence from Japanese municipal data. *Munich Personal RePEc Archive, 72455*.

Heinisch, R., Lehner, T., Mühlböck, A., & Schimpf, C. H. (2018). How do municipal amalgamations affect turnout in local elections? Insights from the 2015 municipal reform in the Austrian state of Styria. *Local Government Studies, 44*(4), 465–491. https://doi.org/10.1080/03003930.2018.1465935

Hellenic Rebublic. (2019). *Hellenic Constitution.* https://www.hellenicparliament.gr/UserFiles/f3c70a23-7696-49db-9148-f24dce6a27c8/FEK 211-A-24-12-2019 NEO SYNTAGMA.pdf

Hellenic Statistical Authority. (2011). *Απογραφή Πληθυσμού-Κατοικιών 2011—ELSTAT.* https://www.statistics.gr/2011-census-pop-hous

Hellenic Statistical Authority. (2019). *Digital library of the Hellenic Statistical Authority.* http://dlib.statistics.gr/portal/page/portal/ESYE/complexsearch

Hinnerich, B. T. (2009). Do merging local governments free ride on their counterparts when facing boundary reform? *Journal of Public Economics, 93*(5–6), 721–728. https://doi.org/10.1016/j.jpubeco.2009.01.003

Hogan, B. E., & Trotter, L. D. (2013). Academic freedom in Canadian higher education: Universities, colleges, and institutes were not created equal. *Canadian Journal of Higher Education, 43*(2), Article 2. https://doi.org/10.47678/cjhe.v43i2.2427

Huggins, R., Johnston, A., & Steffenson, R. (2008). Universities, knowledge networks and regional policy. *Cambridge Journal of Regions, Economy and Society, 1*(2), 321–340.

Iannaccone, L. R. (1998). Introduction to the Economics of Religion. *Journal of Economic Literature, 36*(3), 1465–1495.

Iimi, A. (2005). Decentralization and economic growth revisited: An empirical note. *Journal of Urban Economics*, *57*(3), 449–461. https://doi.org/10.1016/J.JUE.2004.12.007

Inglehart, R. (1999). Trust, well-being and democracy. *Democracy and Trust*, 88–120. https://cir.nii.ac.jp/crid/1360855568555279616

James, E. (1986). The private nonprofit provision of education: A theoretical model and application to Japan. *Journal of Comparative Economics*, *10*(3), 255–276. https://www.sciencedirect.com/science/article/pii/0147596786900983

Janin, H. (2009). *The university in medieval life, 1179-1499* (Vol. 46, Issue 06). McFarland. http://choicereviews.org/review/10.5860/CHOICE.46-3393

Jardine, L. (2000). *The Curious Life of Robert Hooke: The Man Who Measured London*. HarperCollins.

Kalimeri, V. (2018). The Kallikrates vs the Kapodistrias Reforms in Greece: A Story of Moderate Success. *Politics in Central Europe*, *14*(1), 65–76. https://doi.org/10.2478/pce-2018-0003

Kantor, S., & Whalley, A. (2014). Knowledge spillovers from research universities: Evidence from endowment value shocks. *Review of Economics and Statistics*, *96*(1), Article 1.

Kaplan, B. J. (2007). *Divided by Faith: Religious Conflict and the Practice of Toleration in Early Modern Europe*. Harvard University Press. https://doi.org/10.4159/9780674039308

Kapucu, N. (2016). *Fiscal federalism. Encyclopedia Britannica.* https://www.britannica.com/topic/fiscal-federalism

Kasper von Greyerz & Thomas Dunlap. (2007). *Religion and Culture in Early Modern Europe, 1500-1800*. Oxford University Press.

Kjaer, U., Hjelmar, U., & Olsen, A. L. (2010). Municipal amalgamations and the democratic functioning of local councils: The case of the Danish 2007 structural reform. *Local Government Studies*, *36*(4), 569–585. https://doi.org/10.1080/03003930.2010.494112

Kortt, M. A., Dollery, B., & Drew, J. (2016). Municipal Mergers in New Zealand: An Empirical Analysis of the Proposed Amalgamation of Hawke's Bay Councils. *Local Government Studies*, *42*(2), 228–247. https://doi.org/10.1080/03003930.2015.1007133

Kwiek, M. (2006). *The university and the state. A study into global transformations.* Frankfurt and New York: Peter Lang.

Kyvelou, S. S., & Marava, N. (2017). From centralism to decentralization and back to recentralization due to the economic crisis: Findings and lessons learnt from the Greek experience. In *The Palgrave Handbook of Decentralisation in Europe* (pp. 297–326). https://doi.org/10.1007/978-3-319-32437-1

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. W. (1996). *Trust in large organizations.* National Bureau of Economic Research Cambridge, Mass., USA. https://www.nber.org/papers/w5864

Ladi, S. (2012). *The Eurozone Crisis and Austerity Politics: A Trigger for Administrative Reform in Greece? Hellenic Observatory Papers on Greece and Southeast Europe.*

Lam, P. (2002). As the Flocks Gather: How Religion Affects Voluntary Association Participation. *Journal for the Scientific Study of Religion, 41*(3), 405–422. https://doi.org/10.1111/1468-5906.00127

Lambert, F. (2010). *The founding fathers and the place of religion in America.* Princeton University Press.

Lapointe, S., Saarimaa, T., & Tukiainen, J. (2018). Effects of municipal mergers on voter turnout. *Local Government Studies, 44*(4), 512–530. https://doi.org/10.1080/03003930.2018.1465936

Lassen, D. D., & Serritzlew, S. (2011). Jurisdiction size and local democracy: Evidence on internal political efficacy from large-scale municipal reform. *American Political Science Review, 105*(2), 238–258. https://doi.org/10.1017/S000305541100013X

Lazzeroni, M., & Piccaluga, A. (2015). Beyond 'town and gown': The role of the university in small and medium-sized cities. *Industry and Higher Education, 29*(1), 11–23.

Lechner, M. (2002). Some practical issues in the evaluation of heterogeneous labour market programmes by matching methods. *Journal of the Royal Statistical Society. Series A: Statistics in Society, 165*(1), 59–82. https://doi.org/10.1111/1467-985X.0asp2

Leyden, D. P., & Link, A. N. (2013). Knowledge spillovers, collective entrepreneurship, and economic growth: The role of universities. *Small Business Economics*, *41*, 797–817.

Leydesdorff, L., & Sun, Y. (2009). National and international dimensions of the Triple Helix in Japan: University–industry–government versus international coauthorship relations. *Journal of the American Society for Information Science and Technology*, *60*(4), 778–788.

Lima, R. C. de A., & Silveira Neto, R. da M. (2018). Secession of municipalities and economies of scale: Evidence from Brazil. *Journal of Regional Science*, *58*(1), 159–180. https://doi.org/10.1111/jors.12348

Lin, J. Y., & Liu, Z. (2015). Fiscal Decentralization and Economic Growth in China. *Economic Development and Cultural Change*, *49*(1), 1–21. https://doi.org/10.1086/452488

Lindberg, C. (2021). *The European Reformations*. John Wiley & Sons.

Lindberg, D. C., & Numbers, R. L. (Eds.). (1983). *God and Nature: Historical Essays on the Encounter between Christianity and Science*.

Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, *22*(1), Article 1.

Lyytikäinen, T. (2012). Tax competition among local governments: Evidence from a property tax reform in Finland. *Journal of Public Economics*, *96*(7–8), 584–595. https://doi.org/10.1016/j.jpubeco.2012.03.002

MacCulloch, D. (2017). *The reformation: A history*. Tantor Audio.

Macfarlane, B. (2012). Re-framing student academic freedom: A capability perspective. *Higher Education*, *63*(6), 719–732. https://doi.org/10.1007/s10734-011-9473-4

Maierù, A., & Pryds, D. (1994). *University training in medieval Europe*. https://www.semanticscholar.org/paper/University-training-in-medieval-Europe-Maier%C3%B9-Pryds/1993d525491a71ce68777ddc054e66dedda8c249

Mantovanelli, F. (2014). The Protestant legacy: Missions and literacy in India. *Available at SSRN 2413170*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2413170

Mapuranga, B. (2016). The role of universities in economic development. *J. Econ. Sustain. Dev*, *7*(6), 1–23.

Marginson, S. (2011). Higher education and public good. *Higher Education Quarterly*, *65*(4), 411–433.

McCleary, R. M. (2013). Protestantism and human capital in Guatemala and the republic of Korea. *Asian Development Bank Economics Working Paper Series*, *332*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2239556

McCloskey, D. N. (2010). Bourgeois dignity: Why economics Can't explain the modern World. university of Chicago Press. *Chicago, Il*, *592*.

McNeely, I. F. (2009). The renaissance academies between science and the humanities. *Configurations*, *17*(3), 227–258.

Melhuish, C., & Bletter, R. H. (2015). The role of the university in urban regeneration: The sources of Bruno Taut's Glashaus. *Arq: Architectural Research Quarterly*, *19*(1), 5–8.

Mille, M. (2005). The university, knowledge spillovers and local development: The experience of a new university. *Higher Education Management and Policy*, *16*(3), Article 3.

Ministry of Interior. (2010a). *Αιτιολογική Έκθεση Στο Σχέδιο Νόμου «Νέα Αρχιτεκτονική της Αυτοδιοίκησης και της Αποκεντρωμένης Διοίκησης—Πρόγραμμα Καλλικράτης».*

Ministry of Interior. (2010b). *Κριτήρια Συνενώσεων για τους Νέους Ισχυρούς Δήμους | Υπουργείο Εσωτερικών.* http://www.opengov.gr/ypes/?p=379

Ministry of Interior. (2019). *Ministry of Interior.* https://www.ypes.gr/

Miyazaki, T. (2018). Examining the relationship between municipal consolidation and cost reduction: An instrumental variable approach. *Applied Economics*, *50*(10), 1108–1121. https://doi.org/10.1080/00036846.2017.1352077

Moisio, A., & Uusitalo, R. (2013). The Impact of Municipal Mergers on Local Public Expenditures in Finland. *Public Finance and Management*, *13*(3), 148.

Mokyr, J. (2002). The Gifts of Athena: Historical Origins of the Knowledge Economy. In *The Gifts of Athena*. Princeton University Press. https://doi.org/10.1515/9781400829439

Mokyr, J. (2009). *The Enlightened Economy: An Economic History of Britain 1700-1850*. Yale University Press.

Mokyr, J. (2016). A Culture of Growth: The Origins of the Modern Economy. In *A Culture of Growth*. Princeton University Press. https://doi.org/10.1515/9781400882915

Moretti, E. (2004). Estimating the social return to higher education: Evidence from longitudinal and repeated cross-sectional data. *Journal of Econometrics*, *121*(1–2), Article 1–2.

Musgrave, R. (1959). *The theory of public finance: A study in public economy*. McGraw-Hill.

North, C. M., Orman, W. H., & Gwin, C. R. (2013). Religion, Corruption, and the Rule of Law. *Journal of Money, Credit and Banking*, *45*(5), 757–779. https://doi.org/10.1111/jmcb.12024

North, D. C. (1973). *The rise of the western world: A new economic history*. Cambridge University Press.

Nunziata, L., & Rocco, L. (2016). A tale of minorities: Evidence on religious ethics and entrepreneurship. *Journal of Economic Growth*, *21*(2), 189–224. https://doi.org/10.1007/s10887-015-9123-2

Oates, W. E. (1972). *Fiscal federalism*. Harcourt Brace Jovanovich.

Oates, W. E. (1993). FISCAL DECENTRALIZATION AND ECONOMIC DEVELOPMENT. *National Tax Journal*, *46*(2), 237–243. https://doi.org/10.1086/NTJ41789013

Oates, W. E. (1999). An Essay on Fiscal Federalism. *Journal of Economic Literature*, *37*(3), 1120–1149. https://doi.org/10.1257/JEL.37.3.1120

Oates, W. E. (2005). Toward a second-generation theory of fiscal federalism. *International Tax and Public Finance*, *12*(4), 349–373. https://doi.org/10.1007/s10797-005-1619-9

Oates, W. E. (2008). On the evolution of fiscal federalism: Theory and institutions. *National Tax Journal*, *61*(2), 313–334. https://doi.org/10.17310/NTJ.2008.2.08

O'Malley, J. W. (1995). *The First Jesuits*. Harvard University Press.

Oosterhoff, R. J. (2019). Apprenticeship in the Renaissance University: Student authorship and craft knowledge. *Science in Context*, *32*(2), 119–136.

Parsons, N. (2008). *Vienna: A Cultural History*. Oxford University Press.

Pazarskis, M., Goumas, S., Koutoupis, A., & Konstantinidis, K. (2019). Do municipal mergers work? Evidence from municipalities in Greece. *Journal of Governance and Regulation*, *8*(2), 61–67. https://doi.org/10.22495/jgr_v8_i2_p6

Pettegree, A. (2015). *Brand Luther: 1517, printing, and the making of the Reformation*. Penguin Press.

Pfaff, S., & Corcoran, K. E. (2012). Piety, Power, and the Purse: Religious Economies Theory and Urban Reform in the Holy Roman Empire. *Journal for the Scientific Study of Religion*, *51*(4), 757–776. https://doi.org/10.1111/j.1468-5906.2012.01680.x

Pomeranz, K. (2000). *The Great Divergence: China, Europe, and the Making of the Modern World Economy*. Princeton University Press.

Pomeranz, K., & Topik, S. (2014). *The world that trade created: Society, culture and the world economy, 1400 to the present*. Routledge. https://www.taylorfrancis.com/books/mono/10.4324/9781315698762/world-trade-created-kenneth-pomeranz-steven-topik

Potter, P. B. (2001). The Role of Law and Legal Institutions in Asian Economic Development, 1960–1995. *The Journal of Asian Studies*, *60*(4), Article 4.

Prazeres, L., Findlay, A., McCollum, D., Sander, N., Musil, E., Krisjane, Z., & Apsite-Berina, E. (2017). Distinctive and comparative places: Alternative narratives of distinction within international student mobility. *Geoforum*, *80*, 114–122.

Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*. Simon and Schuster.

Rambachan, A., & Roth, J. (2023). A More Credible Approach to Parallel Trends. *Review of Economic Studies*, *90*(5), 2555–2591. https://doi.org/10.1093/restud/rdad018

Rasmussen, K. L., Delbey, T., d'Imporzano, P., Skytte, L., Schiavone, S., Torino, M., Tarp, P., & Thomsen, P. O. (2020). Comparison of trace element chemistry in human bones interred

in two private chapels attached to Franciscan friaries in Italy and Denmark: An investigation of social stratification in two medieval and post-medieval societies. *Heritage Science*, *8*(1), 1–21.

Reingewertz, Y. (2012). Do municipal amalgamations work? Evidence from municipalities in Israel. *Journal of Urban Economics*, *72*(2–3), 240–251. https://doi.org/10.1016/j.jue.2012.06.001

Rodnyansky, D. V., Makarov, I. N., Basharimov, Y. P., Nekrasova, E. A., & Shirokova, O. V. (2020). Analysis of the Impact of Universities on the Innovative Development of Russian Regions. *International Scientific Conference "Digitalization of Education: History, Trends and Prospects" (DETP 2020)*, 270–275.

Roesel, F. (2017). Do mergers of large local governments reduce expenditures? – Evidence from Germany using the synthetic control method. *European Journal of Political Economy*, *50*(February), 22–36. https://doi.org/10.1016/j.ejpoleco.2017.10.002

Roth, J., Sant'Anna, P. H. C., Bilinski, A., & Poe, J. (2023). What's trending in difference-in-differences? A synthesis of the recent econometrics literature. *Journal of Econometrics*, *235*(2), 2218–2244. https://doi.org/10.1016/j.jeconom.2023.03.008

Rubin, J. (2011). *Printing and Protestants: Reforming the Economics of the Reformation* (SSRN Scholarly Paper 1742523). Social Science Research Network. https://doi.org/10.2139/ssrn.1742523

Rubin, J. (2014). Printing and Protestants: An Empirical Test of the Role of Printing in the Reformation. *The Review of Economics and Statistics*, *96*(2), 270–286. https://doi.org/10.1162/REST_a_00368

Rublack, U. (2017). *Reformation Europe*. Cambridge University Press.

Rüegg, W., & de Ridder-Symoens, H. (Eds.). (1996). *A history of the university in Europe: Universities in early modern Europe (1500-1800)*. Cambridge University Press.

Ryrie, A. (2018). *Protestants: The faith that made the modern world*. Penguin.

Sauer, R. M. (Ed.). (2023). *The economics of religion*. World Scientific.

Schäfer, H.-B., & Wulf, A. J. (2014). Jurists, Clerics, and Merchants: The Rise of Learned Law in Medieval Europe and its Impact on Economic Growth. *Journal of Empirical Legal Studies*, *11*(2), 266–300.

Scott, P. (1998). The end of the European university? *European Review*, *6*(4), 441–457.

Scott, T. (2012). *The city-state in Europe, 1000-1600: Hinterland, territory, region*. Oxford University Press.

Shapin, S. (1996). *The Scientific Revolution*. University of Chicago Press. https://press.uchicago.edu/ucp/books/book/chicago/S/bo29143181.html

Sharma, R. S. (2015). Role of universities in development of civil society and social transformation. *Proceedings of International Academic Conferences*, *2604181*.

Sheremeta, R. M., & Smith, V. L. (2017). *The Impact of the Reformation on the Economic Development of Western Europe* (SSRN Scholarly Paper 3192660). Social Science Research Network. https://doi.org/10.2139/ssrn.3192660

Sianesi, B. (2004). An evaluation of the Swedish system of active labor market programs in the 1990s. *Review of Economics and Statistics*, *86*(1), 133–155. https://doi.org/10.1162/003465304323023723

Smith, J. A., & Todd, P. E. (2005). Does matching overcome LaLonde's critique of nonexperimental estimators? In *Journal of Econometrics* (Vol. 125, Issues 1-2 SPEC. ISS.). https://doi.org/10.1016/j.jeconom.2004.04.011

Soguel, N. (2006). The inter-municipal cooperation in Switzerland adn the trend towards amalgamation. *Revista de Economía Pública Urbana = Urban Public Economics Review*, *6*, 169–189.

Spufford, P. (2006). Power and profit: The merchant in medieval Europe. *Thames & Hudson*. https://cir.nii.ac.jp/crid/1130282272464425216

Stansel, D. (2005). Local decentralization and local economic growth: A cross-sectional examination of US metropolitan areas. *Journal of Urban Economics*, *57*, 55–72. https://doi.org/10.1016/j.jue.2004.08.002

Strebel, M. A. (2018). Incented Voluntary Municipal Mergers as a Two-Stage Process: Evidence from the Swiss Canton of Fribourg. *Urban Affairs Review*, *54*(2), 267–301. https://doi.org/10.1177/1078087416651935

Strebel, M. A. (2019). Why voluntary municipal merger projects fail: Evidence from popular votes in Switzerland. *Local Government Studies*, *45*(5), 654–675. https://doi.org/10.1080/03003930.2019.1584557

Sun, L., & Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, *225*(2), 175–199. https://doi.org/10.1016/j.jeconom.2020.09.006

Suzuki, K., & Sakuwa, K. (2016). Impact of municipal mergers on local population growth: An assessment of the merger of Japanese municipalities. *Asia Pacific Journal of Public Administration*, *38*(4), 223–238. https://doi.org/10.1080/23276665.2016.1258887

Tanzharikova, A. Z. (2012). The role of higher education system in human capital formation. *World Applied Sciences Journal*, *18*(1), Article 1.

Tavares, A. F., & Rodrigues, M. (2015). The Economic and Political Impacts of Top-Down Territorial Reforms: The Case of Sub-City Governments. *Local Government Studies*, *41*(6), 956–976. https://doi.org/10.1080/03003930.2015.1057278

Teichler, U. (1998). The changing roles of the university and non-university sectors of higher education in Europe. *European Review*, *6*(4), 475–487.

Thiessen, U. (2003). Fiscal Decentralisation and Economic Growth in High-Income OECD Countries. *Fiscal Studies*, *24*(3), 237–274. https://doi.org/10.1111/J.1475-5890.2003.TB00084.X

Tittler, R. (1999). The Reformation and the towns in England: Politics and political culture. *Continuity and Change*, *14*(3), 453–470. https://doi.org/10.1017/S0268416099273432

Tran, C., Kortt, M., & Dollery, B. (2019). Population size or population density? An empirical examination of scale economies in South Australian local government, 2015/16. *Local Government Studies*, *45*(5), 632–653. https://doi.org/10.1080/03003930.2018.1501364

Valero, A., & Van Reenen, J. (2016). How universities boost economic growth. *CentrePiece-The Magazine for Economic Performance*. https://www.semanticscholar.org/paper/How-universities-boost-economic-growth-Valero-Reenen/bf66caca639a870bfb0ab3cd7d0f9a843bda88d5

Valero, A., & Van Reenen, J. (2019). The economic impact of universities: Evidence from across the globe. *Economics of Education Review*, *68*, 53–67. https://doi.org/10.1016/j.econedurev.2018.09.001

Välimaa, J. (2019). The Emergence of Universities in the Middle Ages. In J. Välimaa, *A History of Finnish Higher Education from the Middle Ages to the 21st Century* (Vol. 52, pp. 11–38). Springer International Publishing. https://doi.org/10.1007/978-3-030-20808-0_2

Verger, J. (1992). Patterns. In H. de Ridder-Symoens (Ed.), *A history of the university in Europe: Vol 1. Universities in the Middle Ages* (pp. 35–76). Cambridge University Press.

Weber, M. (1904). *The Protestant Ethic and the Spirit of Capitalism*.

Williams, L., Turner, N., & Jones, A. (2008). *Embedding universities in knowledge cities*. Citeseer.

Witte, J. J. (2007). *The Reformation of Rights: Law, Religion, and Human Rights in Early Modern Calvinism*. Cambridge University Press.

Woller, G. M., & Phillips, K. (1998). Fiscal decentralisation and LDC economic growth: An empirical investigation. *Journal of Development Studies*, *34*(4), 139–148. https://doi.org/10.1080/00220389808422532

Wooldridge, J. M. (2021a). Two-way fixed effects, the two-way Mundlak regression, and difference-in-differences. *Journal of Econometrics*, *222*(1), Article 1.

Wooldridge, J. M. (2021b). Two-Way Fixed Effects, the Two-Way Mundlak Regression, and Difference-in-Differences Estimators. *SSRN Electronic Journal*, 1–77. https://doi.org/10.2139/ssrn.3906345

Wooldridge, J. M. (2023). Simple approaches to nonlinear difference-in-differences with panel data. *The Econometrics Journal*, *26*(3), C31–C66. https://doi.org/10.1093/ectj/utad016

Wright, E., & Horta, H. (2018). Higher education participation in "high-income" universal higher education systems: "Survivalism" in the risk society. *Asian Education and Development Studies*, *7*(2), 184–204.

Xie, D., Zou, H.-F., & Davoodi, H. (1999). Article ID juec. *Journal of Urban Economics*, *45*, 228–239.

Yilmaz, S. (1999). The impact of fiscal decentralization on macroeconomic performance. In *Proceedings. Annual Conference on Taxation and Minutes of the Annual Meeting of the National Tax Association* (Vol. 92, pp. 251–260). National Tax Association.

Yusuf, S., & Nabeshima, K. (Eds.). (2007). *How universities promote economic growth*. World Bank Publications.

Zeedan, R. (2017). Bigger but not always better: Size and democracy in israeli amalgamated local governments. *Journal of Urban Affairs*, *39*(5), 711–728. https://doi.org/10.1080/07352166.2016.1262701

Zhang, T., & Zou, H. fu. (1998). Fiscal decentralization, public spending, and economic growth in China. *Journal of Public Economics*, *67*(2), 221–240. https://doi.org/10.1016/S0047-2727(97)00057-1