FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION (ICADE)

PUBLIC POLICIES FOR REGIONAL AND RURAL DEVELOPMENT: NEW CONTRIBUTIONS TO DEPOPULATION, INEQUALITY AND GROWTH

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ABSTRACT

This thesis presents a comprehensive exploration of key challenges in regional and rural development and policy formulation.

The first aspect addresses the pressing issue of rural depopulation, which poses significant challenges to communities and policymakers in developed countries. A systematic review of 66 studies published since 2000 scrutinises depopulation mitigation policies, accompanied by the development of a comprehensive model to collect the essential components of successful depopulation mitigation policies. This analysis underscores that depopulation is influenced by policies across social, fiscal, sectorial, and infrastructure dimensions, with varying degrees of effectiveness observed within each category. It concludes that a multifaceted policy approach encompassing diverse facets of this complex issue is imperative for success.

In examining the urban-rural income gap, the second dimension of this research investigates the impact of fiscal redistribution policies in Spain from 2017 to 2020. Utilising quantitative methods and microdata, we assess the effectiveness of region-specific fiscal redistribution systems. The results show that there is a 6% urban-rural income gap for market income and that redistribution reduces it to 4% for final income. Individuals in the lower deciles are more affected by the urban-rural income gap before and after fiscal interventions. There is large heterogeneity in the size of this income gap across regions and in their capacity to address it Our analysis reveals a notable reduction in the urban-rural income gap after the implementation of these policies, highlighting the importance of targeted fiscal interventions.

The third facet of this thesis pertains to the inadequacies of traditional Growth Diagnostics frameworks in explaining regional growth dynamics and proposing policy solutions to address them. Drawing upon the concept of the regional development trap, we propose an enhanced analytical framework that better captures region-specific factors influencing growth. This framework's applicability and utility are demonstrated through a Growth Diagnostics analysis of twelve Spanish regions, revealing its capacity to detect the particular binding constraints to regional growth and to recommend tailored place-based policies as solutions for each of the territories.

Collectively, these research dimensions contribute to a holistic understanding of regional and rural development challenges and underscore the necessity of adaptable and multifaceted policy approaches. By bridging the gaps in existing frameworks and addressing critical issues such as regional growth dynamics, income disparities, and rural depopulation, this thesis offers valuable insights and guidance for policymakers and stakeholders working towards regional and rural development.

Keywords: regional growth, public policy, urban–rural gap, fiscal redistribution, growth diagnostics, depopulation.

RESUMEN

Esta tesis presenta una exploración exhaustiva de los principales retos sobre desarrollo regional y rural y de la elaboración de políticas públicas en dichas áreas.

El primer aspecto abordado es el problema de la despoblación rural, que plantea grandes retos a las comunidades y los responsables políticos de los países desarrollados. Una revisión sistemática de 66 estudios publicados desde el año 2000 examina las políticas de mitigación de la despoblación, acompañada de la elaboración de un modelo exhaustivo para encontrar los componentes esenciales de las políticas de mitigación de la despoblación exitosas. Este análisis pone de relieve que la despoblación se ve influida por políticas en las dimensiones social, fiscal, sectorial y de infraestructuras, observándose distintos grados de eficacia en cada categoría. Se concluye que, para tener éxito, es imprescindible un enfoque político polifacético que abarque diversos aspectos de este complejo problema.

Examinando la brecha de ingresos entre las zonas urbanas y rurales, la segunda dimensión de esta investigación analiza el impacto de las políticas de redistribución fiscal en España de 2017 a 2020. Utilizando métodos cuantitativos y microdatos, se evalúa la eficacia de los sistemas de redistribución fiscal específicos de cada región. Los resultados muestran que existe una brecha de renta urbano-rural del 6% para la renta de mercado y que la redistribución la reduce al 4% para la renta final. Los individuos de los deciles inferiores se ven más afectados por la brecha de ingresos urbano-rural antes y después de las intervenciones fiscales. Existe una gran heterogeneidad en la magnitud de esta brecha entre regiones y en su capacidad para abordarla. Nuestro análisis revela una notable reducción de la brecha urbano-rural tras la aplicación de estas políticas, lo que muestra la importancia de las intervenciones fiscales selectivas.

La tercera faceta de esta tesis se refiere a las insuficiencias de los marcos tradicionales de diagnóstico del crecimiento para explicar la dinámica del crecimiento regional y proponer soluciones políticas para abordarla. Basándonos en el concepto de la trampa del desarrollo regional, proponemos un marco analítico mejorado que capta mejor los factores específicos de cada región que influyen en el crecimiento. La aplicabilidad y utilidad de este marco se demuestra a través del análisis de doce regiones españolas, revelando su capacidad para detectar las limitaciones vinculantes particulares al crecimiento regional y recomendar soluciones políticas basadas en el lugar para cada uno de los territorios.

En conjunto, estas dimensiones de la investigación contribuyen a una comprensión holística de los retos del desarrollo regional y subrayan la necesidad de enfoques políticos adaptables y polifacéticos. Al abordar cuestiones críticas como la dinámica del crecimiento regional, las disparidades de renta y la despoblación rural, esta tesis ofrece valiosas orientaciones para responsables políticos y partes interesadas que trabajan en pro del desarrollo rural y regional.

Palabras clave: crecimiento regional, políticas públicas, brecha urbano-rural, redistribución fiscal, diagnósticos de crecimiento, despoblación.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXES

INTRODUCTION

"The standard approach (in economics) is: «forget about places. Places are not the issue; what we are trying to do is raise people's income levels, so let's target policies on individuals whose livelihoods we directly want to affect». The problem here is that, when it comes to changing outcomes, place effects are real" - Gordon Hanson

Motivation

This thesis starts with a fundamental observation: within a country, certain regions undergo economic expansion while others do not (Iammarino et al., 2019). To be more precise, distinct places exhibit diverse growth rates, leading to persistent economic development disparities across geographical areas. Extensive research in the field of regional studies has investigated the underlying causes of these disparities in growth rates (Breinlich et al., 2014). The current dissertation does not focus on the causes of stagnant growth but rather concentrates on exploring policy interventions capable of addressing this issue. Specifically, this thesis contributes to partially answer the research question: which policies can be implemented to reduce the differences between places that grow and places that do not grow?

Throughout the research question, we do not focus on delivering an answer for places in an abstract sense; our geographical scope is targeted to regions. In the thesis chapters, we examine the differences between urban and rural areas within regions or the rural regions that suffer depopulation.

This thesis adopts an interdisciplinary approach. The three domains to which we contribute extend beyond the field of economics, as depicted in Figure 1. Disciplines including economics, geography, sociology, demography, and history, among others, intersect in the disciplines of regional studies, rural studies, and inequality studies.

As previously stated, this thesis is distinctly policy-oriented. Public policy recommendations are derived from the study's conclusions. In doing so, this doctoral dissertation enhances the connection between academia and policymaking. Each chapter addresses public policies and their impacts in specific places. The thesis facilitates access to policy evaluations, recommendations, and analyses.

Figure 1. Intersection between disciplines where the contribution of this thesis is located
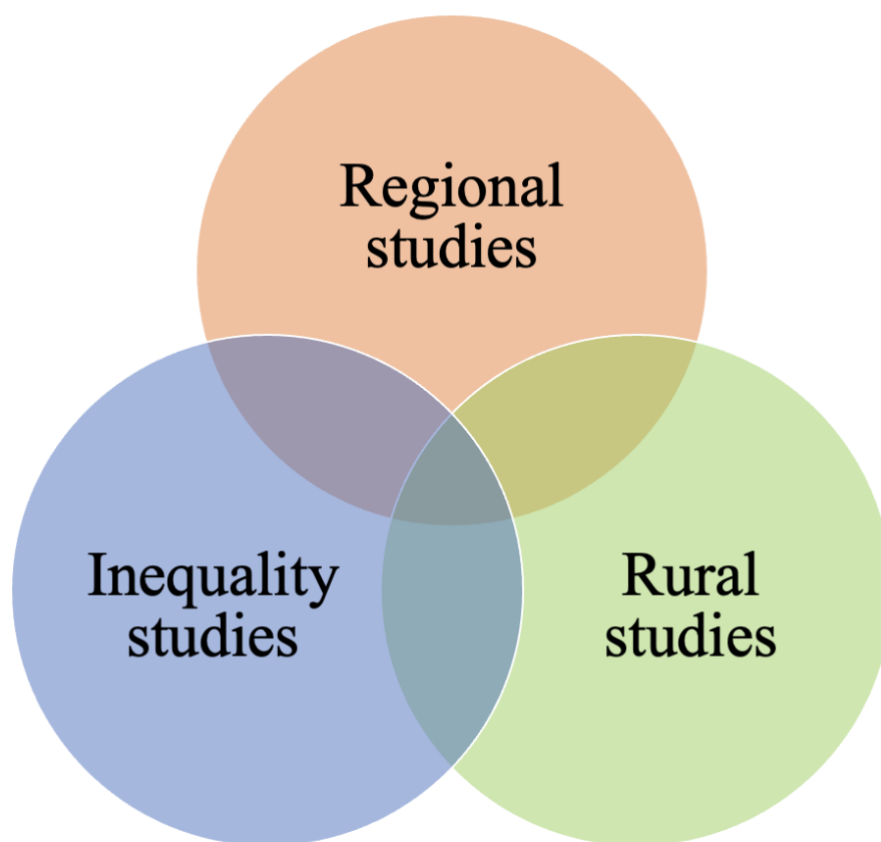
Outline and structure

This thesis is organized as follows: after this introduction, the central part of the document contains three chapters[1]. The first chapter, titled "Policies against depopulation in the 21st century", answers the research question: what policies have been proven effective in reducing depopulation in rural areas? The chapter acknowledges that rural depopulation is growing throughout this century and poses a significant challenge to policymakers and communities worldwide (European Commission, 2022). We then present a systematic literature review comprising 66 studies published since 2000 addressing policies to mitigate rural depopulation. The primary objective is to evaluate the effectiveness of such policies in deterring

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[1] The three chapters are single papers: chapter 1 is under review in a journal and chapter 3 is still a working paper. Chapter 2 is already published: Loras-Gimeno, D., Gómez-Bengoechea, G. & Díaz-Lanchas, J. (2024) "Fiscal redistribution and the narrowing urban-rural gap", *Regional Science Policy & Practice*, vol 16, issue 5, 100045.

depopulation. Additionally, we develop an analytical framework to identify the critical components of successful policies promoting rural development. The analysis reveals that depopulation is influenced by policies within four broad categories: social, fiscal, sectorial, and infrastructure. Each category has subgroups of policies that vary in level of effectiveness. We conclude from the review that no single policy can independently stop depopulation in rural areas; instead, multiple policies addressing different aspects of the phenomenon are necessary for a successful outcome. The findings have significant implications for policymakers addressing this complex socioeconomic and territorial challenge.

The second chapter, titled "Fiscal redistribution and the narrowing urban–rural income gap", answers the research questions: How large is the urban-rural gap in Spain and its regions? How much is this gap reduced due to redistribution? The chapter explores the regional impacts of heterogeneous fiscal redistribution policies on urban–rural income gaps. We construct market income and final income measures for Spain using combined microdata from the Living Conditions Survey and Household Budget Survey for the years 2017-2020. We use quantile regressions to estimate the impact across income deciles and across urban and rural areas of the different fiscal redistribution systems that operate regionally. The results show a 6% urban–rural income gap for market income. Redistribution reduces the difference to 4% for final income. Individuals in the lower deciles are more affected by the urban–rural income gap before and after fiscal interventions. A significant heterogeneity exists in the size of this income gap across regions and in their capacity to address it.

The third chapter, titled "Scaping Regional Development Traps: A New Growth Diagnostics Framework to Propose Place-Based Policies", answers the following research question: how can we design a framework which detects the binding constraints to growth that regions have and, once detected, propose tailored place-based policies to solve the binding constraint? The chapter draws on the growth diagnostics framework proposed by Hausmann, Rodrik, and Velasco (2008). In addition, our approach incorporates the concept of regional development traps to enhance its effectiveness. We evaluate our framework by applying it to assess eleven socioeconomic variables across twelve Spanish regions experiencing low growth rates. Our findings highlight unique region-specific barriers impeding their progress. Utilising these insights, we propose a range of targeted place-based policies aimed at overcoming each identified constraint to growth. Our study concludes that the developed framework effectively

disentangles regional growth challenges and provides specific, well-suited policy interventions.

The thesis is closed by the conclusions section, where the main take-away messages from each chapter and the contributions are summarised, and the implications for policymaking are explained.

Contributions

This thesis constitutes a substantial contribution to the academic literature on various fronts. Firstly, the development of a model that systematically assesses the effectiveness of diverse policies aimed at mitigating depopulation. Categorising these policies into four overarching domains—social, fiscal, sectorial, and infrastructure—this research offers a comprehensive framework for evaluating the multifaceted strategies employed to combat the pressing issue of depopulation. Including a systematic literature review of policies targeting depopulation in the 21st century adds an innovative dimension to the field. This review not only consolidates and synthesises the existing knowledge but also provides a comprehensive and up-to-date reference for policymakers and scholars alike. By structuring and categorising policies within a systematic framework, this contribution improves our understanding of policies against depopulation, enhancing the efficacy of future policy development and implementation in addressing this complex socioeconomic challenge.

The second noteworthy contribution of this research lies in its accurate examination of the urban-rural income gap within the Spanish context, analysed across different income quantiles and accounting for both pre- and post-fiscal redistribution situation. This detailed measurement exercise not only reveals the extent of income disparities but also examines the redistributive impact of fiscal policies at the regional level. Moreover, the research deepens into the regional variations in the effectiveness of redistribution efforts, shedding light on the factors that help some regions in being more successful at narrowing the urban-rural income gap across various income deciles. This empirical analysis fills an important gap in the literature and provides a comprehensive understanding of the dynamics underpinning income inequality and redistribution within Spain's regions.

The third and equally significant contribution of this thesis is the development of a growth diagnostics framework that represents a regional adaptation of the classical Hausmann-Rodrik-Velasco model. By incorporating a regional perspective, this novel framework substantially enhances the capacity for future analyses to explain the complex dynamics of regional growth. This framework fills a critical gap in the existing literature, allowing for a more specific and contextually relevant examination of regional growth patterns. Moreover, the analytical framework introduces a second contribution as it detects the binding constraints to regional growth. Thanks to these efforts, specific place-based policies could be proposed to solve the detected problems. The results of the application of this refined growth diagnostics framework to twelve regions in Spain not only underscore its practical utility but also contribute invaluable insights into the growth determinants of each particular region.

In sum, this thesis helps to enrich the academic discourse surrounding regional growth, income inequality, and depopulation by introducing novel frameworks, comprehensive empirical analyses, and systematic policy evaluations. These contributions collectively add value to a more profound understanding of the multifaceted challenges and opportunities that regions face. The contributions also offer valuable insights and guidance for academic research and practical policymaking efforts.

CHAPTER 1. POLICIES AGAINST DEPOPULATION IN THE 21ST CENTURY

1.1. Introduction

'Our rural areas are the fabric of our society and the heartbeat of our economy. […] They are a core part of our identity and our economic potential.' 'We will cherish and preserve our rural areas and invest in their future.' Ursula von der Leyen, President of the European Commission – July 2019 (Political guidelines for 2019-2024).[2]

Policies aiming at tackling rural depopulation have garnered recent attention. Among scholars, the number of publications devoted to this phenomenon has remarkably increased over the last years (Rodríguez-Soler et al., 2020). International organizations such as the OECD,[3] the United Nations (Lutz & Gailey, 2020) or the European Commission are paying more attention to this topic as a source of territorial disparities (Proietti et al., 2022). These concerns are becoming more notorious especially on advanced and mature economies as a result of their ageing dynamics which are intensively affecting rural areas (Ceccorulli, 2015).

There is a precise diagnosis of depopulation's roots (Collantes & Pinilla, 2011; Johnson & Lichter, 2019), as well as of its future consequences (Newsham & Rowe, 2022). There is also growing evidence on which policies are contributing to curb it, and which ones are not (Díaz-Lanchas et al., 2022). The COVID-19 pandemic has represented a tipping-point on this literature as new studies have opened a vibrant policy debate on the role that digital connectivity and remote teleworking may have in revitalizing, or even fostering, rural areas in the long-run (González-Leonardo et al., 2022).

Despite these efforts, there is not a systematic compilation of policy assessments that could categorize research findings and enhance the discussion on depopulation policies. This chapter aims to perform a systematic literature review on an extensive number of qualitative and quantitative academic works that analyse policies against depopulation in the XXI century. Given the progressive improvements in empirical tools for policy evaluation, our focus on

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[2] European Commission. (2021). 'A Long-Term Vision for the EU's Rural Areas—Towards Stronger, Connected, Resilient and Prosperous Rural Areas by 2040'. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions. European Commission, COM(2021) 345 final, Brussels, 30.6.2021. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0345

[3] The OECD is carrying out extensive initiatives within the workstream on 'Policies for depopulation and service delivery in rural regions'. Available at: https://www.oecd.org/regional/rural-development/rural-service-delivery.htm.

works published specifically in the 21st century provides a more rigorous and precise analysis of the assessment of policies against rural depopulation.

This literature review takes an interdisciplinary approach, encompassing works from various social science disciplines, including economics, geography, politics, demographics, engineering, and environmental science. However, it includes mainly empirical papers, as our goal is to identify those policies that have been practically implemented and evaluated.

This chapter does not address the broad array of studies on population decline, as this phenomenon can also impact urban and semi-urban areas. Instead, we focus specifically on depopulation in rural areas. Therefore, an absolute population loss, even by a small rate, is considered as depopulation in this chapter. Moreover, population losses need to take place in a rural area as defined in the territorial typologies in Eurostat (2018).

These distinctions are essential since the policies to solve the problem of general population decline and rural depopulation may be different. As an example, population decline due to problems with the deindustrialization of some areas requires a different analysis than the phenomenon of depopulation in remote villages due to a lack of services, lack of infrastructure, or cultural ideas (Rieniets, 2009).

We consider only policies that try to affect the trajectory of population decline, in this case defined as a decrease in total population. Thus, our policies' analysis focuses on population growth as the primary variable of interest. Unlike alternative indicators such as net migration flows, population growth captures the demographic structure of rural areas characterized by ageing populations and low fertility rates (Dorling & Gietel-Basten, 2017), while also reflecting the influx and outflow of workers and residents. Accordingly, we deem a policy successful if it can arrest population decline and promote population stabilization or even trigger a trend of population growth. Conversely, we also examine policies with adverse effects on depopulation, namely those that accelerate the rate of population loss in low-density rural areas.

All the studies considered for this chapter are limited to the last decade given the scarce evidence prior to 2000. Furthermore, the various policies analysed are categorized into four broad groups based on their scope: social, fiscal, sectorial, and infrastructure programs. This

categorization provides a detailed summary of the studies analysed including the most important factors for each paper, such as country, period, sample, method and main results.

Obtained findings show that a number of public policies have proven effective in mitigating, halting, or even reversing depopulation trends. In particular, tax exemptions and transport infrastructures policies could help to create employment and foster firms' development in rural areas.

The provision of housing, connectivity and other basic services, would also help to curb depopulation patterns. This variegate of findings underscore the importance of adopting a holistic policy approach by which not only one specific policy but a combination of them, should be considered when assessing depopulation policies.

The contribution of this chapter for the regional and rural literatures is twofold. First, it synthesizes the existing evidence on evaluated policies against rural depopulation. The comparison of policies across their focus area is useful for enhancing the discussion on the efficiency and redistributive features of rural depopulation policies as well as the existing interlinkages between them.

Secondly, this chapter also presents a critical analysis of the literature and highlights its main weaknesses: excessive atomization, lack of scale and data scarcity, which often draw partial, local and non-scalable results. As said, we detect that in almost all the reviewed cases, policies successfully curb depopulation processes, with just five exceptions (Duarte et al., 2022a; Duarte et al., 2022b; Morettini, 2023; Pérez-Sindin López et al., 2023; Fabra et al., 2023), which point to the potential existence of a selection bias in the literature as a whole.

This chapter is structured as follows. The next section revises the methods and data used for the systematic review of the literature. The third section presents the results of the four main policy areas we have detected. In the discussion section, we critically analyse the main findings in the literature and stress their limitations. Finally, the last section concludes.

1.2. Methods and data
1.2.1. Search strategy

We conducted a systematic literature review utilizing two of the most prominent and widely used academic research databases, the Web of Science (WoS) and Scopus (Zhu & Liu, 2020). Nevertheless, it's worth noting that using these two databases resulted in 93 duplicated studies that were removed.

Our review process involved a key-inform search strategy to identify academic papers relevant to the assessment of depopulation policies. Specifically, we targeted papers published in English between 2000 and 2024, using the following Boolean algorithm:

[TS=(evaluat*) OR TS=(assess*)]

AND

[(TS=(policy) OR TS=(policies)]

AND

[(TS=(rural)]

AND

[TS=(depopulat*) OR ((TS=(declin*) OR TS=(shrink*)) AND TS=(population))]

The search took place on June 3, 2024. The Boolean algorithm identified 202 articles and book chapters on WoS and Scopus. We screened all the manuscripts to select those that evaluated the effect of a public policy on depopulation. The exclusion criteria were as follows:

- Studies not written in English as the standard language criteria.
- Research articles published in the fields of medicine or ecological science, to focus the search on social sciences disciplines.
- Studies analysing static urban-rural differences in policy impacts, rather than dynamic effects.
- Studies lacking a policy-focused analysis, excluding those addressing the depopulation phenomenon broadly and/or its long-term socioeconomic factors and drivers.

Applying these exclusion criteria resulted in a total of 109 manuscripts. However, the screening process further filtered out papers not directly related to the topic and the specific assessment of depopulation policies. As a result, we refined the database to include 44 relevant studies. Additionally, we manually searched the reference lists of 42 studies to identify further eligible works. This cross-citation and validation strategy yielded 22 additional studies. In total, our final database included 66 academic papers suitable for our analysis.

Annex 1 includes a comprehensive table listing all these papers. We categorize them based on *i*) the country where the policy was implemented; *ii*) the time period analysed; *iii*) the sample size of the study; *iv*) the methodology used; and *v*) their main findings.

It is worth mentioning that the process of screening, identification and inclusion strictly followed the PRISMA principles (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), as a methodology to perform systematic literature reviews (Beller et al., 2013; Holden et al., 2014). Reporting the literature review according to the PRISMA methodology ensures a sufficient set of items that guarantee that a literature review is done in a systematic way (Sarkis-Onofre et al., 2021). For further details, Annex 2 shows all the steps applied throughout the searching process and the PRISMA methodology.

1.3. Results

According to our final database, Figure 2 shows the number of studies published per year. Most of the 66 studies included have been published since 2019. In the past four years, at least five papers per year have been published on this specific topic, with some years in the 2000s showing no publications at all. As previously mentioned, the assessment of depopulation policies is becoming an increasingly important topic among scholars and international organizations. This trend highlights the existence of a research gap for an article to collect and summarize the existing evidence on the subject.

Figure 2. Studies in the review per year
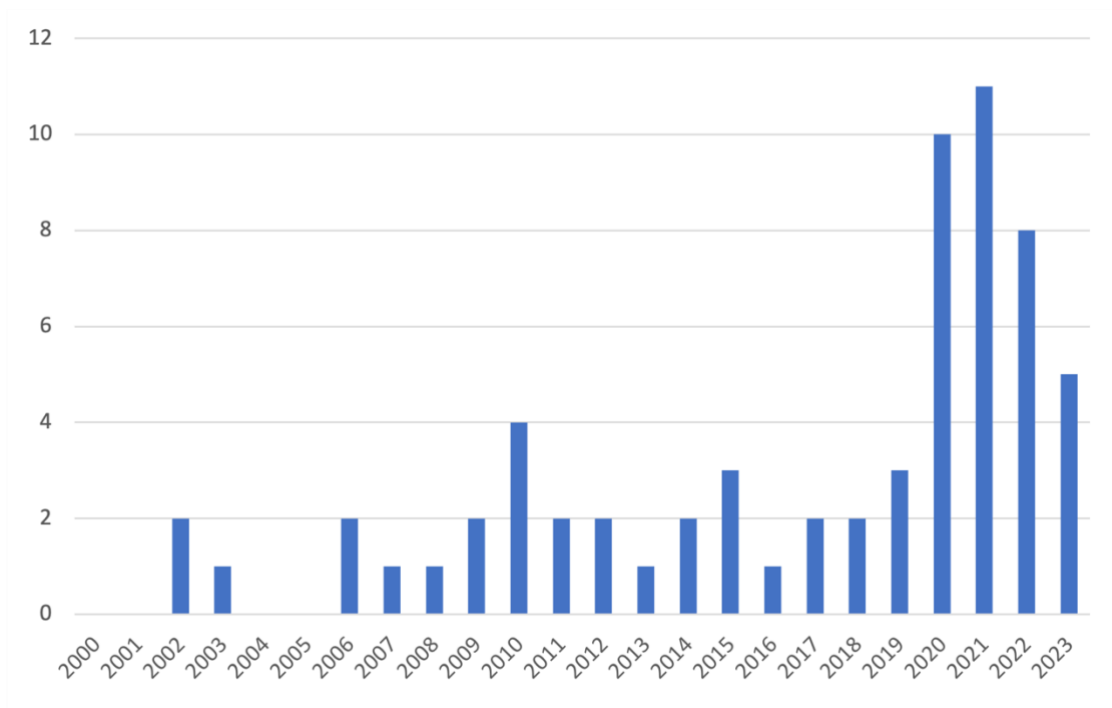
Figure 3. Policy areas that influence rural depopulation dynamics
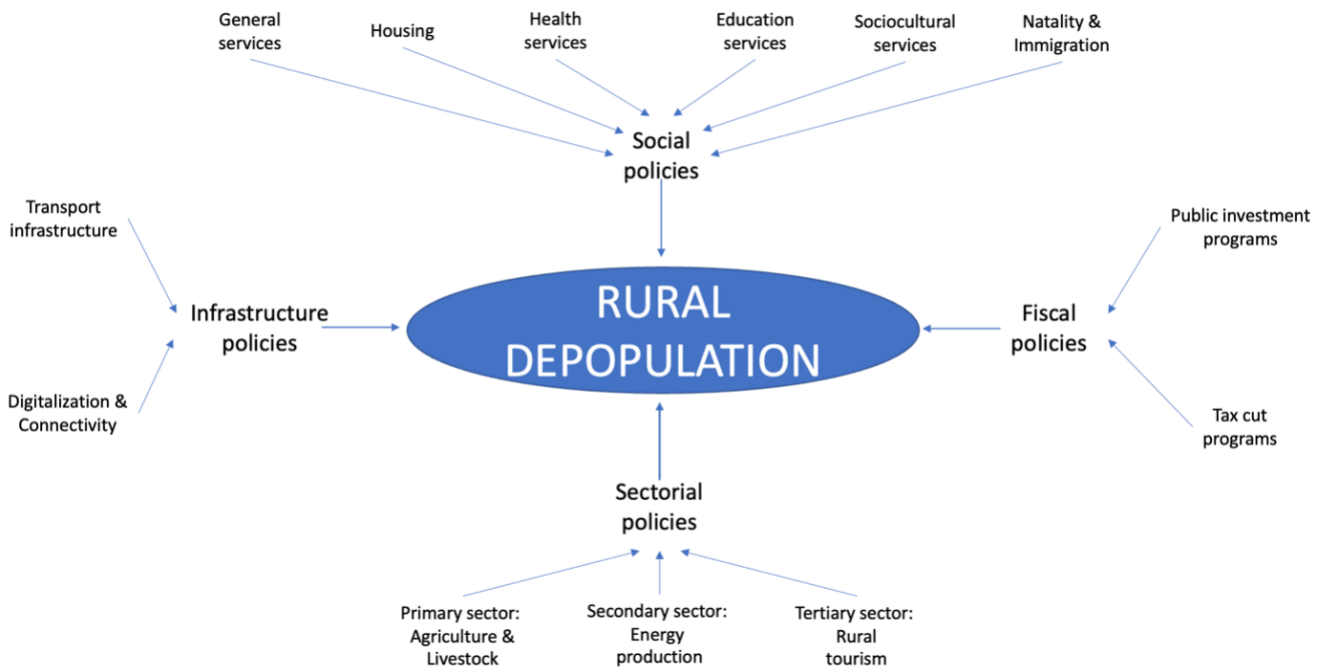
The information contained therein allows us to exploit qualitative information on the type of policies used. We categorize them into four major types of interventions: sectorial, social, fiscal and infrastructure policies. Figure 3 synthetises this information and serves as the cornerstone

of our analysis on rural depopulation policies. 'Social policies' include general services, housing, health, education, and sociocultural services, as well as and natality and immigration-related interventions. 'Fiscal policies' consider both public investment and tax deduction programs. 'Sectorial policies' focus on agriculture and livestock, energy production, and rural tourism initiatives. Finally, 'Infrastructure policies' accounts for policies related to transport infrastructure and digital connectivity.

Table 1 shows the distribution of papers across each category, as well as the specific types of policies within each one. As seen, 'Social policies' are the most predominant, particularly those related to 'General Services,' 'Housing,' and 'Health Services'. 'Sectorial policies' and 'Fiscal policies' are also significant. Sectorial policies primarily focus on agricultural issues, while fiscal policies emphasize investment and tax programs. Lastly, 'Infrastructure policies' are less frequently addressed in our literature review, representing only 12% of the studies considered. These policies are evenly divided between transport and digital initiatives.

Table 1. Share of studies by category

Category	Share (%)	Type of Policies	Share (%)
Sectorial Policies	26%	Agriculture & Livestock	11%
		Energy Production	8%
		Tourism	8%
Social Policies	39%	General Services	9%
		Housing	8%
		Health Services	5%
		Educational Services	8%
		Sociocultural Services	3%
		Natality & Immigration	8%
Fiscal Policies	23%	General Investment Programs	12%
		Tax Cut Programs	11%
Infrastructure Policies	12%	Transport Infrastructures	6%
		Digitalization and Connectivity	6%

After analysing the composition and distribution of our database of papers, we proceed with a detailed description of the policies and findings for each of the four categories.

1.3.1. Social policies

General services involve the provision of services, that cannot be included in any of the other categories, and without further specifications. Literature highlights that most of the analysed rural municipalities are too small to efficiently provide all the minimum services needed.

An effective policy is to create clusters of Local Administrative Units (LAUs) close to each other so that each service can be provided in at least one of the LAUs (Alamá-Sabater et al., 2021). The critical point of this policy is to create clusters large enough (in terms of population) to be able to provide all the essential services but small enough (in terms of geographical distance) so that all the population can access the services in a reasonable time span (Goodwin-Hawkins et al., 2021). It is also better to disseminate the distribution of services along the LAUs than to centralize them in a large central cluster.

The problem of accessibility to services disproportionally affects individuals with reduced mobility (non-drivers) living in depopulated areas. Larger municipalities tend to retain at least part of the services under their jurisdiction, while smaller ones suffer from a progressive closure of the services (Christiaanse, 2020). Innovation and citizen involvement in designing new forms of service provisions would play an essential role in the future of general services policies (OECD, 2010). Technological advances, particularly the concept of "smart villages," can significantly enhance the provision of services and address other needs in depopulated areas (Paniagua, 2020).

General services is a broad category that includes private initiatives such as supermarkets, pubs, and banks, which are as important as public services like health, education, or security (Mount & Cabras, 2016). Innovative solutions, such as the integration of different services to reduce financing costs, generally work well. One example is the introduction of ATMs in rural pharmacies where financial or banking services do not exist (Náñez Alonso et al., 2022).

Housing policies are essential to curb rural depopulation, but their effectiveness increases significantly when combined with other public interventions. When well-managed, they can greatly contribute to community resilience in depopulating areas (Hernández-Ramírez et al., 2022). These policies are particularly impactful when paired with local employment initiatives. For example, employment policies without adequate housing plans can result in workers

residing in large non-rural municipalities and commuting daily to their jobs in rural areas (Cheng et al., 2019). One potential solution is to create construction programs that also provide rental options. New inhabitants often seek rental homes until they achieve a certain stability of living in the area for several years. A housing market limited to homes for sale is a barrier for individuals with temporary plans to reside in rural areas (Alexander, 2019).

More broadly, many houses remain unused and off the private market in rural and depopulating villages for various reasons, such as being second residences (Gallent et al., 2003). There has been a general lack of public initiatives on rural housing to prevent depopulation. Ireland's "Rural Renewal Scheme" (RRS) is an exception from which several lessons can be learned. For instance, publicly financing the construction of houses in rural areas helps prevent depopulation and creates temporary employment (Gkartzios & Norris, 2011). However, if the program is applied equally to primary and second residences, it may lead to an excess of the latter (Norris & Winston, 2009). Consequently, the literature suggests that subsidies should be aimed at the construction of primary residences, ensuring that the beneficiaries will remain living there.

Evidence on the relationship between health provision and depopulation follows a two-way pattern. On the one hand, there is not much literature on the relationship between one variable and the other; thus, we cannot draw clear conclusions. On the other hand, there is plenty of literature on the problems derived from health service provisions in rural areas. What research is clear about is that accessibility to health services is usually challenging in depopulating areas, which constitutes a barrier to those living in those areas (Henderson et al., 2003). The problem is not only constituted by the lack of hospitals or health centres, but also by the absence of human capital (Shipman et al., 2019). One of the standard policies that has been proposed to solve this problem is telemedicine, which is generally refused by patients (Sørensen, 2008). In the context of policy evaluations, there is still a lack of evidence on how difficulties in rural health affect depopulation patterns.

Education services and overall quality are vital to understand living and migration decisions. Education is at the core of the migrating decision from and to rural areas, which often drive depopulation processes. Families that must send their children to schools in different municipalities may decide to migrate closer to them in order to maximize welfare and protect social networks (Cedering & Wihlborg, 2020). Evidence shows that depopulation rates

increase significantly after primary and secondary schools closures in small municipalities (Lehtonen, 2021; Sørensen et al., 2021). Depopulation increases, and the social capital in those areas is reduced (Kłoczko-Gajewska, 2020). Furthermore, depopulation driven by the closure of education services is also observed in more populated municipalities for tertiary education and universities (Lovén et al., 2020).

The availability of sociocultural and leisure services is crucial to understand whether a family or an individual may decide to stay or to move from / to rural areas (Iversen et al., 2023). In addition to schools or cultural centres, pubs and bars are other common locations where individuals meet. The closing of these types of services significantly increase depopulation according to Mount & Cabras (2016).

Depopulating areas show large cohorts of individuals in the older part of the age distribution. Fostering natality and immigration should contribute to the formation of a younger demographic pyramid. However, there are mixed evidence on the impact of this type of policy. On the side of immigration, some articles show a positive effect of immigration as an adequate tool to curb depopulation (Collantes et al., 2014), while others find the opposite result (Bayona-i-Carrasco & Gil-Alonso, 2012).

This means that policymakers cannot rely on a general intervention to help these areas in this regard. In the case of increasing natality, implemented policies have not led to the desired results, and they have not contributed to reverse depopulation and fertility decline (Brainerd, 2014; Cook et al., 2022). Primarily due to the higher percentage of masculinization rural areas, it is easy to think that the effect on fertility would be even lower in these areas (Díaz-Lanchas et al., 2022). Precisely, women have higher migration rates to urban areas, where their wellbeing is more increased that for their counterparts (Cobano-Delgado & Lorent-Bedmar, 2020).

As we have explained in this section, literature shows that different social policies contribute in various manners to depopulation tendencies. In general, an approach of clustering services by a network strategy has proven to be an effective way to organize services for villages that are too small to maintain services that require a minimum population (Christiaanse, 2020). Policy makers should apply service delivery in depopulated areas at administrative scales superior to the municipality, but inferior to the province (Alamá-Savater, 2021). Moreover, the

provision of several services in one place saves resources and allows efficient retention of services in small villages. Technology can also help reduce costs and maintain service delivery in depopulated areas (Paniagua, 2020).

1.3.2. Fiscal policies

Literature shows that fiscal policies have different effects depending on the specific situation to tackle and the kind of instrument implemented. We have divided fiscal policies into two main groups: public investments and tax cuts programs. The former consists of financing interventions to curb depopulation, while the latter includes tax reductions to businesses or households.

In the case of public investment policies, there have been diverse schemes depending on where to direct the investments. Even when the goal of all of them is to promote rural development. Some programs have been directed to small enterprises so that they can increase their growth, generate economic activity and create jobs. Other strategies have transferred funds to low-income citizens of rural areas so that they complement their wages, and the probability of out-migration is reduced. Lastly, some schemes have opted by an independent and local agency to allocate funds to the projects that better can promote economic development according to the local specificities.

The epitome of this type of policies can be found in the EU's LEADER (*Liaison Entre Actions de Développement de l'Économie Rurale*, or links between activities for the development of rural economy) and Spain's SIPTEA (*Sistema Integrado de Protección de los Trabajadores Eventuales Agrarios*, or integrated system for the protection of agrarian temporary workers) programs.

In the case of the LEADER program, subsidies are articulated through the Local Action Groups (LAGs), a bottom-up development strategy promoted and financed by the European Union across all member countries since 1991. Reviewed studies analyse the LEADER program across European countries (France, Germany, Spain, England, and Ireland), and show good results in general, with different focuses on the program's weaknesses. The program has contributed to the shift from a rural development strategy based on agriculture and livestock to

the incorporation of other sectors and economic activities. Some of these issues have been tackled thanks to the adaptation of the program over time (Scott, 2002).

However, the LEADER program presents some limitations according to the literature. First, it has a propensity to focus more on non-depopulated rural areas where resources are more available. This would increase the gap between high-density rural areas and low-density rural areas (Navarro-Valverde et al., 2021). Most studies point to the necessity of reforming the policy in some direction to be more effective in reducing depopulation. Another problem related to the LAGs, especially in areas with low population, is that they are highly dependent on local elites that have used them as instruments of power (Esparcia et al., 2015). A further issue is that the innovative factor of the program, which in theory is the key to promote endogenous growth and population attraction, is not working adequately (Bruckmeier, 2000). Additionally, a better system for evaluating projects should be adopted (Bosworth et al., 2016).

The SIPTEA program is implemented in rural areas of Andalusia and Extremadura, two lagging regions in Spain. The income subsidy complements unemployment benefits as an incentive to preserve populations in rural areas. The program resulted in a higher probability of individuals to remain in or to move to rural areas. This program has been effective in moderating depopulation in those areas (Jofre-Monseny, 2014; Serra et al., 2023).

Furthermore, subsidies orientated towards the financing of place-based policies is a policy idea that has also worked in revitalising economic activity in rural areas and thus, reducing depopulation. Particularly, the Italian Strategy for Inner Areas (SNAI) has subsidised the creation of businesses, increasing employment and population retention (Monturano et al., 2023).

Regarding tax reductions, literature focuses more on businesses than on households. This is because most individuals live where they work or nearby, and it is difficult to convince individuals to change their place of residence only through tax exemptions. Tax reductions usually take the form of payroll tax deductions or of the creation of rural enterprise zones.

Literature shows that tax reductions are generally a positive policy for employment creation and, sometimes, wage growth in depopulated areas. In Sweden, a 10% reduction in the payroll tax of businesses in specific rural areas significantly increased employment creation and

slightly increased wages (Bennmarker et al., 2009). In Norway, the zoning of the country depends on the population density, with a difference of 14% in the payroll tax between densely populated and depopulated areas. This strategy has contributed to stimulating local employment and rising salaries in the latter (Ku et al., 2020; Rybalka et al., 2018).

In Australia, the creation of a zone tax offset positively affected employment and population settlement. However, this effect vanished when the policy was lifted (Kettlewell & Yerokhin, 2019). In Colorado (US), the creation of enterprise zones with tax benefits for businesses increased employment in rural areas. The same policy did not have those positive effects in urban areas (Lynch & Zax, 2011).

Tax exemptions in depopulated areas are generally applied to all companies, but they have also been directed to enterprises in specific sectors, such as construction. These programs also have positive effects on employment generation (Keane & Garvey, 2006). However, the main risk of tax programs lies in a non-generous implementation of tax exemptions and reductions. This can result in local enterprises benefiting from the tax breaks without creating jobs, increasing wages, or migrating their activities to those areas (Behaghel et al., 2015).

1.3.3. Sectorial policies

We divide this category into the three sectors of the economy, each one represented by the most important activity of that sector in the studied geography. In rural areas, the predominant sector is the primary, with agriculture and livestock as the main economic activities. The secondary sector is represented mostly by mining and renewable energies, and the tertiary by touristic services.

Agriculture and livestock are living through constant transformations of their productive model, subsidies to this sector, and land consolidation are policies that the literature has analysed. First, irrigation has been widely proposed by policymakers as an effective method to improve agricultural productivity by changing the type of cultivation to high value-added crops. This increase in agricultural productivity and income has translated into lower depopulation and higher attraction of new inhabitants (Cazcarro et al., 2015). Consequently, the promotion of water infrastructures to expand the possibility of irrigation is a way to reduce

depopulation (Silvestre & Clar, 2010; Tenza-Peral et al., 2022). However, other studies find evidence that the relationship is not that strong (Cazcarro et al., 2024).

Moreover, land consolidation policies, that increase the size of fields and farms, show a positive effect for retaining population through increased economic productivity (Miranda et al., 2006). On the contrary, implementing taxes to non-environmentally friendly aspects of the livestock activity fosters depopulation of those areas whose economy is heavily dependent on farming (Morettini, 2023).

In the case of public subsidies to compensate for the low prices of some activities, such as EU's Common Agricultural Policy (CAP), evidence shows that the impact of those subsidies is slightly positive for depopulation reduction but cannot attract new inhabitants to those areas (Grodzicki & Jankiewicz, 2022; Lasanta & Marín-Yaseli, 2007).

It is rare to observe industry in rural areas. Factories generally need large amounts of workers, and thus, they are located in urban environments. If a factory is installed in a rural area, the new employment opportunity generated attracts residents, and the area soon becomes a small town (Liu, 2021). There is only one industrial sector that has been implemented in rural areas: the energy generation industry. Decades before the energy transition movement, those areas with coal mines in their territories were benefited by the extraction and transformation process of coal. The effect of mining activities in rural areas has been beneficial to reduce depopulation, or even generate population attraction to those rural areas with mines during decades (Oei et al., 2020). However, the progressive closing of coal mines due to financial inefficiency and the ecologic transition has fostered depopulation at a fast pace in those areas dependent on mining (Pérez-Sindín López et al., 2023). In other words, mining has been substituted in many cases by renewable energy installations.

The recent rise of renewable energies has affected rural areas since the new energy installations have been almost exclusively installed in rural areas. This is the case of windmills or solar panels which have been installed in rural areas to use natural resources, such as the sun, as well as to exploit lower production costs. Given that the functioning of those plants need only a few workers, literature shows that these kinds of installations contribute to increase depopulation as they do not generate employment after the construction phase. Indeed, they boost the migration of individuals who worked in sectors such as agriculture or rural tourism (Duarte et

al., 2022b; Fabra et al., 2023). The only way in which this policy could be somehow beneficial for these areas is if there is local community ownership of the installations (Duarte et al., 2022a; Phimister & Roberts, 2012).

Rural tourism has been an alternative for some rural economies in recent decades. Those areas that have developed these resources as tourism-oriented factors have succeeded in stopping depopulation in their areas (Hashimoto & Telfer, 2010). This strategy depends on each area's endowments and include different activities (Vidal-Matzanke & Vidal-González, 2022). Literature highlights the importance of involving inhabitants in the experience offered through community-based tourism (Cáceres-Feria et al., 2021), developing museums or amusement parks adapted to the territorial reality (Alcalá, 2018), or using water reservoir management for leisure activities (Larraz & San-Martin, 2021). All in all, policymakers should be aware that not all rural depopulating areas can develop this industry due to the lack of attractive resources for tourists.

1.3.4. Infrastructure policies

Infrastructure often appears in the public debate as the category of policies where the gap between populated and depopulated areas is more significant (Whitacre & Mills, 2007). Infrastructure policies are expensive, so governments prioritize their construction in densely populated areas. Moreover, it could be argued that this investment may not be cost-effective for depopulated areas or that some of these policies would foster depopulation. Literature considers two categories of infrastructures: for transport and for digitalization or connectivity.

Evidence on transport infrastructure is mainly focused on evaluating the impact of roads and highways, as there is a lack of evidence for the effects of railway access on depopulation. The general conclusion is that the expansion of these networks effectively reduces rural depopulation and even transfer residents from suburbs of urban areas to rural ones. According to Levkovich et al., (2020) the gain in population for rural areas derived from their connection to highway networks is explained by the fact that individuals and firms prefer to move there than to a suburb at an urban area.

Road infrastructures that increase accessibility can break long-term population decline tendencies, especially in mountainous regions (Bjarnason, 2021). In the case of the European

Union, the road and highway expansion across Europe from 1990 to 2012 shows significant positive effects on rural areas, not only in terms of population attraction, but also from the employment and economic activity perspectives. This effect is stronger for long-distance connections (Adler et al., 2020).

This evidence contradicts the general view that highways accelerate the process of depopulation. Individuals who migrate from urban to rural areas due to highway construction exceed those who move in the opposite direction from rural to urban locations. Moreover, this policy also helps reducing the urban–rural income gap (Lu et al., 2022). For transport infrastructure, we find evidence on the impact of roads and highways on depopulation reduction.

Research on digital infrastructure policies evaluate the implementation of Internet access technologies. Literature shows that rural depopulated areas would be the ones benefitting more from these interventions (Salemink et al., 2017). Results overwhelmingly show that the increase in digital connectivity effectively reduce depopulation. This policy cannot solve depopulation by itself (Lehtonen, 2020) as workers need to acquire the skills necessary to take advantage of those technologies (Esteban-Navarro et al., 2020). Nevertheless, the evaluation of this kind of policy concludes that the urban–rural digital divide decreases and that the areas of implementation are protected from depopulation (Briglauer et al., 2019).

1.4. Discussion
1.4.1. Implications from findings

Results in the literature overwhelmingly show that the policies described in the previous section can stop and reduce rural depopulation. There are only five exceptions found in the literature warning about a negative relationship between depopulation and public policies intervention (Duarte et al., 2022a; Duarte et al., 2022b; Morettini, 2023; Pérez-Sindin López et al., 2023; Fabra et al., 2023). We present the implications from the obtained findings following the diagram in Figure 3.

First, sectorial policies are essential to guarantee employment possibilities in these areas. Without employment, it is difficult to retain or attract workers and their families, which can increase or maintain the population of a specific village or area. Investing in the most influential

economic sectors in terms of employment creation could be one of the pillars for depopulation reduction.

Agriculture and livestock continue to be the main sectors in rural depopulated areas. Working to increase the productivity and innovation of the existing sectors is the approach taken by the EU CAP and other subsidies. The studies analysed show that this strategy is preferred to making investments in new sectors. Policies such as land consolidation or irrigation projects can also increase productivity.

The closing of mining activities rapidly fosters depopulation, and this is not remediated by the transition to clean energy production. On the contrary, renewable energies do not create stable employment in rural areas. They can even foster depopulation as they crowd out other economic activities such as agriculture or rural tourism. Rural tourism contributes to the shift from traditional rural activities to new ones, which often increases employment opportunities in depopulated areas.

Second, fiscal policies can also generate employment in depopulated areas. They are fundamental to complement specific investments in economic sectors, like those already mentioned. Public investments and tax reductions have been found to be effective in generating a more dynamic economy, with companies hiring more workers and paying higher wages. Public investments accelerate business creation and services' demand from local companies. However, employment creation is a necessary but not sufficient condition to stop depopulation. It may be the case that new workers do not choose to live in that same area or that the employment offer is simply not taken by any demand.

More specifically, programs like EU's LEADER or Spain's SIPTEA have worked as bottom-up rural development accelerators and as incentives to economic activity. Tax cut programs are found to have a stronger impact than interventions from the spending side. In general, policies such as the reduction of social security contributions or the creation of tax-free zones generate employment and raise salaries in areas at risk of depopulation.

Third, social public interventions play a crucial role in complementing the other three categories. It has been already said that employment creation is not enough to reduce depopulation by itself; housing policies are needed to incentivize the presence or the migration

to rural areas. Results suggest that public interventions to achieve affordable housing is important in depopulated areas where private initiatives do not provide it.

In the same way, the provision of education, health, or sociocultural services influences individuals' decisions to live in one area or another. They may not need to be offered in the same way than in large cities, where scale economies allow the existence of certain formats that may not be efficient in rural depopulated areas. Different formats of service delivery can be designed to make those areas more attractive. The literature examined also shows that some specific services, such as hospitals, universities, or shopping centres, need large agglomerations to be economically viable.

Finally, infrastructure policies ease the access to those services that require large agglomerations through increased connectivity and accessibility. Research shows that adequate infrastructures are fundamental to turn a depopulation trend into a population gain one. On the one hand, thanks to Information and Communication Technologies (ICTs), many of the advantages of large agglomeration economies have partially disappeared. There is a world of possibilities for depopulated areas, including e-commerce or remote working. On the other hand, the development of transport infrastructure from unpopulated areas to more populated ones increase the accessibility of both areas. Infrastructure improvements would lead to easier access to cities where agglomeration services are available; this would constitute a way to access them from rural areas in a reasonable time span.

The simultaneous combination of policies that belong to the four categories in Figure 3 should ensure the effectiveness of public interventions to curb rural depopulation. For instance, to address the problem of low employment in a rural depopulated area, policymakers would need to implement sectorial policies (housing) and fiscal policies (public investments or tax cuts). At the same time, social policies would provide the basic services that individuals need for their daily life, while infrastructure investments would connect rural areas with areas that offer those large-scale services. Although this hypothesis is not specifically evaluated in any of the revised papers, many of them point in this direction. The notion that policy interventions need to follow a holistic approach, rather than an atomistic one, is indirectly present throughout the literature.

1.4.2. Critical analysis of the literature

We present our critical analysis around three vectors. First, we stress the limitations and specificities of the literature on policies to tackle rural depopulation. Second, we highlight the consequences derived from them. Finally, we stress how these particularities and weaknesses should condition policymakers' decisions and researchers' strategies.

There are three big limitations that the analyzed literature exhibits. The first one is its atomization. Most of the analyzed papers respond to very narrow research questions, like the impact of irrigation projects on population (Silvestre and Clar, 2010), services provision in rural areas (Goodwin-Hawkins et. al, 2021) or the establishment of fiscal incentives for job creation in specific sectors (Keane and Garvey, 2006). Furthermore, almost 23% of the literature analyzes the research on a specific year and not in a broader time frame, which naturally limits its scope, as it can be seen in Figure 4:

Figure 4. Distribution of Reviewed Articles per Time Frame Analysis

- Point-in-Time   - Time Window
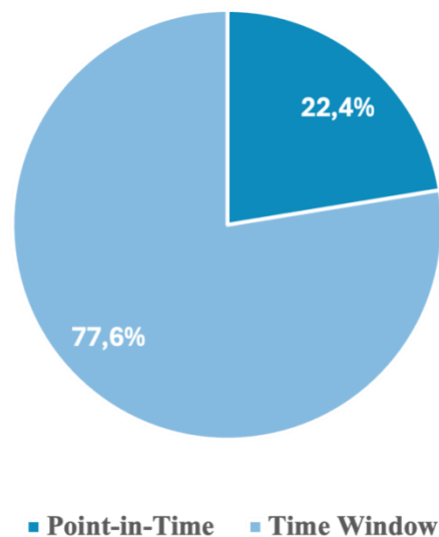
The second one is its regional and geographical limitations. 80% of the analyzed articles focus on European countries or regions. Of the remaining studies, only four were conducted in America, three in Asia, and one in Oceania, with none addressing depopulation in Africa. This distribution can be attributed to the fact that depopulation predominantly affects advanced and mature economies characterized by demographic stagnation.

As for its regional-level analysis, 65% of the articles cover administrative units smaller than the country (regions, counties or municipalities). Only 22% of analyzed countries implement cross-country comparisons (13%), as can be seen in Figure 5.

Figure 5. Distribution of Reviewed Articles per Administrative Level Covered

■ **Higher than Country** ■ **Country Level** ■ **Lower than Country**
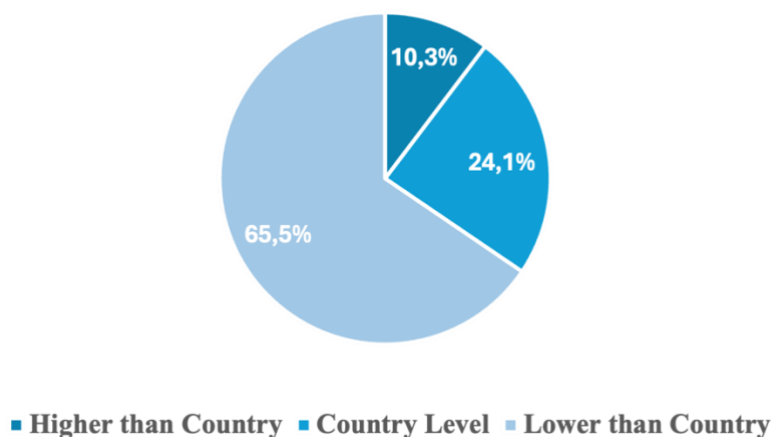
Figure 6. Distribution of Reviewed Articles per Research Strategy

■ **Case Studies / Surveys**   ■ **Quantitative Analyses**
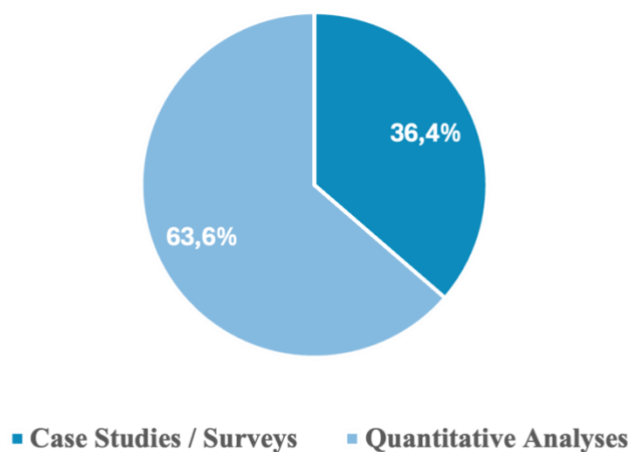
This result is not particularly surprising, as most anti-depopulation policy interventions tend to be focused on specific areas rather than covering full countries. However, the lack of comparative analyses or articles that elevate circumstantial findings to permanent, reduce the aggregate robustness of this literature.

The third problem is connected with data availability and research methods. The lack of aggregate and homogeneous public data on depopulation policies leads researchers to rely on case studies, surveys or theoretical conjectures. More than 35% of the considered papers use these methods for data obtention, as shown in Figure 6. Decade by decade analysis shows that the percentage of qualitative articles has decreased from 50% in the 2000-2009 period, to 43% in the next 10 years, to 38% since 2020. Even if this trend suggests the existence of a richer-data environment, researchers in this literature seem to have adapted their strategies to this data-scarce issue. Empirical strategies rely heavily on simulations, differences-in-differences and cross-section estimations.

From these limitations two consequences arise. The first one is the lack of comparability and scalability of the reviewed findings, as they often consider a very specific region or a set of municipalities during a single year, for example. This makes the conclusions to be tentative and narrow in many cases, as has been already mentioned. The second one is that this literature cannot derive global and homogeneous findings.

For policymakers, this means that research can only back interventions in a narrow and specific manner. Policies should then be adapted to the particularities of each issue and region. Furthermore, the lack of public data on depopulation and on the effects of policies to fight against it, demands a necessary effort from national and supranational authorities to produce quality, comparable and homogeneous data to foster policy analysis and evaluation. Researchers, as it will be shown in the next subsection, have a large avenue to explore at the aggregation of all these atomized findings and on the analysis of all the new policies that are currently being implemented.

1.4.3. Limitations and future research agenda

The findings and limitations in this chapter open a series of research avenues that could be complemented with substantial academic contributions. The reviewed articles combine an academic approach, as they are all published in peer-reviewed journals, with public policies assessments. Consequently, the revision does not cover non-peer-reviewed studies that often are published by government agencies, NGOs, think tanks, or consultancy firms, among others. These studies are also published in the national language of the country where the policy is implemented, which makes more complex the task of doing a generic worldwide comparison

study. This is an area that should be covered in future literature reviews to obtain a more precise image of the anti-rural-depopulation policies efficiency.

Future research can focus on developing studies within a smaller geographical scope but combining both academic and non-academic literature. Studies putting together both streams of literature would be less academically rigorous and geographically diverse, but at the same time would incorporate the results from policy evaluations that would have been otherwise overlooked. This can potentially enrich the contributions of those articles that may have a deeper influence on policymakers due to the incorporation of non-academic references.

As explained before, the results acknowledge that there may be a selection bias in the publishing of papers containing policy evaluations since none of the articles report a lack of effect of the policy. Five articles report a negative effect of the policy evaluated on depopulation reduction. The rest of the articles report a positive effect on depopulation reduction. However, none of the papers report a null effect, which is something plausible in policy evaluations. Literature has extensively documented this publishing bias when the effect found is null (Kepes et al., 2014). It would be useful in future research to document policies with null effects in depopulation. It is equally fundamental for policymakers and academics to know the policies that work and the policies that do not work.

With respect to the comparability of the results from different papers, it constitutes an almost inevitable limitation. Indeed, the different geographical scopes of where the policies have been implemented deal with diverse demographic realities. As an example, the patterns in countries with intensely depopulated rural areas, like Spain or the Nordic countries, contrast with the reality of population loss in countries with vibrant rural areas like the Netherlands or Germany.

Finally, this chapter opens a complementary line of study on the factors that are behind rural depopulation which cannot be influenced by public policies. It has been already commented that public policies may be weaker in achieving certain goals than cultural and social ideas. Therefore, there is a need for future qualitative research on the different motivations that individuals who left rural depopulated areas have on their minds. Further evidence is needed to acknowledge to what extent rural depopulation is caused by social and cultural perceptions of the rural areas more than by the lack of material means that can be provided by public policies.

1.5. Conclusion

This chapter contains a systematic review of the literature that includes all the existing evidence on policies against rural depopulation. After identifying 202 studies through the Web of Science and Scopus databases, we ended up with a total of 66 studies that we finally included in this review. Among all these papers, we differentiate four categories of thematic policies: social, fiscal, sectorial and infrastructure policies.

The obtained results indicate that various public policies have been effective in mitigating, halting, or even reversing depopulation trends. Notably, policies involving tax exemptions and public subsidies can help create employment and foster business development in rural areas. Improved transport infrastructure also enhances accessibility. Additionally, providing housing, connectivity, and other basic services can further curb rural depopulation patterns. Ensuring employment and accessibility, housing, and connectivity, can allow depopulated areas to reverse their population loss trajectories.

These findings underscore the importance of adopting a holistic policy approach to effectively address the depopulation phenomena. Instead of focusing on a single policy, a combination of policies should be considered.

More broadly, the results of this chapter can inform policymakers about which policies have been proven more or less effective in specific contexts. Given the scarcity of public resources for policy interventions, this chapter contributes to the policymaking debate by analysing the efficiency of evaluated policies against rural depopulation.

This chapter has several limitations. First, our methodology is limited to articles that contain policy assessments. Consequently, some effective policies may be excluded from our analysis if they have not yet been formally evaluated in academic journals.

Second, this chapter does not encompass all the reasons behind individuals' migration decisions, which may be influenced by cultural or social factors (Figueiredo et al., 2020). Public policies primarily aim to achieve social ends (e.g., reducing depopulation) through material means (e.g., infrastructure construction, subsidies, service provision). However,

migration's decisions between rural and urban places might be influenced by other interests and objectives beyond material means, as the literature on this topic suggests (Alonso-Carrillo et al., 2023).

Lastly, the main limitation of this chapter is that the method lacks the ability to analyse the sociocultural perceptions affecting the depopulation process. While the chapter rigorously evaluates public policies, it cannot analyse the impact of rural areas' perceptions and values on individuals' mental frameworks. Depopulation, in some cases, may not solely be associated with a lack of housing or employment but with a negative perception of rural areas. Conversely, individuals may choose to reside in rural areas despite facing challenges in accessing services if they hold a positive view of the area. To the best of our knowledge, empirical assessments on policies affecting sociocultural dimensions of rural depopulation are scarce, therefore, more efforts should be made to shed more light on this unexplored topics.

CHAPTER 2. FISCAL REDISTRIBUTION AND THE NARROWING URBAN-RURAL INCOME GAP

2.1. Introduction

In recent years the urban–rural division has been attracting more attention as a social phenomenon (Mettler & Brown, 2022; Carson et al., 2022; Proietti et al., 2022). It affects many dimensions of the social sciences, ranging from income differentials (Su & Heshmati, 2013; Su et al., 2015), skills distribution (Zarifa et al., 2019) and firm performance (Laurin et al., 2020), to child poverty (Wang, Hai, & Cai, 2022), youth engagement (Botrić, 2022), population changes (Henning, 2022), subjective well-being (Gross-Manos & Shimoni, 2020) and even political voting patterns (de Dominicis et al., 2022).

Seminal works on economic geography (Lukermann & Porter, 1960; Thrift & Olds, 1996) and New Economic Geography (NEG) (Krugman, 1999; Fujita et al., 1999; Henderson et al., 2001; Ottaviano et al., 2002; Combes et al., 2008) point out the emergence of territorial urban-rural disparities and subsequent territorial inequalities. The agglomeration and concentration of skills and firms in urban areas boosts productivity and attracts workers from peripheral rural to core urban areas. Under this scenario, income differentials between urban and rural areas increase and lead to the appearance of long-lasting income gaps among territories.

Fiscal redistribution policies may affect regional and urban-rural inequalities (Gaubert, et. al., 2021). In particular, their design determines their effects in reducing territorial inequalities. Although the evidence of such effects is still not conclusive, a long stream of the literature raises two important policy dilemmas which are far from being close. The first one is whether fiscal interventions should address interpersonal or interregional inequalities (Rietveld, 1991; Gbohoui et. al., 2019; Gaubert, et. al., 2021). Should policymakers focus on regional policies that level-up poor regions, even if they are regressive from the households' point of view, or should they target poorest individuals independently of the region in which they live?

Fiscal redistributive policies focused on households in the lowest quantiles of the income distribution could reduce interregional inequalities if they are primarily located in lagging regions (Silveira-Neto & Azzoni, 2012) and when labour markets face distortions in depressed areas (Kline & Moretti, 2013). A larger interpersonal inequality mobility, as compared to regional inequality mobility, suggests that policies may have more impact on tackling income disparities from the individual rather than from the regional perspective (Rey, 2018). However,

the discussion on how lagged regions development relates with interpersonal inequality reduction (and vice versa) is still open in the literature.

The second dilemma lies in the trade-off that exists between interregional equity and economic national growth (Richardson, 1979). Sometimes sacrifices in one of the two goals must be done. Evidence shows that the best way to tackle interregional inequality is to achieve sustained national growth (Williamson, 1965). However, this hypothesis is still disputed since the benefits derived from agglomeration economies have not been proven to expand to the rest of the surrounding territories (Dauth et al., 2018). Indeed, the effects of concentration and dispersion forces on economic growth and inequality is still under debate (Ganau & Rodriguez-Pose, 2022).

This chapter contributes to this discussion on the role of redistributive policies across territories. Specifically, we focus in differences between urban and rural places. We argue that fiscal redistributive policies such as direct taxes, personal transfers, and in-kind transfers play a key role in reducing differences in final income between these two territorial categories. To such end, we propose a joint analysis of *market income*, i.e., income before taxes and subsidies, and *final income*, i.e., income after (direct and indirect) taxes, transfers, and in-kind transfers, for both rural and urban areas. Thanks to these two measures of income, we calculate the urban-rural income gap (urban–rural gap, henceforth) for both as well as the variation in this gap induced by fiscal interventions.

We focus on the case of Spain since it offers several specificities for its scientific relevance. The country has a governance system that gives some independence to the regional fiscal decisions; therefore, regional redistributive outcomes are expected to differ between territories (Díez-Minguela et al., 2018; López-Casasnovas & Rosselló-Villalonga, 2019). Additionally, Spain has the lowest settlement density across Europe (Gutiérrez et al., 2023). There is an uneven population distribution across Spanish territories that leads to the appearance of certain depopulation patterns (Proietti et al., 2022) and a more inefficient provision of public services in rural than in urban areas (Alloza et al., 2021).

With respect to the data, our analysis examines the role played by taxes and transfers at the low and high tails of the income distribution in different territories. We hypothesize that the urban–rural gap is not the same along the income distribution with some deciles being more affected

than others. To tackle this hypothesis, we combine microdata from two micro databases, i.e., *Encuesta de Condiciones de Vida* (Living Conditions Survey, ECV in Spanish) and *Encuesta de Presupuestos Familiares* (Household Budget Survey, EPF in Spanish), for the years 2017, 2018, 2019 and 2020. This way we create a unique cross-sectional database that enables us to measure the gap between urban and rural areas before and after national and regional taxes and transfers. We then estimate a series of quantile regressions (QRs) that assess the urban–rural gap across deciles of both market and final incomes for each Spanish region.

Income survey databases entail two limitations that should be highlighted. First, survey data on living conditions are normally captured through domestic samples, which eliminates the variability of fiscal interventions, and limits the depth of the policies that could potentially be prescribed. Second, even when international living conditions surveys (such as the European Union Survey on Living Conditions, EU-SILC) are available, fiscal policy comparisons may be imprecise due to the different legislative and public sector structures that operate in each country, which might affect policies such as in-kind transfers.

These two limitations are overcome in the Spanish case. First, all individuals in Spain share the same fiscal intervention structure. Second, regions have enough fiscal and political autonomy to implement their own regulatory and fiscal policies. After decades of an in-depth decentralization process, Spain has become one of the most decentralized countries worldwide (Rodríguez-Pose & Ezcurra, 2011; Dziobek et al., 2011; Díaz-Lanchas et al., 2021). Third, Spanish regional and local governments involve heterogeneous regulatory jurisdictions accompanied by tax collection and fiscal expenditure policies that, in 2018, reached 8.5% of GDP in terms of tax revenues and 18.8% of GDP in terms of government expenditures (for further details, see OECD, 2021). Consequently, this regional diversity in fiscal and redistributive capacities allows us to exploit the differences in individuals' final incomes coming from varied regional fiscal policy agendas.

Our findings show that the urban–rural market income gap is 6% on average. After fiscal interventions are implemented, we find that the gap diminishes on average to 4% for the final income. Furthermore, the size of the gap is larger for those in lower income deciles than for those in upper income deciles. The differences in the urban–rural gap endured by the richest and by the poorest individuals account for 4% for market income and 1% for final income. We document these results and verify that the urban–rural gap increases with the market income,

whereas the urban–rural gap diminishes after fiscal interventions. Moreover, our results indicate that, for market income, the gap is 2% higher for the 1st decile than for the 5th decile. In contrast, the gap is 2% lower for the 9th decile than for the 5th decile. These differences change after redistribution takes place. For final income, the gap is similar for the 1st and 5th deciles, while it is 1% lower for the 9th decile.

Our regional results also show that the urban–rural gaps for market and final incomes are different across regions. There is one high-income region (Navarre) and three middle-income regions (Extremadura, Cantabria, and Andalusia) that reduce the gap for the lowest deciles by more than 10%, albeit these regions remarkably differ in their average income per capita levels. On the other side of the spectrum, Asturias (middle-income region) and the Basque Country (high-income region) increase the gap for all their deciles throughout the income redistribution.

The heterogeneity in the gap reduction among regions suggests the existence of a "place-blind" fiscal redistribution system (Gaubert, et al., 2021), built around a set of taxes, transfers and other interventions based on specific households' socioeconomic characteristics that do not include the regions they belong to. This means that the way in which the Spanish fiscal system redistributes income between urban and rural territories is through fiscal interventions that are not designed for such purpose. In other words, fiscal policies based on standard income-taxation schemes may have redistributive impacts in poorer regions and in rural areas because of hosting larger percentages of unemployed and retired individuals receiving unemployment benefits and pensions transfers respectively. Consequently, we speak of "place-blind" policies when their main goal is related with individual socioeconomic conditions, even though they have territorial and spatial consequences. Therefore, we argue there is policy space to implement future place-based policies that complement the standard income-taxation scheme.

This chapter contributes to the literature in three ways. First, it measures the urban–rural gap before and after taxes and benefits. Whereas measuring the urban–rural gap is becoming an increasingly relevant research topic (Yuan et al., 2020; He & Du, 2022; Lu et al., 2022; Zhong et al., 2022; Bucci, 1993; Nguyen et al., 2007; Sicular et al. 2008), there is little systematic evidence on this topic for advanced economies and, specifically, for European ones. Earlier papers focused on the estimation of urban–rural gaps in the case market income. They present mixed results on urban–rural gaps for market income ranging from values around 40% in the

case of emerging economies (Bucci, 1993) to values of 7% for the case of advanced economies (Hertz & Silva, 2020), in line with our findings.

In the same line, there is an important stream of literature that has considered the effects of fiscal redistribution on variables such as inequality (Goñi et al., 2011), poverty (Lustig, 2017), or social welfare (Coady et al., 2022). Nevertheless, no study has measured before fiscal incidence from market to final income from the urban-rural gap perspective. This contribution of the chapter is distinctive since it shows, not only the size of the gap, but also how effective is fiscal policy in the reduction of the gap. Public policies can be informed by this pre-redistribution and post-redistribution joint analysis.

Second, the chapter analyses the urban-rural gap for the entire income distribution and not only for the mean values. It assesses the variation of the urban-rural gap throughout the entire income distribution. Finally, it extends the pre-fiscal and post-fiscal urban–rural gaps for the entire income distribution to all Spanish regions. This exercise allows us to draw some of the channels behind the redistributive capacity of regions and to contribute to the debate of the efficiency of place-based vs. household-oriented fiscal redistribution policies to tackle urban-rural gaps (Duranton & Venables, 2018; Austin, et al., 2018).

This chapter is organized as follows. In the Section 2, we revise the literature on the existence of urban–rural gaps. In Section 3, we describe the data and the methodology, and we report the fiscal interventions conducted regionally and nationally. Section 4 describes the data and the empirical results obtained. Section 5 discusses the main findings. Section 6 concludes.

2.2. Literature Review

There is a wide set of exogenous circumstances that matter for opportunities in life (Dang, 2014; Barros et al., 2009; Hick, 2016; Robeyns, 2017; Sen, 1999; World Bank, 2005). The role played by location and territory in determining individuals' opportunities is studied, broadly, by the economic geography research (Lukermann & Porter, 1960; Thrift & Olds, 1996; Barnes & Christophers, 2018; Bonet-Morón & Ayala-García, 2020) and, in particular, within NEG literature (Krugman, 1999; Fujita et al., 1999; Henderson et al., 2001; Ottaviano et al., 2002; Combes et al., 2008) as part of the so-called geography of inequalities (Martin, 2009).

Economic geography provides a theoretical and empirical framework for analysing the localization of economic activity. According to this literature, technology, knowledge, transport, infrastructure, and capital accumulation are among the factors that explain economic concentration. NEG research has shown how economic activity tends to be located in places where its initial level was already high.

Economic concentration generates economic growth. This is true for urban (Henderson, J. Vernon, 2000) and industrial agglomeration (Geppert et al., 2008), which generally take place simultaneously. Spillovers from concentration affect both urban and rural locations (Artz et al., 2016) and have played a fundamental role in regional development programs like the EU cohesion policy (Arbia et al., 2005). However, at a certain level of economic growth, congestion costs may overcome agglomeration benefits (Glaeser, 1998). Public policies can be effective in fostering agglomeration in places below this development threshold while discouraging concentration in places above it (Rodríguez-Pose & Griffiths, 2021). The discussion is still open in whether efficiency and equity are complemented through concentration and agglomeration dynamics (Gordon & Kourtit, 2020).

These dynamics of spatial concentration of economic activity and their relationship with economic growth influence the design of public instruments and the formulation of territorial development policies (Baldwin et al., 2005). For instance, economic clusters play an important role in regional economic development. Therefore, there may be no need to foster big clusters from a public policy perspective since they are created naturally when there is an initial endowment of firms (Mayer et al., 2008).

Public policy interventions can be important in lagging regions to create, attract and sustain initial endowments that, ultimately, can lead to the formation of a specific cluster (Ganske & Carbon, 2023). The design and implementation of clusters in lagging regions cannot follow a top-down approach, but to profit from endogenous resources or activities. Place-based policies invest in profiting from local knowledge and underutilized resources in lagging regions to push regions to their maximum potential (Barca et al., 2012).

In addition to regional economic development, the formation of clusters and the new wave of place-based policies (Austin, et al., 2018; Duranton & Venables, 2018), one of the many territorial attributes that economic geography has studied is the urban–rural gap, an old research

topic (Dewey, 1960; Benet, 1963; Pahl, 1966). This branch of the literature has focused on how the gap relates with other social variables; factors such as inequality and migration within a country are widely explained by it (Young, 2013).

Research that focuses on urban systems has shown that they tend to accumulate knowledge, innovation, and economic growth (Duranton & Puga, 2004; Glaeser, 2011; Combes et al., 2012) due to more dynamic economic settings, in contrast to rural areas. This idea alone will predict an increase in the urban–rural gap due to the contrast between the permanent growth in urban areas and the decline or stagnation of rural areas. Nevertheless, recent research has pointed out that "there is no law that makes big cities always more dynamic" (Rodríguez-Pose, 2018). The degree of urbanisation (our variable of interest) is confirmed as a determinant of income differences. Consequently, urban–rural gap dynamics continue to be an area of discussion in which there is an opportunity to shed more light by providing new evidence.

Since the differences in income suggested by the economic geography literature play a crucial role in the development of the urban–rural gap, it is necessary to evaluate whether and how fiscal redistribution can help in reducing such differences. According to Lustig (2018), fiscal redistribution refers to the process by which the state collects revenues from individuals and households (primarily through taxes) and spends these revenues on benefits (for example, cash transfers, price subsidies, and in-kind benefits such as education and health) intended for specific individuals and households. In doing so, the state changes the post-fiscal income distribution that would have prevailed in the absence of any intervention.

Efficient fiscal redistributive systems help to reduce income inequality and to close social gaps in a country. Understanding the efficiency of the fiscal redistributive systems should contribute to the design of better policies capable of addressing inequality problems without damaging other economic outcomes, such as growth or employment creation.

Modern ideas on how to reduce income inequality have relied on fiscal redistributive system reforms (Atkinson, 2015; Milanovic, 2016; Blanchard & Rodrik, 2021). In the case of Spain, Ayala & Cantó (2018) analysed the relationship between inequality of opportunities and income inequality. They detected the crucial role of regional minimum income benefits in reducing inequality before and after fiscal interventions.

This chapter grounds on these two branches of the literature and tackles four specific hypotheses. First, we suggest that there is a significant urban–rural gap in Spain, both for market and final incomes. Second, this urban–rural gap is reduced thanks to the redistribution operated through the fiscal system. Third, the different income deciles bear different sizes of the urban–rural gap. Fourth, the urban–rural gap is remarkably different across regions.

2.3. Methods
2.3.1. Data

For our analysis, we use microdata from two different databases. The first one is the ECV, which is an annual survey that contains data on approximately 13,000 households and 35,000 individuals in Spain collected by the Spanish National Statistical Institute (INE). It provides data on income distribution and social exclusion dimensions, among others. The second is the EPF, which provides annual information on consumption expenses. For this survey, approximately 24,000 households are interviewed by the INE. We merge both surveys (ECV and EPF) for 2017, 2018, 2019 and 2020 to obtain a combined cross section database of approximately 140,000 observations with detailed information on individuals' and households' income and expenses.[4] It is worth highlighting that, first, individuals are not the same across all the years and, second, the aggregation of the four years provides enough number of observations by region and type of territory.

2.3.2. Income definitions and tax–benefit policy decentralization

We consider two income definitions to characterize the rural–urban gap. According to Lustig (2018), market income includes labour income, capital income, private pensions income, self-consumption, imputed rent, and other sources of income (e.g., remittances). Final income is obtained from the process of adding and subtracting each fiscal intervention through its direct imputation, estimation, or simulation from the indirect information available in the survey. Most of these fiscal interventions are built through the complementary use of the information contained in different variables in the survey. For instance, through the combined use of income data and family conditions, we can infer whether a household or an individual has the right to obtain a particular subsidy. Table 2 summarizes all the taxes and benefits estimated for the

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[4] The database uses the most recent surveys, and it is unaffected by the effects of the COVID-19 pandemic since the survey in 2020 collected the data in 2019.

Spanish case. Full details on the construction of each indicator can be obtained in Gómez-Bengoechea & Quan (2020).

Table 2. Income definitions for Spain

A. Transfers	Income Concepts	B. Taxes
	Market Income (MI)	
A.1. Contributory social insurance old-age pensions	MI + pensions	B.1. Contributions to social insurance old-age pensions - Employee contributions - Employer contributions
A.2. Direct cash and near transfers + Non-contributory pensions + Unemployment benefits + National family transfers + Regional family transfers + Minimum income benefit	Disposable income	B.2. Direct taxes - Personal income tax (IRPF) - Other contributions to social security
A.3. Indirect subsidies + Energy + Food	Consumable income	B.3. Indirect taxes - VAT
A.4. Monetized value of in-kind transfers + Education + Health	Final income	B.4. Co-payments/user fees

Source: own elaboration from Lustig (2018).

In the case of Spain, we consider income tax and social security contributions as direct taxes and value-added tax (VAT) as an indirect tax. Direct benefits include cash transfers (contributory and non-contributory pensions, unemployment benefits, national and regional family transfers and minimum guaranteed income). Indirect benefits (energy subsidies, food subsidies, etc.) or in-kind transfers (monetary value of public education, public health services and other public services) are also taken into account to estimate final income.

The tax–benefit system in Spain is currently evolving towards more decentralized mechanisms. Most of the taxes are collected partly by regions and partly by the national government (Bozio

et al., 2021).[5] This is the case of the personal income tax; its structure is the same, but the tax rates and tax credits may differ across regions. VATs are claimed at the national level. Regarding benefits, contributory and non-contributory pensions, unemployment, and some family transfers are centralized, whereas the minimum income benefit and in-kind transfers are designed and established by regional governments. The benefit eligibility conditions, amounts and durations may differ across regions as well.

In-kind transfers (education and public health) require a particular estimation methodology (Lustig, 2018). For in-kind public education transfers, we first group individuals by educational level based on their age and the response given regarding their current employment status, which includes student as a possibility. We then stratify students by income level. Using data from Murillo et al. (2018), we randomly assign a percentage of students who, based on their income level (10th, 25th, 75th and 90th percentiles) and their region, might attend a private or public educational centre. Finally, using data from the Spanish Ministry of Education, we allocate for each student the average public spending per region and type of educational centre. We also scale-down the results using total expenditures on education from public accounts and disposable income from national accounts.

For the allocation of in-kind transfers linked to health expenditures, we follow a two-step strategy. First, we use the European Health Survey (EHS) for the definition of income levels and the random selection of individuals who, based on their income and region, may complement public health care with private plans. Second, we assign to each individual the regional public spending per capita depending on the individual's use of public health care ("average number of visits to a specialized doctor") and the existence of complementary private plans.

2.3.3. Territorial differences

We consider different territorial definitions based on the degree of urbanization of the area in which an individual lives. Territories are divided into urban, intermediate, and rural areas following the definition of local administrative units (LAUs) developed by Eurostat-European Commission (Eurostat, 2018). For Spain, the definition corresponds to municipalities (NUTS-

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[5] The Basque Country and Navarre have their own tax systems, with a different tax and benefit structure. The results for both regions were estimated including those particularities of fiscal devolution.

5 level). In order to divide the municipalities into the categories, the total area of each municipality is divided in grid cells of 1 square kilometre.

Those groups of contiguous grid cells that have a density of at least 1.500 inhabitants, and a total population over 50.000 inhabitants are categorized as urban centres. Those groups of cells that have a density over 300 inhabitants and they have a total population over 5.000 inhabitants are categorized as urban clusters. Rural grid cells are defined as those outside urban centres and clusters. Urban municipalities are those where at least 50% of the population lives in urban centres. Intermediate municipalities include those where at least 50% of the population lives in urban clusters. Rural municipalities comprise those whose grid cells have at least 50% of the population living in rural grid cells (Eurostat, 2018).

Figure 7 shows these three territories and the NUTS-2 regional borders. The north-western regions (Galicia, Asturias, and Cantabria) and inner-centre regions (Castille and Leon, Castilla-La Mancha, Extremadura, and Aragon) have the highest share of rural territories, whereas the Mediterranean coast (Catalonia, Valencian Community, Murcia, and Andalusia) and the Madrid region are the most urban-oriented areas.

Figure 7. Urban, intermediate, and rural territories in Spain
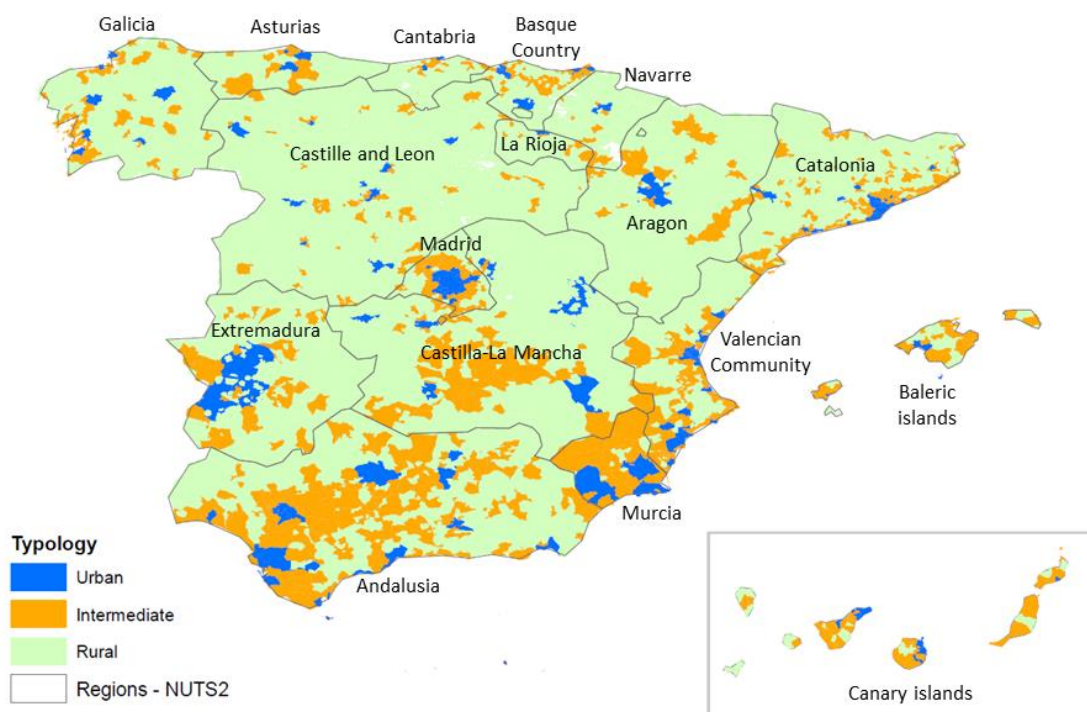
Source: own elaboration from Eurostat data.

Table 3 provides a general overview of the socioeconomic situation of each region and allows to compare them. The table indicates the total population for each region, the percentage of that population that lives in an urban, intermediate, or rural area. It also indicates the GDP per capita and the poverty rate (AROPE). Last, it shows the number of observations per region that our database includes, showing that our database is large enough to ensure significant results not only at the national level but also for each region.

Table 3. Regional socioeconomic figures

Region	Population	% Urban	% Intermediate	% Rural	GDP per capita (€)	Poverty rate (%)	Observations
Madrid	6.750.336	93	5	2	32.048	14,8	13.571
Basque Country	2.208.174	75	15	10	30.401	12,2	7.327
Navarre	664.117	50	26	23	29.314	10,9	3.800
Catalonia	7.792.611	76	14	10	27.812	14,5	28.817
Aragon	1.326.315	62	13	24	26.512	15,0	5.516
Balearic islands	1.176.659	54	33	13	22.048	16,9	3.946
La Rioja	319.892	58	20	23	25.714	16,6	3.911
Castille and Leon	2.372.640	49	12	38	23.167	17,8	8.400
Cantabria	585.402	48	18	34	22.096	14,8	4.425
Galicia	2.690.464	32	10	58	21.903	18,0	9.489
Asturias	1.004.686	52	15	33	21.149	20,1	5.033
Valencian Com.	5.097.967	73	18	9	20.792	22,3	9.489
Murcia	1.531.878	53	28	19	19.838	26,3	6.003
Canary islands	2.177.701	49	26	25	17.448	29,4	4.933
Castilla-La Mancha	2.053.328	44	31	26	19.369	26,1	6.853
Andalusia	8.500.187	67	22	11	17.747	29,1	16.468
Extremadura	1.054.776	38	36	26	18.301	30,0	5.800

2.4. Empirical strategy

We use Quantile Regressions (QRs) to assess the existence of gaps between different territories throughout the entire income distribution for both the market and the final incomes. In contrast with standard OLS regressions providing average results, QRs allow to assess income differentials by type of territory in the lower and the upper tails of the income distribution (Nguyen et al., 2007; Su & Heshmati, 2013). In other words, given that income distributions

are different between and within territories and regions, estimates of urban-rural gaps may change across income deciles. We, therefore, argue that QRs are optimal to estimate the magnitude of such gaps, and, ultimately, to answer the research question that this chapter addresses.

Equation 1 captures the specification for individual i at time t:

$$Q_{\emptyset}[y_{it} | m_{it}, r_{it}, x_{it}, s_{it}, a_i] = \propto_{it}^{\emptyset} + \delta Intermediate_{it}^{\emptyset} + \rho Rural_{it}^{\emptyset} + \beta x_{it}^{\emptyset} + \gamma s_i^{\emptyset} + \lambda a_t^{\emptyset} + \epsilon_{it}^{\emptyset} \quad (1)$$

where y_{it} independently represents the (logarithm of) market income and final income of individual i in year t for a given conditional quantile ($\emptyset$[th]) and x_i represents individual control variables such as age, gender (takes value 1 for females), educational level (taking the value of 1 for the secondary and tertiary educational levels), employment status (taking the value of 1 for employed individuals), household size (single-individual households vs. all other sizes), and sectors of activity (primary, secondary or tertiary sector). These control variables are in line with the literature on the determinants of income per capita (Huber & Stephens, 2014). An individual's age (Murphy & Welch, 1992), education, employment status, household size (Atkinson, 1992) and sector of activity (Kenessey, 1987) are expected to have a positive effect on personal income, whereas the gender dimension is expected to negatively impact income (O'Neill, 2003).

The variables $Intermediate_{it}$ and $Rural_{it}$ account for territorial differences. In particular, $Intermediate_{it}$ is a dummy variable that takes the value 1 if the individual lives in an intermediate area and 0 otherwise, whereas $Rural_{it}$ takes the value 1 when the individual lives in a rural area. Our coefficients of interest are those attached to Intermediate (δ) and Rural (ρ). They measure the impacts on income of living in an intermediate area (urban–intermediate income gap) or in a rural area (urban–rural gap) compared to individuals that live in an urban area.

The remaining variables account for region ($s_i^{\emptyset}$) and time-variant year ($a_t^{\emptyset}$) fixed effects, which, in the case of regional effects, capture the differences in the per capita income variables compared to the Madrid region. We include time and region fixed effects to control for time-specific and region-specific variations that could potentially bias the regression results. As

argued above, Spanish regions are characterised by their heterogeneity and their high levels of decentralization. In the 4.2. Results section we provide further evidence on the appropriate use of regional fixed effects to reduce potential biases in the urban-rural gap.[6]

We run a series of QRs for the 1st, 5th and 9th deciles ($\emptyset$) for both market income and final income. This way, we isolate urban–rural gaps once the fiscal redistribution process takes place. We argue that regions with stronger redistributive fiscal policies achieve a lower final urban–rural gap.

We calculate the redistributive capacity of each region in each quantile as the difference between the quantile coefficient of the rural variable (ρ) for the market income and final income regressions. In other words, we define the redistributive capacity of region R in quantile $\emptyset$ as follows:

$$Redistribution_R^{\emptyset} = \left(\rho_{market\ income}^R - \rho_{final\ income}^R\right)^{\emptyset} \quad \forall \quad \emptyset = (1, \dots, 9) \qquad (2)$$

2.5. Results
2.5.1. Descriptive analysis

Table 4 shows the values of the main statistics for each type of territory.[7] Individuals in rural areas tend to experience lower median market income levels, less income dispersion and lower income growth rates between 2017 and 2020 than individuals in intermediate and urban environments. Market income inequality, measured by the Gini coefficient, is higher in rural areas than in the other two types of territories. These patterns are in line with the NEG literature, as stressed above.

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[6] In Annex 4, we include a correlation matrix between all the variables used in the regressions (except for region and time variables). Rural correlates negatively (and significantly) with market and final income, while urban correlates positively (and significantly). Correlations are also informative in other dimensions: Rural correlates negatively with gender (less women than men in rural areas), while the correlation with age is positive (older people in rural areas). Rural correlates positively with autonomous workers and negatively with salaried ones, showing the structure of the labor market in those areas. In the same direction, rural correlates positively with the primary sector and negatively with the tertiary sector. The correlations for urban areas point in the opposite direction.

[7] Tables 8 and 9 in Annex 3 show further evidence on the distribution of individuals in each decile for market income and final income, respectively.

Regarding the final income, data shows a narrower gap between rural and urban areas. The final income dispersion is lower, and the income distribution becomes more evenly distributed for the three types of locations, with lower and more similar growth rates and Gini coefficients.

Table 4. Summary statistics for market income and final income, 2017-2020

Type of income	Urbanization	Obs.	Median (€)	Std. Dev. (€)	Gini Coef.	Growth rate (%)	Diff. with rural med.
Market income	Rural	40.894	10.085,22	13.643,85	0,48	12,07	-
	Intermediate	33.875	11.014,86	14.238,96	0,47	42,45	929,64
	Urban	68.314	11.432,55	14.840,59	0,47	33,77	1.347,33
Final income	Rural	40.894	12.197,81	7.272,62	0,28	-6,10	-
	Intermediate	33.875	12.616,24	7.349,01	0,28	5,46	418,43
	Urban	68.314	13.084,64	7.636,67	0,28	7,22	886,83

Figure 8 displays the distributions of market income and final income for urban and rural areas. Final income is higher in both urban and rural areas, and compared to market income, a more even income distribution is revealed. Nevertheless, rural areas tend to concentrate lower final income households.

Figure 8. Market and final income density distributions (in €), 2017-2020
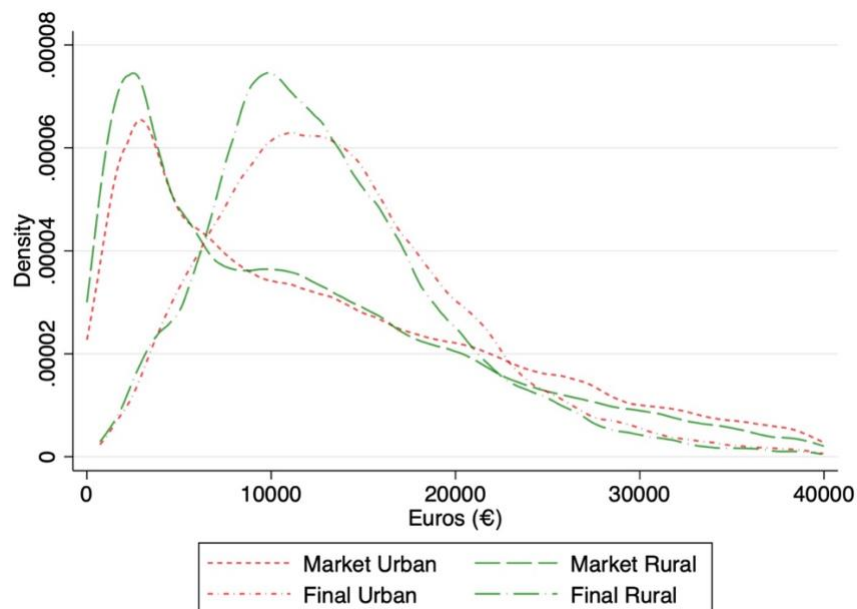
Figure 9 illustrates the market income and final income gaps between urban and rural areas for the 1st, 5th and 9th deciles. Income gaps are estimated as the difference between the median

market income and the median final income within each decile. The higher the decile for both types of income, the larger the absolute gap. In contrast to market income, the final income gap is remarkably lower, which highlights the role played by fiscal redistribution. However, as it is shown in the Results section, this difference is reversed when we observe the results of the regressions, instead of looking simply to the data descriptive analyses.

Figure 9. Urban–rural gap by deciles, with median values in euros, 2017-2020
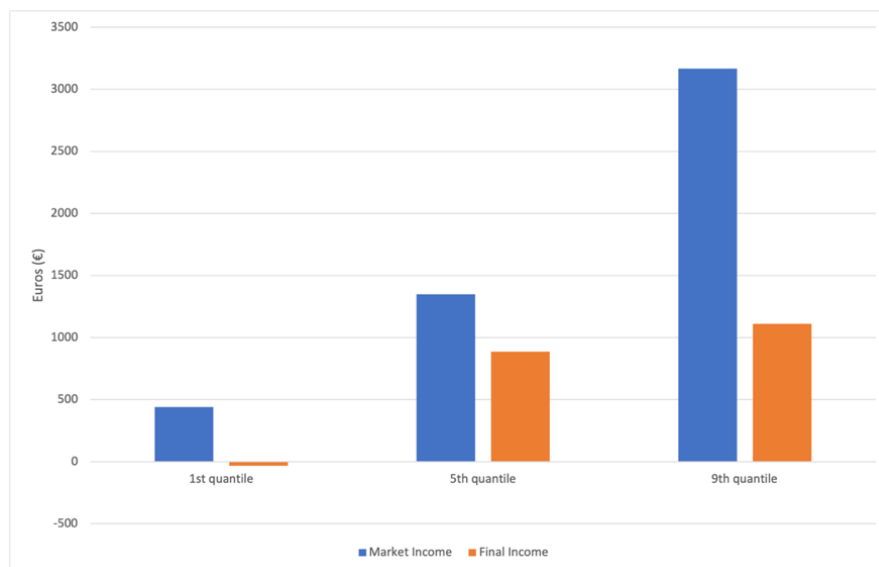
Figure 10 depicts the median income gap between urban and rural locations for each region. Regions such as Extremadura, Castilla-La Mancha, La Rioja, and Catalonia present large market income gaps, whereas Navarre and Aragon have narrower gaps. In contrast, larger final income gaps are mainly concentrated in regions such as Asturias, the Basque Country and, again, La Rioja and Catalonia. These differences in final income gaps highlight the heterogeneous redistributive policies that exist among Spanish regions and indicate their divergent spatial impacts across territories, which we analyse in the next section.

Regional income data differentiated by urban and rural areas is shown in Figure 16 of Annex 3. Regional heterogeneity in both market income and final income follows the patterns obtained for the national distributions. As shown in panels a) and c) of Figure 16, some regions (Aragon and Murcia) have a higher median market income in urban areas that is reduced after fiscal interventions. Other regions, such as Navarre and Galicia, experience the opposite. Panels b) and d) of Figure 16 also show a similar redistribution pattern from market income to final income in each region. However, there are some exceptions, such as Andalusia, which have a

different pattern compared to the urban trajectory; the redistribution process benefits more to those individuals in urban areas of Andalusia than in the rural areas of the same region.

Figure 10. Urban–rural gap by NUTS-2 regions, with median values in euros, 2017-2020

a) Market income   b) Final income
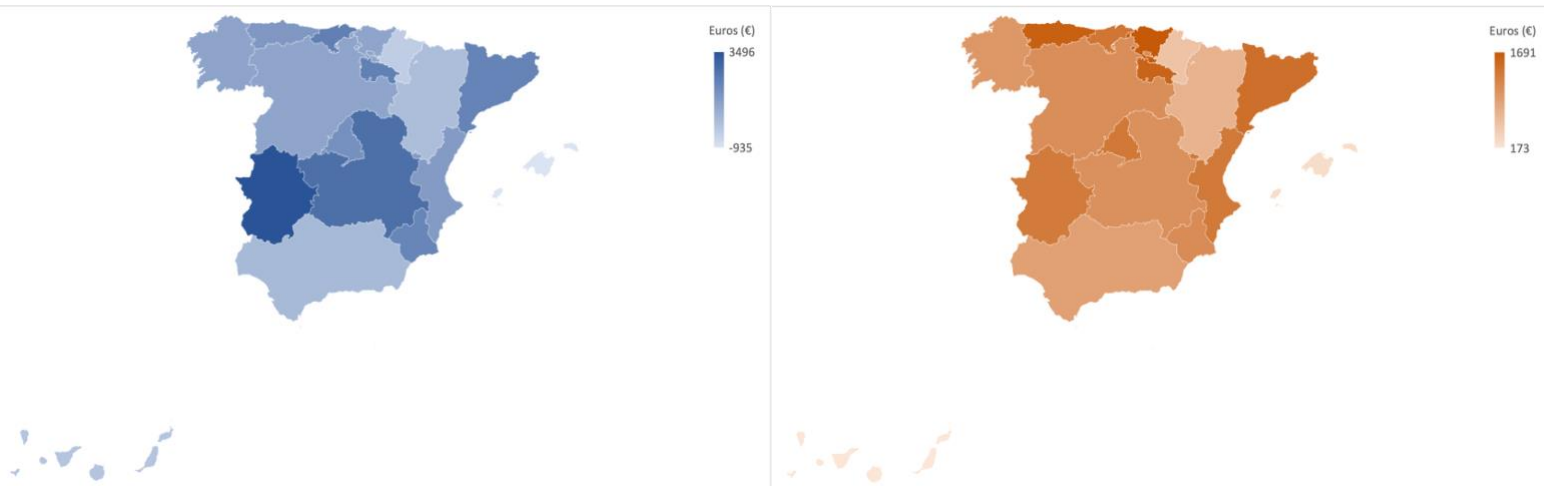
2.5.2. Quantile regression results

Table 5 shows the QR results for the 1st, 5th, and 9th deciles and for market income and final income. It also includes the results of an ordinary least squares (OLS) regression as a baseline comparison. The first column presents the OLS regression, while from the second onwards, the columns show the QR results for the 1st, 5^{th,} and 9th deciles. The table shows our coefficients of interest for the analysis, while Annexes 5 and 6 show the full results including all the coefficients. Annex 5 shows the results using market income as the dependent variable, and Annex 6 shows the results with final income as the dependent variable. Almost all the variables are significant. Age and educational level have a positive effect on income. In contrast, household size has a negative effect. Sectors of activity and employment status also matter in determining income.

These results on the urban–rural gap reveal three main findings. First, OLS estimations show that market income is 1.84% lower for individuals who live in intermediate areas than for those in urban areas and 5.69% lower for those in rural areas compared to those in urban areas. Regarding final income, the urban–intermediate gap increases to 2.08%, and the urban–rural

gap falls to 4.41%. Fiscal interventions increase the urban–intermediate gap and reduce the urban–rural gap. The urban-rural gap is larger for both market and final incomes.

Table 5. Quantile estimation for different types of individuals' market and final income.

	(1) OLS	(2) 1st decile	(3) 5th decile	(4) 9th decile
	Log market income pc	Log market income pc	Log market income pc	Log market income pc
Urban–intermediate gap (δ coefficient)	-0.0184** (-2.61)	-0.0317* (-2.17)	-0.0200** (-2.59)	-0.0233* (-2.49)
Urban–rural gap (ρ coefficientl)	-0.0569*** (-8.07)	-0.0869*** (-5.93)	-0.0619*** (-8.02)	-0.0430*** (-4.59)
	Log final income pc	Log final income pc	Log final income pc	Log final income pc
Urban–intermediate gap (δ coefficient)	-0.0208*** (-4.92)	-0.0229** (-2.93)	-0.0190*** (-2.93)	-0.0234*** (-3.34)
Urban–rural gap (ρ coefficient)	-0.0414*** (-9.75)	-0.0403*** (-5.16)	-0.0443*** (-8.78)	-0.0304*** (-4.32)

Note: t statistics in parentheses. * $p<0.05$;   ** $p<0.01$; *** $p<0.001$.

Second, the negative impact on income of living in a rural area is higher than the one when living in an intermediate area. Finally, in general terms, the higher the income decile is, the smaller the gap.

The findings suggest that living in a rural or in an intermediate area may not be a substantial disbenefit in terms of income for high-income individuals. However, living in such an area may constitute a disadvantage in terms of income for those in the lower deciles of the income distribution. For market income, individuals in the 1st decile of the income distribution experience an urban–rural gap close to 9%, compared to 4% for those in the 9th decile.

Regarding final income, the results show that the fiscal system, through taxes and transfers, reduces the urban–rural and urban–intermediate gaps. From the income distribution perspective, the higher the decile is, the lower the reduction produced by the fiscal system. Individuals in the 9th decile experience a small gap reduction in relative terms.[8]

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[8] We also perform additional robustness checks for the baseline regressions without controlling by regional fixed effects. Our results point out that the signs of the coefficients for the urban-intermediate and urban-rural areas remain the same. Nevertheless, the magnitude of such gaps increases in the case of the market incomes and decreases for final incomes. In either case, we consider the use of regional fixed effects in the baseline regressions as more appropriate to get accurate results.

2.5.3. Regional results

Figure 11 shows the urban–rural gap in market income and final income by decile for all the regions in our sample. The regions are ordered in descending order of regional GDP per capita. The blue squares represent the coefficient of the urban–rural gap for the 1st decile of each region. The red circles do the same for the 5th decile, whereas the green triangles reproduce the 9th decile. The red line placed at 0 differentiates those having a negative urban–rural gap for rural areas, from those having a positive urban–rural gap for rural areas.

Figure 11. Regional urban–rural gaps by decile

a) Market income   b) Final income
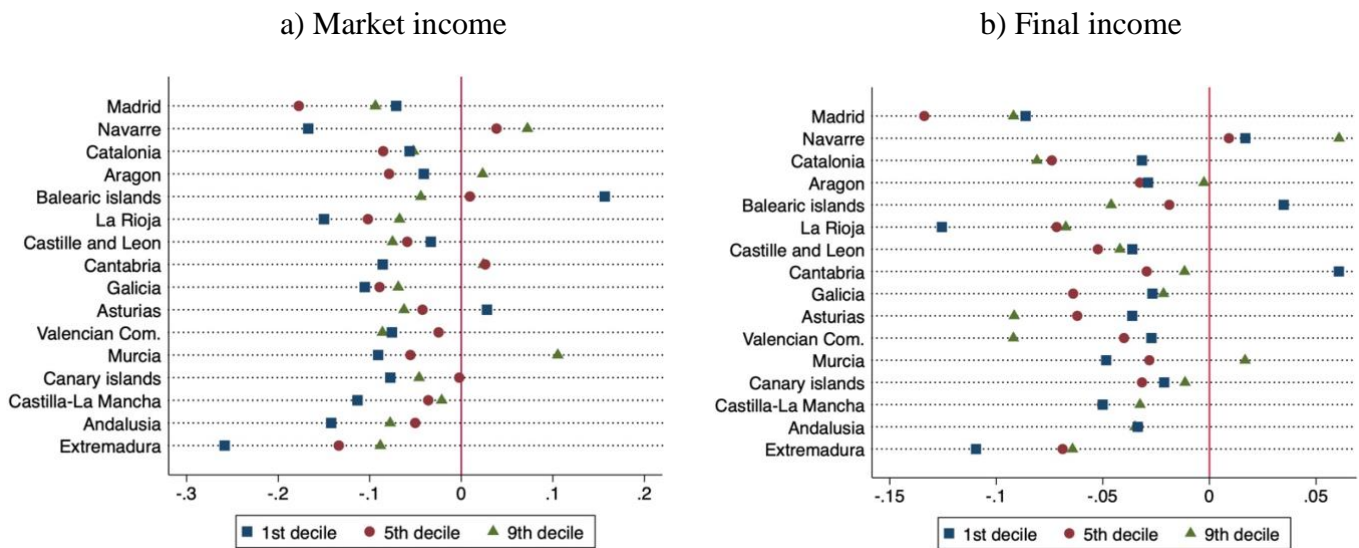
In general, the data points are closer to 0 in panel b) of final income, meaning that the fiscal system usually helps reduce the urban–rural gap across all deciles. While the coefficients for market income range from -0.3 to 0.2, the coefficients for final income range from -0.15 to 0.07. However, the variation between regions is large, and some regions redistribute better than others.

We observe noticeable heterogeneous results, especially for market income, where the differences are larger than in the final income graph. Extremadura, Andalusia and Castilla-La Mancha follow the previous pattern in which the market income gap is negative and is the largest for the 1st decile, followed by the 5th decile and, lastly, the 9th decile. Furthermore, the Balearic Islands and Castille and Leon have the largest gap for the 9th decile, followed by the 5th decile and, lastly, the 1st decile. We also observe regions such as Cantabria, Navarre, and

the Balearic Islands in which two out of the three deciles analysed have positive urban–rural gaps.

Exploring the results of the regional analysis in more depth, panel a) in Figure 11 shows that there is a remarkably greater urban–rural gap for the lowest decile of income in regions such as Extremadura (-26%) and Navarre (-17%). Conversely, the lowest decile of individuals in the Balearic Islands has a positive gap of 16%. For the middle part of the market income distribution, surprisingly, Navarre has a positive gap of 4%. Regarding the income distribution, Madrid (18%) and Extremadura (13%) have the largest gaps. With respect to the highest decile of market income, Extremadura continues to have a large negative gap (-9%) shared at that level only by the Valencian Community. In contrast, Murcia has a positive gap of 11% for the highest decile of income.

Panel b) in Figure 11 shows that La Rioja (-13%) and Extremadura (-11%) have the largest urban–rural gaps for the lowest decile. However, Cantabria has a positive gap (6%) in that specific decile. Regarding the 5th decile, Madrid has the largest negative gap (-13%), and Navarre has the smallest and the only positive gap for that decile (1%). For the highest decile, three regions have a gap of -9%, with these cases having the largest gap (Asturias, Madrid and the Valencian Community). On the other hand, Navarre has a positive gap of 6%.

Figure 12 shows the extent to which each region reduces the urban–rural gap due to fiscal redistribution. That is, the coefficients in the figure show the result of subtracting the urban–rural final income gap from the urban–rural market income gap for each region and decile. Based on equation 2, if we subtract the urban–rural gap coefficient for the final income of a specific decile in a particular region from the same coefficient for market income, we obtain the results shown in Figure 12. With this difference between incomes, we observe the gap reduction in absolute terms, that has taken place due to the redistribution process. The coefficients in the graph measure the redistributive efficiency of the fiscal system in terms of urban–rural gap reductions. The more negative a coefficient is, the larger the gap reduction from market income to final income for a specific region and decile has been. Similarly to previous figures, regions are ordered in descending order of regional GDP per capita.

We observe a large shrinkage of the gap for the 1st decile of income in Andalusia, Cantabria, Extremadura, and Navarre. Positive coefficients suggest that they not only do not reduce the

urban–rural gap through taxes and transfers, but that they also increase this gap. Asturias, the Balearic islands and the Basque Country are the three regions that have positive values for the three deciles. This result means that their redistribution process increases the urban–rural gap for all individuals, regardless of where they are in the income distribution. In contrast, Andalusia and Extremadura are regions that have coefficients for the three deciles below zero, meaning that they are conducting an effective redistribution process, reducing the urban–rural gap for all individuals, regardless of their income category. However, while the size of the gap reduction in Extremadura is highest for the 1st decile, followed by the 5th decile and, lastly, the 9th decile, in Andalusia, the gap is reduced by a larger size for the 9th decile than for the 5th decile.

Figure 12. Fiscal reduction in the urban–rural gap
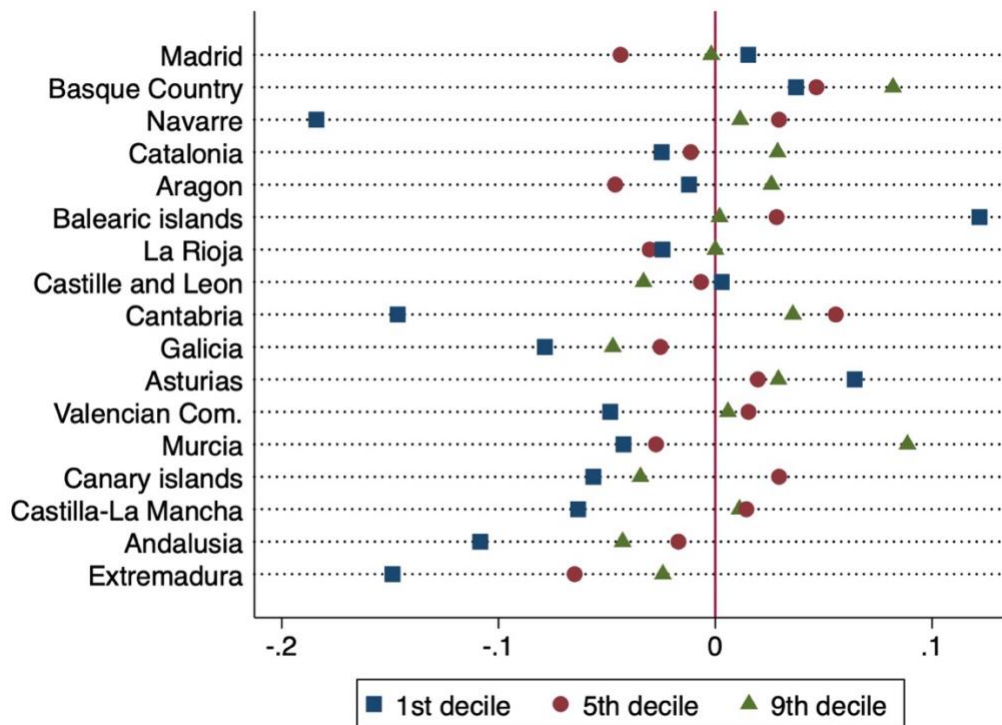
From both Figures 10 and 11, we note that there are considerable differences in the sizes of the urban–rural gaps among regions and deciles of the income distribution. Panel a) in Figure 11 shows that larger and negative urban–rural gaps are generally located in the richer and poorer regions, but not on those with an intermediate GDP per capita. Figure 12 indicates that poorer regions reduce more the urban–rural gap, at least for the 1st decile.

These results point out that we do not observe that richer regions reduce more the urban–rural gap than poorer regions. Indeed, we find that there is a great diversity in how efficient regional fiscal systems are in meeting the goal of reducing urban–rural gaps. Some regions such as Andalusia reduce the urban–rural gap while others even increase it (e.g., Asturias and the Basque Country). However, most regions have different gap reduction patterns for each income decile.

2.6. Discussion

Results in the previous section stress that individual's market and final incomes differ from rural to urban places, even after controlling for geographical variables such as the region of residence. This urban–rural gap is larger for lower income deciles, which means that poorer individuals in rural territories suffer from a proportionally larger gap than those in the higher deciles of the income distribution. These differences are reduced, but still exist, when we move from market to final incomes.

From the regional perspective, the urban–rural gap shows significant heterogeneity in both market and final incomes. Compared with market income, regional final income gaps are smaller in all cases. The gap reduction is not evenly distributed among deciles and regions. These differences can be explained, on the one hand, because of the rural sprawl of some regions. For instance, regions such as Aragon and Castille and Leon experience one of the weakest reductions in the urban–rural gap as a result of having one of the highest percentages of rural territories in Spain.

On the other hand, the interplay between national and regional interventions determines the redistributive outcomes in many regions. To grasp these differences, a comparison of regions like Extremadura and Asturias becomes an illustrative example. The tax–benefit system of Extremadura is very effective in redistributing resources across territories. The reduction in the urban–rural gap for the 1st decile is 15%, for the 5th decile 6,5%, and for the 9th decile 2,4%. For Asturias, the opposite occurs. The gap increases by 6,4% for the 1st decile, by 2% for the 5th decile and by 3% for the 9th decile. Although they are two middle-income regions that operates within the same Spanish tax-benefit system, the combination of national income-taxation schemes and the specific regional fiscal structures generates very different redistributive outputs.

Furthermore, this analysis of the regional results after fiscal redistribution raises four main conclusions. First, even if regional income differences matter, most of the redistribution takes place at the national level through contributory and non-contributory old-age pensions, unemployment benefits and disability transfers. Centralized fiscal interventions are focused on individuals' characteristics and economic conditions while they do not consider the territory (urban, intermediate, or rural) or region where individuals are located. As a result, national policies could potentially exacerbate or ameliorate the urban-rural gaps.

Second, this prominence of national policies makes the Spanish Tax-benefit system to be "place-blind" since they focus on individuals' socioeconomic characteristics rather than in places' differentials. It does not exclude the possibility that policies designed for socioeconomic purposes also have territorial consequences. Indeed, our findings suggest that the Spanish urban–rural gap is reduced because of the individuals' socioeconomic characteristics and not because of policies designed to lift rural areas.

Third, idiosyncratic regional characteristics in terms of their economic, social, and institutional performances have a significant effect in the implementation of fiscal policies. Retired individuals tend to live in a higher proportion in rural areas (Brown et al., 2008) having an impact on the redistributive capacity of transfers (pensions). Unemployment is higher in the south than in the north of Spain (López-Bazo et al., 2005). Consequently, we could expect larger reductions of the gap in the rural southern regions (e.g., Andalusia and Extremadura) than in the urban northern regions (e.g., Asturias and Basque Country).

Last, middle-income regions are good in reducing the urban-rural gap specially for the lowest deciles of the income distribution. In particular, some poorer regions (Extremadura, Andalusia, or Castilla-La Mancha) are narrowing the low-income gap more intensively than richer ones (Madrid, Basque Country, or Catalonia).

These cases need a more nuance analysis. The significant reduction in the urban–rural gap for the lower deciles in Extremadura and Andalusia may be driven by a particular transfer called Plan de Empleo Rural (Rural Employment Plan, PER in Spanish). This transfer programme is specifically designed for workers in the agricultural sector who are unemployed throughout a year to complement temporary incomes and to avoid the migration of agricultural workers from

rural areas. From 1986 to 1996, this transfer affected only the Andalusia and Extremadura regions. This transfer is now extended to other regions in Spain, although Andalusia and Extremadura benefit from more than 85% of the total budget (more than 200 million €). The goal and design of this transfer policy should be reformulated as it presents relevant limitations even in retaining individuals in their territories (Serra, et al., 2023). In either case, this is a good example of a transfer policy that could complement standard income-taxation schemes in achieving higher redistribution outcomes.

Regarding Asturias and the Basque Country, both regions have been affected by deep industrial transformations whose associated social costs were moderated through different fiscal interventions. In Asturias, direct benefits to individuals working on mining activities (mostly placed in urban areas) were established (Fernández-Vazquez, 2022). The Basque Country has experienced a reconversion towards a service-oriented economy (Navarro et al., 2014). This change took place mostly in urban areas through transfer programmes to those affected by the reconversion.

These specific policies from the Spanish case show that the inclusion of a rural perspective on fiscal redistribution can complement dominant households-oriented interventions. Furthermore, they align with the recent trend of public policy declarations that point to the need to adapt policies to rural areas through "rural proofing" mechanisms such as those proposed by the EU (European Commission, 2021).

This mechanism implies that legislations and policies have to be analysed from the perspective of the consequences that they will have in rural areas to prevent governments from broadening the urban-rural gap in any aspect (Nordberg, 2021). The systematic review of the fiscal systems through a "rural lens" would be aligned with the most innovative policy, which should contribute to further reduce the gap by paying attention to it before any reform is implemented (Shortall & Alston, 2016).

From the literature point of view, recent works point in the direction of "place-based policies" (Iammarino et al., 2019) that normally contribute to the development of least developed regions (Leßmann, 2006). The implementation of place-based policies to address urban-rural gaps unfolds a series of new institutional challenges. For instance, national and subnational policies would need to be coordinated, otherwise, the effect of an adequate place-based national policy

could be limited by regional policies, or the other way around (Liu et al., 2021). Evidence on this regard shows that there is not a complete set of guidelines for policies' coordination. This coordination requires a case-by-case approach (Peters, 2018) in which there are some necessary, although not sufficient, minimal prerequisites for making collaboration across the different institutional levels involved as effective as possible. Similar administrative capacities is one of the key elements at this respect (Ferry, 2021).

Even though place-based fiscal redistribution might be a valid instrument to tackle urban-rural gaps, there are other policies that are more cost-effective in the long run (McCann, 2023), although less effective in reducing the urban-rural gap. Policies directed to increase productivity in rural areas might be useful in rising wages in those areas (Pezzini, 2001). Examples such as the creation of enterprise zones, infrastructures or investments in higher education have a role in creating self-sustaining longer-run gains that narrow the urban-rural gap (Neumark & Simpson, 2015). A combination of policies with immediate redistributive effects in the short run with enduring investment policies in the long run may balance the costs and timing of the urban-rural gap reduction.

Policies' analysis confirms that socioeconomic dynamics in rural areas is quite different from those in urban areas where policies are usually designed. Public place-oriented interventions could complement income-based interventions and contribute to a more balanced redistribution system (Vittuari et al., 2020). Societies' support for spatial redistributions would be the key challenge in this respect since economic evidence suggest the validity of fiscal place-based interventions (Gaubert et al., 2021).

Traditionally, economists and policymakers have rejected this approach on fiscal redistribution (Glaeser, 2008), as it was considered to be inefficient due to the artificial increase in economic activity generated in less productive places and, conversely, the decrease in more productive areas. However, consensus on other non-fiscal place-based interventions that tie economic benefits to geographic locations is much wider (Glaeser & Gottlieb, 2008; Kline & Moretti, 2014; Ehrlich & Overman, 2020).

The results presented in Section 4 are aligned with the findings by Gaubert et al., (2021). These authors suggest the necessity of complementing place-blind taxation when income groups are segregated (across regions and areas) through the implementation place-based redistribution

interventions. This would contribute to ease the costs of redistributing across individuals and households' earnings. In highly decentralized countries such as Spain, this should ideally be done at the national level to avoid a new wave of competitive interventions between regions. Doing this, countries could create welfare gains that standard income-based redistributive schemes cannot.

2.7. Conclusions

This chapter studies the existence of an urban–rural gap in households' income in advanced economies using two types of income measures before (market income) and after (final income) fiscal redistribution takes place. We focus on the case of Spain since it offers several specificities for its scientific relevance. Results show that once fiscal redistribution is in play, the urban-rural income gap is reduced. In particular, we find that there is an average urban–rural gap of approximately 6% for market income and 4% for final income. These results are in line with the still few studies on the urban–rural gap for advanced economies (Hertz & Silva, 2020), which show a smaller gap than in emerging economies (Bucci, 1993; Nguyen et al., 2007; Sicular et al., 2008). Moreover, we document the existence of an uneven urban–rural gap along individuals' income distribution. The gap further deteriorates for households in the lowest deciles of the income distribution and improves for highest earning individuals. Regarding market income, individuals in the lowest deciles of the income distribution experience a 9% urban-rural income gap; for the highest deciles, this same indicator falls to 4%. These differences persist with smaller magnitudes after fiscal interventions. (4% for market income and 3% for final income). As far as our knowledge goes, these are novel results that point out to promising areas of research on the interplay between fiscal redistribution and the magnitude of the urban-rural gap.

Finally, we explore regional differences and find heterogeneous urban–rural gaps across regions in which fiscal regional policies have a positive role in reducing these gaps. This redistribution process is not contingent to the economic performance of a region. On the contrary, our results show that low-income regions have similar or even stronger redistributive capacity as high-income regions. In a fiscal system in which taxes and transfers do not explicitly differentiate depending on the territorial typology in which the individual lives, a so-called "place-blind" fiscal system (Nurse & Skyes, 2020), our results shed light on the narrowing impact of fiscal redistributive policies on the urban–rural gap.

Specific policies designed to reduce the urban-rural gap remain understudied. The findings in this chapter open the door to future analyses on the cost effectiveness of fiscal policies in tackling such gap.

CHAPTER 3. SCAPING REGIONAL DEVELOPMENT TRAPS: A NEW GROWTH DIAGNOSTICS FRAMEWORK TO PROPOSE PLACE-BASED POLICIES

3.1. Introduction

Recognising the specific challenges and opportunities that different regions present, place-based policies have emerged as a tailored approach to economic development, causing a significant shift in public policy. Since their inception in the early 21st century, place-based policies have drawn increasing interest from development scholars and practitioners, especially with the rise of the New Industrial Policy (Duranton & Venables, 2021). In the academic field of economic geography, the focus has shifted from spatially blind policies to place-based ones (Seravalli, 2015). While the former addresses the socioeconomic outcomes of individuals without regard to their geographic setting, the latter supports economic growth in specific areas, often through targeted investments, enhancements to infrastructure, or initiatives to engage local businesses. Nevertheless, place-based policies extend beyond any public policy area, affecting education, tax incentives, subsidies, industrial strategy, technology implementation, and infrastructure development. Despite ongoing discussions about their effectiveness, there is a consensus that place-based policies could be vital in influencing the trajectories of regions (Morisson & Doussineau, 2019).

Place-based policies are particularly relevant for regions that face persistent structural growth challenges. Literature has recently introduced the "regional development traps" concept to describe these regions in long-term economic stagnation or decline (Rodríguez-Pose et al., 2023). The regional development trap concept encompasses geographical areas that struggle significantly with regaining their economic momentum or enhancing the prosperity of their residents (Diemer et al., 2022). These regions encounter binding constraints that limit their economic potential. Moreover, regional development traps can result from various elements and not necessarily from a single one (European Commission, 2020). Identifying the specific constraints to growth is critical for choosing place-based policies that could potentially improve the region's prospects.

There remains, however, a gap in the literature for a model that systematically identifies these constraints and proposes customised policies to address them. While there are frameworks for analysing regional socioeconomic situations, they often do not connect their findings to policy recommendations tailored to those conditions. Similarly, the policy recommendations in the literature are rarely integrated into a systematic structure that addresses the specific needs of a particular region.

This study aims to identify the binding constraints that affect and limit regional growth and to propose effective policy solutions for these issues. We have developed a model that examines current indicators and considers historical economic trends to identify development traps and other barriers to regional growth. Upon identifying these elements, our framework guides the selection of specific place-based policies tailored to each region's unique challenges. This research adds to the theoretical foundations of socioeconomic analysis models and highlights the need for adapting and refining policy tools to serve regional policymakers and practitioners effectively.

Our methodology for detecting binding constraints and formulating policy recommendations is based on the Growth Diagnostics (GD) approach developed by Hausmann et al. (2008). This framework was chosen for three reasons: its systematic approach to identifying growth impediments in a multi-level scheme, its adaptability to various contexts, and its suitability for territorial comparisons. Other cross-country growth analysis frameworks require extensive data for regression analysis or fail to integrate various growth-affecting variables. In contrast, the GD provides a bottom-up perspective, allowing for an in-depth analysis of each territory's socioeconomic nuances and the proposition of specific policy reforms. In this study, we have tailored the GD framework specifically for regional applications. Our enhancements to the GD scheme are evaluated in the results part of this chapter, demonstrating that our theoretical advancements lead to improved empirical outcomes. Our goal is to address the limitations encountered in the study of regional growth with the traditional GD method and to enhance it with new dimensions, such as the regional development trap category, among other growth constraints.

The results of applying our regional GD to twelve Spanish regions with lower-than-average growth rates and GDP per capita from 2000 to 2021 allow us to evaluate our framework empirically. We compare indicators for each subcategory within our model. The analysis reveals various factors that reduce growth, ranging from poor digital connectivity and inadequate physical infrastructure to governance and market dysfunctions, costly finance, or a development trap. We identify and categorise the growth constraints of any region into eleven categories using the GD framework. The recommended place-based policies to address these issues are diverse and tailored to each region's specific situation, from tax reductions for

businesses and housing subsidies to investments in education and workforce development or even establishing public agencies to improve governance or financial access.

The structure of this chapter is as follows: the next section reviews existing literature on regional growth analysis, development traps, and place-based policies. Then, we detail the new GD framework we have developed and explain the necessity for its adaptation. Following this, we apply the new GD framework to the case of the twelve Spanish regions and discuss the outcomes. Finally, we conclude with an overview of the study's contributions.

3.2. Literature review

In the latter part of the 20th century, economists focused on understanding how various factors interact to drive a country's economic growth (Barro, 1991). Researchers have explained how technological advancements, institutional frameworks, human capital, and innovation generate economic development (Sala-i-Martín, 1997).

After the first studies on national economic growth, a new branch was developed to study regional economic growth (Richardson, 1973). With its differences and particularities, regional economic growth opened a new field of study focused on the economics of smaller geographical units (Böventer, 1975). While a country can be growing at a specific rate, regional growth dynamics inside the country can be divergent (Sala-i-Martín, 1996). Factors like the agglomeration economies were discovered as crucial to regional growth (Krugman, 1999). Progressively, governments and policymakers have become aware of regional growth's importance in guaranteeing equality among citizens in different geographical areas and shared socioeconomic prosperity within countries (Dotti et al., 2024; Fratesi, 2023).

In parallel with studying the determinants of economic growth in national and regional economies, academics soon started to study the periods in which the economy suffered stagnation (Harrod, 1939). This concept is defined as extended periods without economic growth or downturns (Steindl, 1979). The sustained stabilisation of zero economic growth is associated with multiple features, such as structural inefficiencies inside the economy, institutional problems in political institutions, maladjustments of markets, or international situations that threaten development (Kaldor, 1996). Recently, economists have developed the

idea of "stagnation traps", where the persistence of the stagnation periods is explained by growth traps and liquidity traps acting simultaneously (Beningno & Fornaro, 2018).

In the study of this stagnation process from the regional perspective, recent studies point to a novel concept: the regional development trap. This concept names the situation when a binding constraint exists to economic growth in a specific geographical area for extended periods (Diemer et al., 2022). The concept suggests that some regions could get stuck in a situation where their economy, employment or population are stagnated. It highlights that the different socioeconomic characteristics in the current dynamics and the past trends shape a region's path, significantly impacting economic growth patterns (Rodríguez-Pose et al., 2023). Regional development trap is, thus, an important concept that has introduced the need to analyse time-variant growth trajectories together with point-in-time indicators to have a complete view of the socioeconomic situation of a region (MacKinnon et al., 2024).

Policy responses to soften the binding constraints to growth in those regions in a development trap have varied over time. Some examples are subsidies to the people in those regions (Autor et al., 2021) or policies facilitating migration to more dynamic regions (Hanson, 2009). In most cases, these policies have not revitalised economic activity in the affected regions. On the contrary, they have sometimes harmed their development perspectives (Austin et al., 2018).

Recent literature indicates that place-based policies are the most successful strategies applied to lagging regions (Duranton & Venables, 2018). These policies are specific interventions targeted at improving the economic performance of a particular area (typically a district, a city or a region) immersed in a development trap. The idea consists of switching the paradigm from giving standard policy responses in similar situations to designing specific policies for each place according to each area's characteristics and problematics (Neumark & Simpson, 2015). More specifically, place-based policies are devoted to creating jobs in local communities that increase local wealth and well-being (Bartik, 2020). However, these final goals are accomplished by employing tailored interventions to the local reality that can be applied through diverse means (Shambaugh & Nunn, 2018).

The sectors affected by place-based policies are as diverse as education, finance, infrastructure, housing, local businesses, and local governments (Südekum, 2021; Ehrlich & Overman, 2020). These changes improve the outcomes concerning the previous policy responses to places in

decline that were more oriented to market solutions without state intervention or migration policies for workers in declining areas (Austin et al, 2018). Consequently, there is a growing interest in the literature on this policy paradigm, which is still developing (McCann, 2023). While the concept and characteristics of place-based policies are clear, the literature still lacks decision models to fine-tune how to choose certain place-based policies for specific areas (Grover et al., 2022).

Between the diagnostics of a binding constraint to growth, like a development trap, and a proposal of response, like a specific place-based policy, there is usually a process of diagnosing the problem and discerning the solution. This process is usually done with evaluation frameworks that can analyse the impact of policies in dimensions as diverse as ecology, monetary policy, resilience, health, education, firm behaviour or economic growth (Adjemian et al., 2008; Fong et al., 2006; Glennerster & Takavarasha, 2013; McDonald, 2012; Mickwitz, 2003; Schouten et al., 2012). However, no evaluation tool has taken the perspective of regional development traps to enrich its analysis. At the same time, there is still a bridge to construct between the frameworks that identify growth constraints and the prescription of policies to solve the problem identified.

There is a double gap in the regional growth literature that we try to cover in this chapter. On the one hand, we work on the gap between the regional growth evaluation frameworks and the concept of regional development traps. On the other hand, we also focus on the gap between the regional growth frameworks that propose policies and the literature on place-based policies. In this chapter, we cover that double gap by designing and applying a Growth Diagnostics framework that, first, incorporates the dimension of the regional development traps and, second, that is prepared to prescribe tailored place-based policies grounded on the analysis of specific regional cases.

3.3. Methodology
3.3.1. The Growth Diagnostics original framework

The GD analysis is a tool to explain the lack of economic growth based on the different causes of the low levels of private investment and entrepreneurship. Since its inception, the GD framework has been applied to the design of growth strategies for many countries (Hausmann et al., 2017; Hausmann et al., 2022a; Hausmann et al., 2022b; Hausmann et al., 2023; O'Brien

et al., 2022). It has emerged as a successful tool, now recognised as a fundamental component in economic growth theory. Moreover, it has also been used to analyse the economic situation of regions (Barrios et al., 2018a; Barrios et al., 2018b; Barrios et al., 2018c; Hausmann et al., 2021; Hausmann et al., 2022c).

Acknowledging the strengths of such an analytical framework, some studies have also stressed relevant weaknesses (Felipe et al., 2011; Habermann & Padrutt, 2011). Indeed, a detected problem relies upon not sufficiently attending to regions' specific elements different from those faced by countries. This shortcoming can be tackled by creating a more robust tool. Indeed, a more detailed approach is needed to understand all the different features of regional economic growth.

One of the areas for improvement of the traditional GD framework is the need to focus on dynamic indicators. The variables in the GD model pay attention to point-in-time indicators that do not allow dynamic analyses of economic values. Indeed, the literature has widely studied path dependence as a component of present economic growth (Arrow, 2003; Dutt, 2009; Redding, 2002). This factor is also essential in the specific case of regional growth (Martin & Sunley, 2006).

In the seminal work about GD, Hausmann et al. (2008) depart from the idea that the determinants of growth rates are expressed in equation 3:

$$g = \frac{\dot{c}_t}{c_t} = \frac{\dot{k}_t}{k_t} = \sigma[r(1 - \tau) - \rho] \,, \tag{3}$$

where the rate of economic growth, denoted as g, is determined by various factors, including consumption (c) and capital per capita (k), the intertemporal elasticity of substitution (σ), the expected social return to investment (r), the proportion of this return that can be privately appropriated ($1\text{-}\tau$), and the opportunity cost of funds (ρ).

The authors created a decision tree that identifies the binding constraints that prevent a country from having higher levels of investment and entrepreneurship. The approach involves a diagnostic process that seeks to identify the underlying causes of slow or stagnated growth by

examining various economic features, including macroeconomic indicators, business conditions, and institutional characteristics.

Figure 13 displays the decision tree with the distinct components that can predict the lack of economic growth. Specifically, the model states that low levels of private investment and entrepreneurship are produced by two significant factors determined at the national level: a low return to economic activity and the high cost of finance. If there is a low return to economic activity, the incentives to invest in a particular business or to start an enterprise are reduced compared to countries with higher returns to economic activity. Low social returns and low appropriability can cause this low return to economic activity. Low social returns are explained by poor geography, low human capital, and bad infrastructure. Either government or market failures explain low appropriability. Government failures include micro-risks (property rights, corruption, and taxes) and macro-risks (financial, monetary, and fiscal instability). Market failures include information and coordination externalities.

Figure 13. Hausmann-Rodrik-Velasco growth diagnostics decision tree
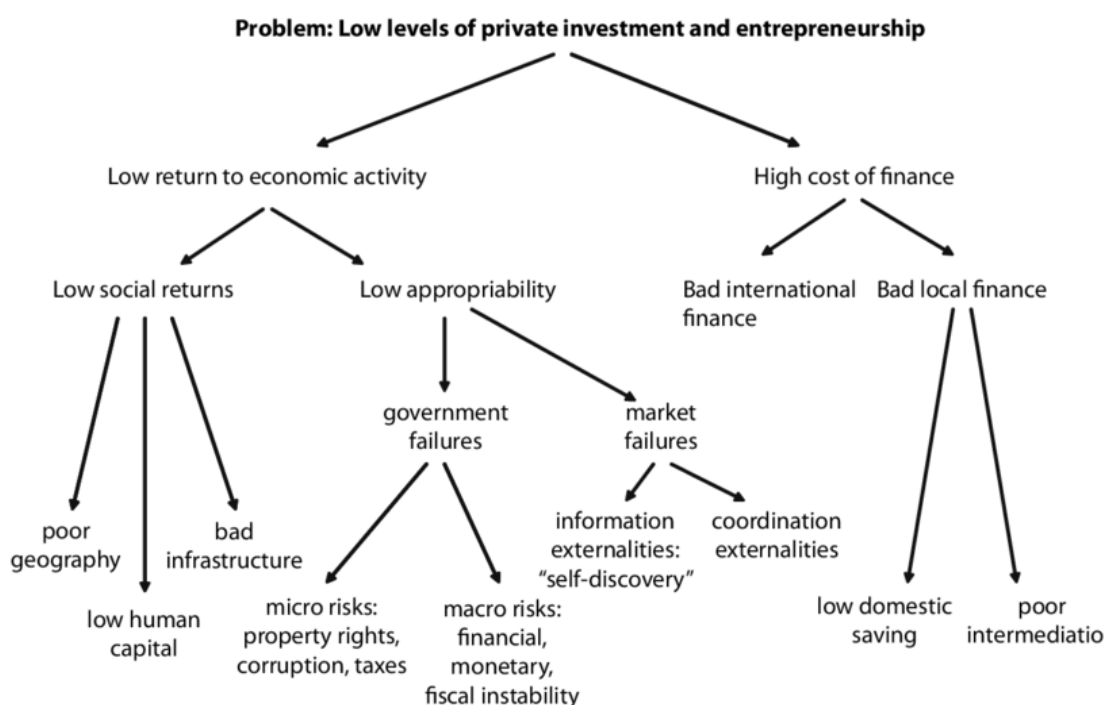
Source: Hausmann, Rodrik and Velasco (2008)

The other significant factor that explains low growth in the model is the high cost of finance. If the cost of finance is high, the incentives for investment and enterprise creation are smaller

than in other countries where entrepreneurs and investors can borrow money at a lower interest rate. Both international finance and local finance conditions matter in determining the cost of finance that would influence the development perspectives of a country.

By analysing the features in the lower section of the decision tree on a specific country case, we can ascend the scheme and elucidate the components that contribute to the diminished levels of private investment and entrepreneurship. This structure of elements within a model gives us a comprehensive understanding of the critical obstacles to growth and highlights the areas where the country exhibits inferior performance.

3.3.2. The new regional Growth Diagnostics

This section explains the additions to the conventional GD framework to adapt it for regional cases. The modifications to the original model encapsulate our theoretical contribution, which consists of developing an improved analysis tool. To include the region-specific features in the expression determining growth explained in equation 3, we have added the regional trap variable (μ) to complete the formula according to our proposition:

$$g = \frac{\dot{c}_t}{c_t} = \frac{\dot{k}_t}{k_t} = \sigma[r(1-\tau) - \rho - \mu] \qquad (4)$$

Where μ is calculated as a regional trap indicator with a similar structure to what is proposed in Diemer et al. (2022), and the rest of the variables stay the same as in equation 3. Moreover, adapting the formula requires introducing changes to the GD decision tree.

Figure 14 proposes an improved growth model for regions. It includes those categories not depicted in the traditional decision tree and necessary for a regional GD. We also reduce the presence of variables with a smaller weight in regional growth determination compared to nations.

Figure 14. New regional growth diagnostics decision tree
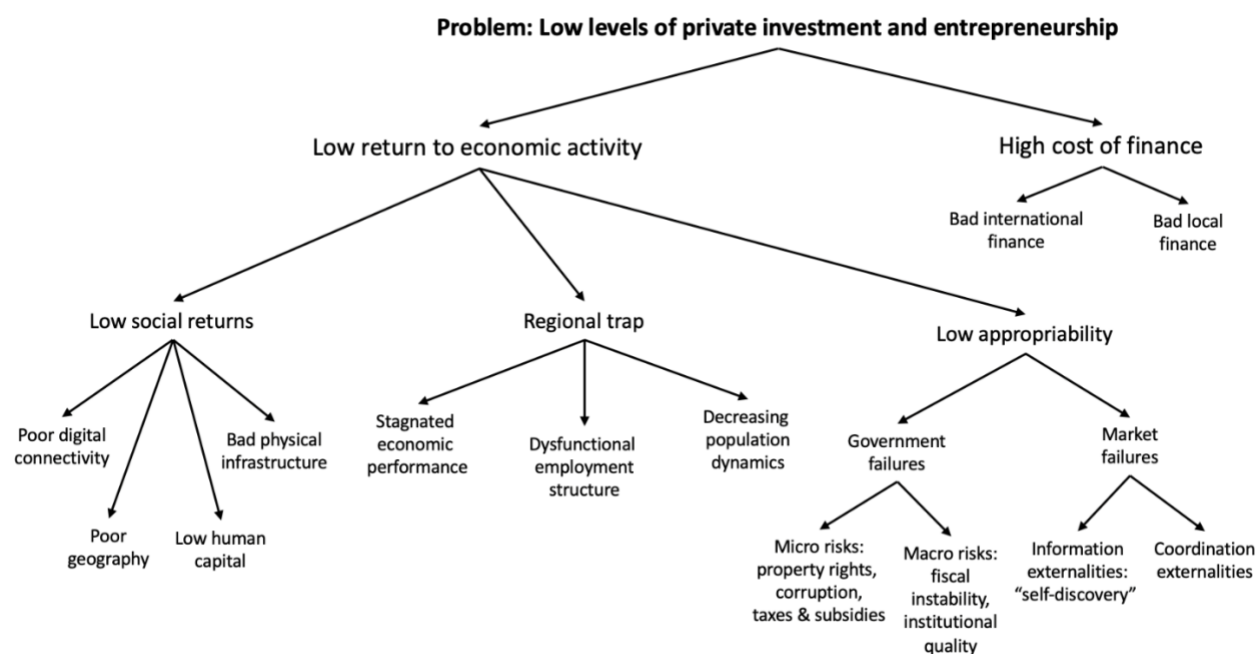
Source: Own elaboration based on Hausmann, Rodrik and Velasco (2008)

a) High cost of finance

In our new decision tree, we have maintained the high cost of finance feature with its differentiation between bad international and bad local finance. Distinct regions within the same country can have various costs of finance. These differences may be derived from international factors, such as unattractive foreign direct investment conditions in the region, or local factors, such as the existing degree of financial development or banking concentration in the region (Guevara & Maudos, 2009). A "region-specific" effect exists in the access to finance in different regions within the same country (Klagge & Martin, 2005; Zhao & Jones-Evans, 2017).

b) Low return to economic activity

The low return to economic activity feature has three categories: low social returns, low appropriability, and the newly created branch "regional trap". These three components can explain the low return to economic activity in regions: first, the low social returns to investments do not attract new investors nor create a favourable environment for business creation. Second, low appropriability prevents businesses from getting the benefits of their

activity. Third, the region is trapped, and investors are not attracted by the trajectory and future perspectives of the region (Storper & Huggins, 2017).

c) Low appropriability

We have two groups within the low appropriability category: government and market failures. The first group has the micro and macro risks nodes, which include several attributes. The second group has the information and coordination externalities nodes.

Government failures are one of the most direct causes of weak economic growth (Acemoglu & Robinson, 2012). They are also a factor that causes countries and regions to stop their development trajectories (Krueger, 1990). As such, the analysis of government failures must be present in any model that explains why there is or is not economic growth in a territory.

Micro risks imply a microeconomic problem influenced by the state. Some examples are the lack of property rights enforcement, a high degree of corruption, or high taxes. To these factors, we have added "subsidies" as a variable that determines regional growth by means of attracting business investments. This variable may not be at the original GD since subsidies to investors are less present as national policies than regional ones (Broekel, 2015). However, subsidies as a regional policy are increasingly important with the spread of public-private partnerships in the new industrial policy paradigm (Mazzucato & Rodrik, 2023).

Macro risks imply a macroeconomic imbalance caused by the state. Some examples can be fiscal instability or the general lack of institutional quality. At this stage, we have eliminated the "financial and monetary instability" since this is determined at the national level, and they generally affect equally all the regions within a country (Cohen, 2002; Wyplosz, 1999). However, we have maintained the "fiscal instability" category since regions may be affected by fiscal differences across geographical areas. These differences are predominantly present in politically decentralised countries where regional governments have the authority to adopt political decisions. The feature would be less crucial in politically centralised countries where most decisions are taken at the national level. Moreover, we have added the "institutional quality" concept that can help disentangle the causes of growth for regions and countries (Agostino et al., 2020; Corradini, 2021; D'Ingiullo & Evangelista, 2020).

Concerning market failures, the neoclassical economic theory predicts that markets in perfect competition always generate the most efficient allocation of factors of production (Krugman & Wells, 2009). Nonetheless, perfect competition is rarely seen in real market structures. A multiplicity of market failures can be observed: imperfect information, lack of competition in monopolistic or oligopolistic structures, rigid prices, or negative externalities (Mankiw, 2023). In this subsection, we have maintained the nodes of the original GD.

d) Low social returns

In the low social returns feature, within "Low return to economic activity", we have four different nodes: poor digital connectivity, poor geography, low human capital, and bad physical infrastructure.

Poor digital connectivity has been included as a new dimension. We have added digital connectivity because it could contribute more to achieving economic growth than variables such as physical infrastructure or the geography of some places (Salemink et al., 2017). This category has exponentially increased in importance through the last decades, which explains why it is not included in the original decision tree. Indeed, digital connectivity has been proven critical to the development of any region (Lehtonen, 2020).

The weight of this variable in determining growth patterns has been increasing in recent years, with the impulse of the social transformations brought about by the COVID-19 pandemic (Esteban-Navarro et al., 2020). Isolated regions with geographical or demographical challenges now have development opportunities due to the possibility of attracting digital businesses or remote workers (Briglauer et al., 2019). Regions with adequate physical infrastructure connections that stay behind in the implementation of digital connectivity may have difficulties maintaining a growth path. Improving digital connections can increase competitiveness between regions, leading to overall gains in productivity and wealth (Salemink et al., 2017).

We have maintained the indicator of poor geography due to its importance in explaining economic development (Krugman, 1999). From the very origins of humanity, the horizontal disposition of Eurasia gave a development advantage to its settlers with respect to Africa and America, which had a vertical disposition (Diamond, 1997). Concerning regional development, many geographical traits affect growth opportunities. From climate to altitude or being landlocked, geography is one of the most time-stable indicators of prosperity (Gallup et al.,

1999). Public policies struggle with orographic difficulties through engineering projects that can reverse the fate of places. Although expensive, tunnelling mountains and constructing large bridges to connect places through infrastructure positively affect the growth of those connected places, especially in less developed areas (Lu et al., 2022).

We have included the node on human capital as a potential explanatory characteristic of the lack of growth. The more educated a society is, the higher the productivity of its individuals and, thus, the larger the economic growth rates (Barro, 2001). Different industries locate, among other reasons, where they can hire workers with the knowledge to accomplish the tasks the business needs to carry out (Cohen & Soto, 2007).

Infrastructures such as highways and railways help regions to achieve higher integration, contributing to economic growth. These benefits are especially significant in the case of poorer regions that are connected to wealthier regions (Adler et al., 2020). However, infrastructures are relatively expensive when compared with other public policies. This cost-effectiveness may cause a lack of investment, especially in sparsely populated regions (Levkovich et al., 2020).

e) Regional trap

The regional trap is a newly added element to reflect a growth determinant not present in the initial framework. This category complements our changes to other variables in the original decision tree. Specifically, we have added the regional trap as a category within the "low return to economic activity", together with low social returns and appropriability. Within this regional trap category, we have included economic performance, employment structure, and population dynamics since those are identified by the literature as the components of the regional trap (Diemer et al., 2022).

When GD is undertaken with the model in Figure 14, several indicators could be used in order to analyse if a region is trapped from the three proposed magnitudes: first, to observe if a region is in a situation of stagnated economic performance, we can use indicators as the GDP growth rate, the gross value added per worker, the average wage, or the firm productivity. Second, to assess whether the employment structure is dysfunctional, a good proxy is variables such as employment to population ratio, structural unemployment or youth unemployment. Third, to distinguish if there are decreasing population dynamics, we can apply variables such as the population growth rate, the old-age dependency ratio or the sex ratio. In each category, other

indicators may complement and enrich the evaluation of the regional trap situation for each case.

3.4. Empirical analysis
3.4.1. Regions selection

In this section, we test the new GD framework by applying it to the Spanish underperforming regions regarding economic growth and situation. We choose the regions that accomplish two conditions. First, they had a GDP per capita below the national average in the year 2000, and second, their growth rate for the 2000-2021 period is under the mean for Spain. Twelve out of the 50 Spanish regions accomplish these two conditions. Thus, we can consider them low-income and stagnated regions relative to the national average. The results obtained for each region are the basis for the policy solutions recommended in the next section.

Spain's regional structure presents an ideal case for applying our framework for several compelling reasons. Firstly, Spain's political decentralisation allows its autonomous regions to implement different policy measures independently from the central government mandates. This autonomy presents an exciting opportunity for analysis, as regions have the latitude to address their economic challenges with localised policy interventions. Secondly, the decentralised political structure naturally gives rise to diverse socioeconomic conditions. Analysing these differences provides insight into the effects of regional autonomy, offering a contrast to the more homogenised outcomes often observed in nations with centralised policy-making. Thirdly, the availability of detailed data for each indicator within the GD framework at the NUTS-3 level is particularly advantageous. This level of granularity in data facilitates a more nuanced analysis. Moreover, the scope of geographical units larger than NUTS-3 is inadequate for place-based policies focused on helping districts, cities or, at most, small regions (Duranton & Venables, 2018). Lastly, the significant regional socioeconomic disparities within Spain underscore the varied landscape across which our framework can be tested, offering a broad spectrum of regional dynamics to consider (McGowan & Millán, 2019).

Spain is geographically divided into fifty NUTS-3 regions, also called provinces. This number is large enough to do an analysis where we can compare groups of regions and get significant results, but not too large to generate overly complex explanations. Also, by analysing the regions in the same country, we avoid the results from being biased by country-specific traits.

Figure 15 shows the relationship between the average GDP growth rate for the period 2000-2021 and the Log GDP per capita of the year 2000. We take the 2000-2021 period since it is sufficiently long to observe growth patterns and since regional GDP data is available from the year 2000. The black lines that divide the graph into four sections are the national average for GDP growth and GDP per capita. We consider those regions in the upper section of the graph as fast-growers, while the regions in the lower part are low-growers. Moreover, we consider the regions on the right part of the graph to be high-income, while the regions on the left are low-income, concerning the national average.

Figure 15. Growth and absolute GDP regional analysis
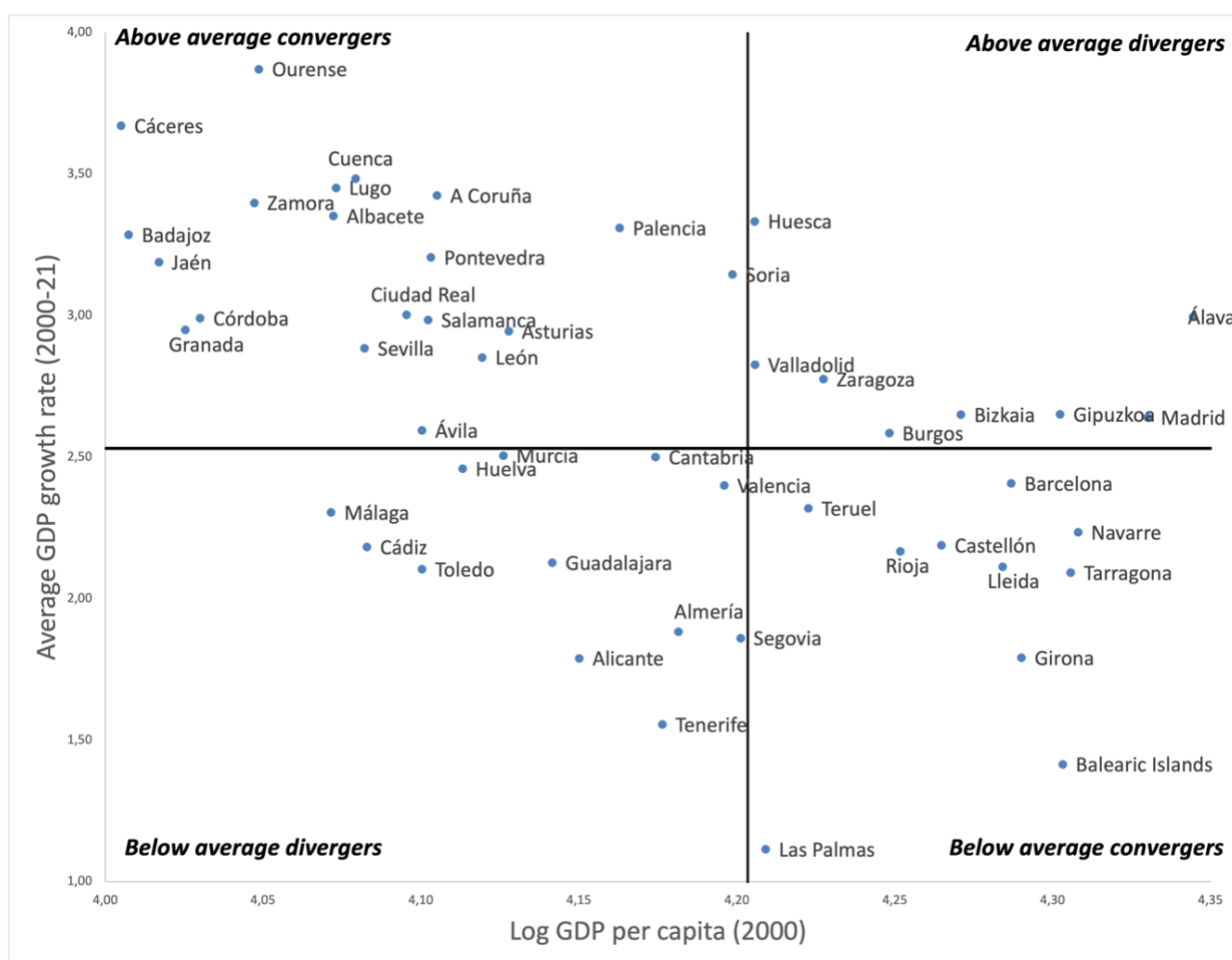
By dividing the scatter plot into four quadrants along the national average, we can classify regions into four categories:

"Above average convergers" (top-left): the regions in this quadrant were low-income in the year 2000 and have grown over the national average during the analysed period. Thus, they were worse off, and they converged with the Spanish average to some extent.

"Above average divergers" (top-right): regions that were high-income in the baseline year and have grown at a fast rate during the 2000-2021 period. Consequently, they have diverged from the national average, being now relatively richer than at the start of the period.

"Below average convergers" (down-right): these regions were high-income in the year 2000 but have grown below the national average during the analysed period. Consequently, they were better off, and they converged with the Spanish average to a degree.

"Below average divergers" (down-left): regions that were low-income in the baseline year and have grown at a low rate during the 2000-2021 period. Consequently, they have diverged from the national average, being relatively poorer compared to the start of the period (i.e. they are richer now since they present a positive growth rate, but relative to the national average, they have become poorer than at the start of the period).

For our analysis, we select the regions that are "below average divergers" since we can consider that they have binding constraints that are blocking their growth potential. Specifically, the twelve selected regions are Alicante, Almería, Cádiz, Cantabria, Guadalajara, Huelva, Málaga, Murcia, Segovia, Tenerife, Toledo and Valencia.

This analysis of the regions' growth rates and absolute GDP patterns is interesting for positioning the geographical areas we are analysing before entering them in detail. With the newly designed framework, the step-by-step approach of the GD methodology would disentangle the explanations of the low levels of private investment and entrepreneurship. In this section, we analyse and compare the twelve selected regions with respect to each of the eleven subcategories of the new GD framework.

3.4.2. Results overview

In order to make the comparison across regions for all the categories described in the previous subsection, we select one variable which can be considered a proxy of the subcategory that we want to compare. Then, we run a one-sample t-test to determine if the data for a particular region is statistically different from the data for the group of regions that we are analysing. To get the t-statistic we perform:

$$t_{ir} = \frac{\overline{x}_i - \mu_{ir}}{s_i / \sqrt{n}} \tag{3}$$

Where t_{ir} is the t-statistic of variable i in region r, $\overline{x}_i$ is the mean of variable i for the group of regions analysed, μ_{ir} is the value of variable i in region r, s_i is the standard deviation of variable i for the group of regions analysed, and n is the number of regions analysed.

As a result, we get a t-statistic and a p-value for each variable and region. With the t-test results, we can observe which regions significantly differ from the group average. We consider that a specific category of the diagram is a binding constraint to the growth process of a certain region if the variable for the category in that region is significantly below the average for the group of regions analysed at the 1% significance level. We repeat the process for all the indicators to have a complete picture of the variables that are the binding constraints to growth in each region.

Table 6 shows the main results for the eleven variables and the twelve regions analysed. The results are depicted in the first line of each row. In the second line, we can observe in brackets the t-statistic that results from the one sample t-test performed by comparing the figure for each region with the data of all the regions. In the last two rows, the group average and the value for Spain are displayed to perform comparisons. The regions are displayed in descending order of the most recent GDP per capita figures (year 2021).

We consider that a variable is a binding constraint to the growth of a particular region if it is below the mean of all the regions and is significantly different from the group average. One of the most compelling results that can be derived from Table 6 is that all the regions have at least one variable that is a binding constraint to their economic growth. Consequently, all the regions have a policy attribute to focus on to improve their growth perspectives, according to our framework results. The only region for which there is not a binding constraint to its growth is Valencia, which is, at the same time, the wealthiest region in the group. Conversely, all the columns show one to four regions performing poorly in each of the eleven aspects. The policy prescriptions of place-based policies for each case that are explained in the discussion, are based on these results.

Table 6. Results of the new Growth Diagnostics analysis for Spanish regions considered below-average divergers

	(1) Poor digital connectivity	(2) Poor geography	(3) Low human capital	(4) Bad physical infrastructure	(5) Stagnated economic performance	(6) Dysfunctional employment structure	(7) Decreasing population dynamics	(8) Government failures	(9) Market failures	(10) Bad international finance	(11) Bad local finance
	% of the pop. with access to 5G NR	Potential Multimodal Accessibility	% of pop. with higher education (>16)	Investment per km^2 (in €)	GVA per worker growth (in %)	Unemp. rate growth (in %)	Population growth (in %)	Corruption cases per 100.000 inhabitants	Economic Complexity Index	FDI per inhabitant (in €)	Credit/ inhabitant (in thousand €)
Valencia	63 (3,21*)	88 (4,87*)	32 (4,09*)	1583 (3,27*)	7 (3,55*)	4,0 (0,57)	19 (2,04)	5,6 (3,13*)	-0,18 (2,94*)	3.955 (6,82*)	24,9 (6,97*)
Cantabria	62 (2,73)	65 (0,13)	34 (5,67*)	1178 (1,00)	6 (3,42*)	5,8 (1,58)	11 (3,68*)	14,4 (4,87*)	0,01 (5,88*)	1.011 (3,99*)	16,6 (1,48)
Segovia	42 (2,92)	70 (1,01)	31 (3,63*)	491 (2,86)	-15 (6,13*)	-1,8 (7,73*)	5 (4,90*)	4,6 (4,03*)	-0,22 (2,32)	1.851 (0,90)	16,6 (1,53)
Murcia	51 (0,33)	54 (2,44)	26 (1,66)	739 (1,46)	7 (3,87*)	5,7 (1,51)	36 (1,34)	7,0 (1,82)	-0,52 (2,30)	2.694 (2,19)	18,1 (0,00)
Almería	64 (3,43*)	54 (2,45)	23 (4,26*)	490 (2,86)	5 (2,76)	1,8 (3,27*)	45 (3,04*)	13,3 (3,89*)	-0,61 (3,69*)	1.717 (1,39)	22,5 (4,51*)
Guadalajara	35 (4,98*)	76 (2,15)	31 (3,35*)	218 (4,39*)	-4 (1,31)	4,4 (0,13)	67 (7,38*)	4,6 (4,02*)	-0,19 (2,78*)	1.575 (1,91)	16,4 (1,66)
Huelva	54 (0,60)	43 (4,79*)	24 (2,87*)	401 (3,36*)	2 (1,56)	7,6 (3,73*)	16 (2,70)	8,0 (0,92)	-0,80 (6,61*)	1.717 (1,39)	13,9 (4,21*)
Tenerife	36 (4,65*)	40 (5,52*)	29 (1,40)	1620 (3,48*)	-15 (6,25*)	4,7 (0,26)	34 (0,88)	10,1 (1,01)	-0,37 (0,01)	1.674 (1,55)	14,9 (3,25*)
Alicante	57 (1,48)	83 (3,80*)	24 (3,24*)	1861 (4,84*)	-1 (0,02)	4,5 (0,03)	35 (1,20)	10,5 (1,32)	-0,34 (0,47)	3.955 (6,82*)	18,4 (0,30)
Toledo	35 (4,94*)	63 (0,59)	23 (3,80*)	379 (3,48*)	1 (0,86)	6,6 (2,54)	37 (1,40)	5,3 (3,40*)	-0,23 (2,17)	1.575 (1,91)	19,6 (1,59)
Cádiz	63 (3,10*)	63 (0,61)	26 (1,48)	1199 (1,12)	-2 (0,48)	8,7 (5,16*)	13 (3,36*)	9,7 (0,57)	-0,52 (2,30)	1.717 (1,39)	14,0 (4,10*)
Málaga	64 (3,28*)	87 (4,70*)	27 (0,83)	1840 (4,72)	-5 (1,83)	2,0 (3,05)	37 (1,44)	15,3 (5,67*)	-0,48 (1,68)	1.717 (1,39)	20,9 (2,85)
Group average	52	66	27	1000	-1	4,5	29	9,0	-0,37	2.097	18,1
Spain	58	60	33	2239	4	5,1	19	7,9	-0,21	11.716	25,4

Notes: the * indicates that the value above significantly differs from the group's values at the 1% significance level.
The PMA and ECI values for Spain are not the actual values of the country but the average values of all regions. That allows a comparison that otherwise would not be possible

A second compelling result is the attribute on the development traps that our new GD especially captures. These characteristics of the regions would have not been analysed without the framework improvement. The results especially point to Segovia as a region in a development trap since their results are significantly lower than those of the regions analysed in two of the three dimensions: economic performance and population dynamics. Additionally, this region does not perform worse than the group in any other category of the GD out of the regional trap indicators. Other regions like Cantabria, Almería, Tenerife, and Cádiz seem to be partially trapped, with one of the three dimensions being significantly lower than the rest of the group.

3.4.3. Results: Low Social Returns

In the following subsections, we interpret the results depicted in Table 6, classifying them into groups of variables according to the GD diagram. As such, we have four groups of variables depending on the area they affect: low social returns, regional development trap, low appropriability and high cost of finance. All the numbers columns cited are referred to Table 6.

a) Poor digital connectivity

Column 1 shows the digital connectivity in the twelve selected regions for 2022. Digital connectivity is measured through the percentage of the population accessing 5G New Radio (5G NR). The 5G is the fifth-generation technology standard for cellular networks. The New Radio is a version of the 5G technology that ensures high-speed connection to the internet (over 100 Mbps). This variable is a standard measurement of digital connections, together with FTTH technology (Salemink et al., 2017). Spain has an average of 58% of the population with access to 5G NR. The average for our group of regions is 52%. Guadalajara, Tenerife and Toledo are between 35% and 36%, a percentage significantly below the group average.

b) Poor geography

Within the twelve regions we are analysing, we have islands (Tenerife), inland regions (Segovia, Guadalajara and Toledo) and coastal regions (all the rest). These differences would impact growth, derived from the diverse difficulties for trade and migration that the regions have. However, the regions' landform does not show the whole picture of growth perspectives. Thus, we need additional variables to determine the geographical characteristics of the regions.

Column 2 shows the Potential Multimodal Accessibility (PMA) Index developed by the European Observation Network for Territorial Development and Cohesion (ESPON). The indicator is a compound index of the travel time needed to reach the region from different geographical points and through different means of transport. The higher the index, the more accessible a region is. The PMA is developed exclusively for regions; thus, we do not have data for Spain as a country. The index is an adequate indicator to proxy the geographical difficulties in accessing a particular region (Pagetti et al., 2020). The average for this indicator of the Spanish regions is 60, while the group average in our sample is 66. Huelva and Tenerife are the regions significantly below the average.

c) Low human capital

Column 3 displays a classical indicator of human capital, the percentage of the population over 16 years old that has attained higher education (Altbach et al., 2019). The data shows that the average for Spain is 33%, while the group average is 27%. Almería, Huelva, Alicante and Toledo, between 23% and 24%, are significantly below the group average. As a consequence, low human capital may be a cause of their lack of growth.

d) Bad physical infrastructure

Column 4 shows the investment in public infrastructure per square kilometre in the regions we are analysing, which is an appropriate variable for measuring physical infrastructure (Nunez & Wei, 2015). The average for Spain is 2.239 while for the group is 1.000. Guadalajara, Huelva, and Toledo are the regions that perform worse in this section, with results between 200€ and 400€ per km^2. For those regions, we can consider the bad physical infrastructure as a binding constraint to economic growth.

3.4.4. Results: Regional Development Trap

This section corresponds to the newly introduced branch of the regional development trap. Since the goal is to cover the dynamic evolution of variables, the figures are displayed as growth rates that reflect the variation of an indicator over time. These variables allow us to capture to what extent the variable is stagnated. The period analysed for economic performance and employment structure is 2008-2019. For population dynamics, we analyse 1998-2021, since population changes take longer, and we need a more extensive period to observe variations.

e) Stagnated economic performance

The evolution of the regional GDP generally measures economic performance, as shown in Figure 15. However, other interesting economic performance indicators can shed light on features that the GDP indicator cannot (Gatto et al., 2011). This is the case of productivity measures, such as the Gross Value Added (GVA) per worker. In contrast with GDP, GVA does not include taxes and subsidies, so it is more accurate for measuring the value of what is produced in an economy in terms of productivity. Moreover, measuring GVA per worker, and not per capita, allows us to determine what each worker produces, without disturbing the measurement with the level of unemployment (which is analysed in the following subsection).

Column 5 shows the growth rate in GVA per worker from 2008 to 2019 in the selected regions. Spain showed an increase in GVA per worker of 4% during that period. The change in the group of twelve regions is more modest, with an average decrease of -1%. Tenerife and Segovia are the regions that have the largest decrease in GVA per worker (-15%). This is a significantly lower figure as compared to the group average. As a consequence, these regions can be considered as stagnated in terms of productivity and, thus, of economic performance.

f) Dysfunctional employment structure

Column 6 depicts the growth of the unemployment rate in the selected regions, which is a rigorous indicator to analyse the state of the regional labour market (Oesch, 2015). The growth of the unemployment rate for that period in Spain was 5,1%, while the average for the group was below 4,5%. Segovia is the region that has performed better, being the only one that has reduced its unemployment rate during this period. Toledo and Huelva are the regions that have performed worse, with an 8,7% and 7,6% increase, respectively. These results are significantly larger than the group average and indicate stagnation in the regional unemployment dimension.

g) Decreasing population dynamics

Column 7 shows the evolution of the population in each region as an indicator of population dynamics. Two regions, Almería and Guadalajara, have increased their population between 45% and 70% with respect to 1998. Meanwhile, Cádiz, Cantabria and Segovia have increased their population below 15%. Even more, with a modest 4% growth, Segovia's population trajectory can be considered as stagnated and significantly below the group's average. The

average for Spain in that period was a growth rate of 19% and an average for the group of regions of 29%.

3.4.5. Results: Low Appropriability

h) Government failures

Government failures have several variables that can act as a proxy, from governance indicators to government fiscal stability figures. However, these indicators tend to reach the NUTS-2 level and are rarely measured at the NUTS-3 level of detail. However, Abreu (2022) does an in-depth study of corruption in Spain and gives data at the NUTS-3 level. We use this indicator since corruption is a reasonable proxy for government failures (Acemoglu & Verdier, 2000). As a result, Column 8 shows the corruption cases for every 100.000 inhabitants from 2000 to 2020. The mean for Spain is 7,9, while the average for the group of regions is 9,0. Málaga, Cantabria and Almería, with rates between 13% and 16%, are significantly over the group, indicating the presence of government failures in those regions.

i) Market failures

It is difficult to measure market failures at the regional level with an index. Even nationally, the difficulties quantifying our variable of interest generate the unavailability of estimations in this area (Acemoglu & Verdier, 2000). However, the Economic Complexity Index (ECI) is an acceptable proxy to measure coordination and information failures (Hausmann et al., 2014). The ECI is an indicator of the productive capacities in one territory. It measures the complexity of the products the area produces and how that affects the trade patterns of the country or region. The fewer coordination and information failures exist, the more complex products a country or region can produce.

Column 9 displays the ECI for our regions. The group average has an ECI of -0,37, while the average ECI for the Spanish regions is -0,21 (the ECI for Spain as a whole country is larger). Huelva and Almería, with -0,80 and -0,61, are the only regions with an ECI significantly below the group's average. Consequently, market failures can be a binding constraint to economic growth in the mentioned regions.

3.4.6. Results: High Cost of Finance

j) Bad international finance

The conditions concerning international finance can be proxied by the amount of Foreign Direct Investment (FDI) the region receives. Regions with bad conditions, such as high-risk investment premiums, would attract less FDI (Iammarino, 2018). Column 10 presents the total amount of FDI per capita received in each region in the 1993-2022 period. One limitation of this indicator is that it is the only one not available for NUTS-3 territorial units. Consequently, we assign to each region the value of the NUTS-2 area that contains each particular region. Still, the results are valid for the analysis. The mean amount of FDI per inhabitant in Spain is 11.717 €. However, most of the FDI is concentrated in the two largest urban regions, Madrid and Barcelona, which are not analysed here. Our group of regions has an average of 2.097€ per inhabitant. This variable can be a binding constraint to growth for Cantabria, which is substantially below the rest of the regions with 1.011€.

k) Bad local finance

Column 11 shows the total amount granted on credits in each region; these are credits granted at any time and are still ongoing. The more credit there is in circulation in an economy, the larger the availability of financial capacity to lend money to entrepreneurs and investors in the region (Guevara & Maudos, 2009). According to the data, the mean for Spain is 25,4 thousand € in credits per inhabitant. However, the mean in the regions analysed is lower, with an average below 20 thousand €. Huelva, Tenerife, and Cádiz are the only regions significantly below the mean of our group, with less than 15 thousand € in credits per inhabitant. This negative result points to the financial sector in the three regions as one of the factors that may be causing a lack of growth.

3.5. Discussion and Policy Recommendations

Our research findings are concisely presented in Table 7. The first column displays the hierarchical structure of the GD model, as depicted in Figure 14. The middle column highlights the regions that exhibited a significant below-average performance in each category of the GD analysed. Finally, in the right column, we suggest place-based policies to alleviate the constraints that hinder growth in each GD category. This section will elaborate on the logical relationship between the binding constraints to growth we identified earlier and the proposed place-based policies to tackle them.

We have suggested several place-based policy options to address the issues faced by various regions in each category. These policies have been chosen based on previous evidence of their effectiveness. However, our goal is not to provide an exhaustive list of policies for each problem. Instead, we have highlighted the most commonly used policies to give policymakers advice on the solutions available for the regional issues identified by the GD. Additionally, we have not assigned a specific policy to each affected region within the same category. These region-by-region recommendations would require a thorough analysis of each territory's socioeconomic situation, which is beyond the scope of this study.

Table 7. Summary of results of the GD and proposed Place-Based Policies

GD category affected			Regions significantly below the group average	Proposed place-based policies
Low return to economic activity	Low social returns	Poor digital connectivity	Guadalajara, Tenerife, Toledo	Investment in 5G/6G/FTTH implementation Teaching digital skills to the population
		Poor geography	Huelva, Tenerife	Compensation for the transport costs Establishment of transport minimum service obligations
		Low human capital	Almería, Huelva, Alicante, Toledo	Invest in local universities / Connect them to businesses Development of high-quality vocational training Subsidies to in-company formation of workers
		Bad physical infrastructure	Guadalajara, Huelva, Toledo	Investment in infrastructure (railways and highways) that connect the region with a developed area
	Regional trap	Stagnated economic performance	Segovia, Tenerife	Creation of Digital Innovation Hubs Subsidies to SMEs digitalisation Public-private cooperation in productive sectors
		Dysfunctional employment structure	Huelva, Cádiz	Implementing active labour market policies Reskilling of workers
		Decreasing population dynamics	Cantabria, Segovia, Cádiz	Tax cuts to businesses that create employment Subsidising housing Incentivising natality
	Low appropriability	Government failures	Cantabria, Almería, Málaga	Establishment of independent authorities to control local governments
		Market failures	Murcia, Almería, Huelva	Establishment of a regional competition authority Help the creation or growth of companies in sectors with a lack of competition
High cost of finance	Bad international finance		Cantabria	Subsidies to attract international companies Creation of sectorial clusters that attract FDI
	Bad local finance		Huelva, Tenerife, Cádiz	Offer credit to businesses through a public institution Encourage savings behaviour of the population

3.5.1. Policy Recommendations: Low Social Returns

Our GD framework identifies low social returns, regional traps, or low appropriability as the main reasons for a low return to economic activity causing a lack of growth. In the following subsections, we analyse the nodes in each one of these categories. The first one, low social returns, comprises digital connectivity, geography, human capital and physical infrastructure.

a) Poor digital connectivity

Based on our analysis, Guadalajara, Tenerife, and Toledo are currently experiencing a lack of adequate digital connectivity, which hinders their growth potential. We recommend implementing a targeted place-based policy for these regions to address this issue. One potential solution is to invest in deploying 5G technology, aiming to exceed the national average in population coverage (Agiwal et al., 2021). Studies indicate that introducing 5G can positively impact regional growth and generate employment opportunities, particularly in digitally disadvantaged areas (Ivus & Boland, 2015). The "5G for Smart Communities" program initiated by the European Union, implemented in 17 underserved rural and low-connectivity regions across different countries, is a successful policy example (European Commission, 2024).

However, as innovation in digital connectivity develops rapidly, with the transition to 6G technology expected by the end of the decade, these regions could invest in the concurrent deployment of the next generation of connectivity technology. This farsighted investment would ensure that the region progresses from being a laggard in 5G to a leader when the technological shift occurs (Gustavsson et al., 2021). The policy's cost-effectiveness would be enhanced if 5G and 6G were implemented together. A complementary place-based policy to address this binding constraint is creating and implementing a strategic plan for developing the population's digital competencies (Coskun, 2015). Increased digital literacy enhances population well-being, particularly among young professionals (Grigorescu et al., 2021). Programs in this area have been implemented, mainly in developing countries. For example, the Liberia Digital Skills Project is helping to raise the digital skills of 10,000 young people every three months (Sonpon, 2024).

b) Poor geography

One of the most formidable challenges encountered within a particular region is unfavourable geographical conditions. However, strategic measures, such as the allocation of resources towards physical infrastructure, which is another attribute assessed in the context of the GD analysis, possess the potential to enhance regional accessibility and counterbalance geographical hindrances. Our research findings show that Huelva and Tenerife face considerable geographical constraints that impede their growth prospects. A place-based policy solution to address this issue could involve providing compensation for transportation costs incurred by businesses and individuals operating within these geographically challenged areas. This benefit would be granted through a proportionate tax reduction. In fact, since the establishment of the European Union, certain national governments have introduced state aids to mitigate transportation challenges faced by specific regions (Bovis, 2005).

An alternative policy approach that could be implemented involves the establishment of minimum service obligations within the realm of transportation services. This policy would be applicable in situations whereby local companies demand specific modes of transportation for the movement of goods and services, yet the profitability threshold for private enterprises to provide such services is not met. In such instances, the state can intervene by directly offering the required service or providing subsidies to companies that endure losses while delivering the service, which are subsequently offset by the provided subsidies. This policy arrangement has been successfully implemented in various regions, including the European Union's islands and other comparable areas (Chlomoudis et al., 2011).

c) Low human capital

An insufficient degree of human capital represents a significant impediment to regional economic advancement (Wilson & Briscoe, 2004). Our analysis identifies Almería, Huelva, Alicante, and Toledo as regions dealing with this challenge. To address this issue, effective place-based policies emphasise investments to promote local universities as drivers of innovation in conjunction with the region's businesses (Andersson et al., 2009). This objective aligns with the proposal of the Federal Grants Program, which seeks to support distressed regions in the United States following the COVID-19 pandemic (Maxim & Muro, 2021). The prescribed policies in this program are diverse and tailored to suit each unique local context. One viable option involves expanding the scope of knowledge fields and augmenting the range of university degree programs offered. This strategy diversifies educational offerings,

attracting more students to the local university and dissuading them from migrating to regions with more extensive options. Such a measure has proven effective in augmenting human capital and enhancing population retention (Lovén et al., 2020). Another viable approach entails directing investments towards attracting world-class researchers specialising in specific areas of knowledge, fostering the emergence of innovative clusters that yield spillover effects on local industries and companies operating within those sectors (Benneworth & Fitjar, 2019).

Nevertheless, financing higher education should not be considered the sole avenue for bolstering a region's human capital levels. A place-based policy effort oriented towards advancing the regional vocational training system stands as a promising approach to reducing unemployment rates and fostering better alignment between companies and the workforce in the labour market (Hujer et al., 2006). In certain instances, the private sector has taken initiatives in this regard, particularly within sectors associated with the energy transition, where a considerable number of workers needed a skillset transformation to sustain their employment within the evolving industry. An exemplary case can be observed in the Reskilling for Employment (R4E) program implemented by major multinational corporations in Portugal, Spain, and Sweden, providing vocational training to five million individuals (Iberdrola, 2022). Programs of this nature hold the potential to enhance the human capital of workers with lower levels of education, thereby contributing to improvements in productivity and wages (Butler et al., 2007; Mupimpila & Narayana, 2009).

d) Bad physical infrastructure

An inadequate physical infrastructure detrimentally impacts the economic potential of regions by impeding trade and its consequent benefits (Bjarnason, 2021). Within our analysis, this problem is observed in Guadalajara, Huelva, and Toledo. In response to this challenge, a pertinent place-based policy approach suggests investing in infrastructure development that establishes connectivity between the region and adjoining regions exhibiting a relatively higher degree of economic advancement (Lu et al., 2022). This concept has been implemented across particular European Union (EU) territories through the European Regional Development Fund (ERDF), which has provided funding for similar infrastructure initiatives in areas experiencing decline since 1975. This policy has proven impactful in opening novel markets for regional businesses, fostering increased demand and presenting new avenues for growth. More specifically, the construction of highways linking less developed regions with more developed regions has positively affected Gross Domestic Product (GDP), employment, and regional

population within the less developed region (Adler et al., 2020). Similar favourable outcomes have been observed in the context of railway construction (Li et al., 2023; Wang & Wu, 2015).

3.5.2. Policy Recommendations: Regional Trap

The regional trap is the second node in the GD model that explains the low return to economic activity. This part is one of the additions we have introduced in the framework. A region may be trapped according to its economic performance, employment structure, and population dynamics.

e) Stagnated economic performance

Regions become trapped when their economic performance remains stagnant, among other factors. Our analysis identifies Segovia and Tenerife as territories experiencing this difficulty due to their stagnated economic performance. Evidence highlights sluggish productivity as a primary cause behind the lack of economic growth (Mas & Stehrer, 2012). Enhancing productivity through technological advancements is a key policy objective, and several effective place-based policies have already been implemented to achieve this goal.

Firstly, the establishment of Digital Innovation Hubs (DIHs) has emerged as a promising policy approach aimed at accelerating digitalisation among SMEs. This policy, proposed by the European Union (EU) and implemented in numerous member states, encompasses knowledge services, innovation counselling, and subsidies to support the adoption of new technologies (Kalpaka et al., 2020).

Another viable option involves offering subsidies or tax breaks to companies that undergo digitalisation in their production processes. Such initiatives, including the ICT Innovation Vouchers program funded by the EU Cohesion Policy, have demonstrated positive outcomes, resulting in increased output for subsidised firms and beneficial digitalisation spillover effects for non-subsidised firms (Colnot & Pellegrin, 2019).

In the long term, fostering collaboration between the public sector, local enterprises, and research institutions within the ICT sectors has proved successful. This cooperative approach facilitates the formation of regional clusters, ultimately raising overall productivity levels (Focacci & Kirov, 2021).

f) Dysfunctional employment structure

The employment structure of a region can contribute to a development trap. Within our analysis, Huelva and Cádiz exhibit an employment structure characterised by a rapid unemployment increase during the period analysed. A growing trend of unemployment serves as an impediment to economic growth (Ball et al., 2017). Independently of favourable economic performance or population dynamics, a region facing escalating unemployment will encounter significant challenges in achieving sustained economic growth. Nevertheless, regions facing rising joblessness or a high proportion of structural unemployment can implement specific policies to address these issues.

Active Labour Market Policies (ALMPs) are frequently employed in such cases (Meager, 2009). These policies encompass training programs, employment incentives, job creation initiatives, and job-search assistance (Bredgaard, 2015). While these policies have been implemented by most developed countries, not all ALMPs are tailored to address regional needs. A notable example demonstrating practical regional application is the implementation of Short-Term Work schemes in Germany, Austria, Finland, France, Luxembourg, and Portugal (European Training Foundation, 2022).

g) Decreasing population dynamics

A region can face a challenging situation if it exhibits decent economic conditions and relatively low unemployment but still experiences population decline. This demographic event becomes a problematic factor for economic growth and a source of regional entrapment. This phenomenon is often observed in industrial regions undergoing deindustrialisation or in rural regions (Autor et al., 2013). Within our analysis, Cantabria, Segovia, and Cádiz present clear challenges in this regard. Addressing this problem proves to be particularly difficult with short-term policies.

The primary place-based policy approach to overcome population stagnation or decline involves the provision of tax cuts or subsidies to attract new businesses that can generate employment opportunities and help sustain the resident population (Adams et al., 2014). Specific initiatives, such as the regional differentiated social security contributions implemented in Norway, have effectively prevented population decline (Rybalka et al., 2018).

Other place-based policy measures to tackle this issue include subsidising housing for new workers (Sleutjes, 2016). Subsidies for renting or purchasing homes have shown success under specific circumstances (Sinai & Waldfogel, 2005). Existing examples include programs like the Housing Choice Vouchers and the Low Income Housing Tax Credit in the United States (Ford & Schuetz, 2019). However, it is essential to note that while these programs have been tested nationally, their effectiveness within a place-based policy framework requires further examination. Finally, ongoing research delves into the implications of implementing natality subsidies. Current evidence indicates a positive impact when such schemes are sufficiently robust, although the relationship remains relatively weak (Cook et al., 2022).

3.5.3. Policy Recommendations: Low Appropriability

Apart from the binding constraints derived from the low social returns and the regional trap, the low returns to economic activity can also be explained by low appropriability, according to the GD framework.

h) Government failures

Government failures can pose a significant binding constraint to economic growth by creating unfavourable conditions. Factors such as overregulation, corruption, fiscal instability, and misallocating taxes and subsidies contribute to this phenomenon (Schuck, 2015). Within our analysis, Cantabria, Almería, and Málaga find themselves in this situation, exhibiting a notably higher percentage of corruption cases compared to the average of the group.

A viable place-based policy approach to address this issue involves the establishment of independent local authorities entrusted with the power to oversee and act independently from local governments (Ottow, 2012). Specific regulations within the European Union (EU) or the United States require establishing such independent authorities in various sectors, ranging from energy to monetary and fiscal policies (Larsen et al., 2006). While these regulations typically pertain to the supra-regional level, it is essential for these agencies to address regional aspects to prevent government failures (Gilardi, 2007). The Highlands and Islands Enterprise in Scotland serves as an example of a regional public agency that has effectively tackled government failures at the local level (Clarke, 2021).

i) Market failures

Market failures can have detrimental effects on economic growth, similar to government failures. They hinder the efficient allocation of resources, impede overall efficiency, and act as binding constraints to growth (Tirole, 2015). Within our analysis, Murcia, Almería, and Huelva face challenges in this regard. Various policy measures can be implemented to address market failures.

One approach involves establishing a regional antitrust institution responsible for monitoring local markets and identifying competition issues such as firm concentrations or oligopolistic actions (Jenny, 2016; Ottow, 2015). An example of such an institution is the office of the Attorney General in each state of the United States, which independently addresses competition issues within its state, separate from the national antitrust authorities (Greve, 2005). Also, regional antitrust institutions effectively address market failures in other federal countries with regional political autonomy, such as Germany or Australia (Reichard, 2006).

Another place-based policy strategy consists of facilitating the establishment of new companies in sectors dominated by a few firms that control a significant portion of the regional market share (Acosta et al., 2011). This approach was implemented in Australia through the creation of the National Broadband Network (NBN), which the government initiated to break the monopoly on telecommunications infrastructure. This monopoly had a negative impact on less dynamic regions, and the NBN successfully addressed the lack of competition (Sinclair, 2023). A similar strategy has been evaluated for China, demonstrating that state aid enhances competition in selected sectors (Aghion et al., 2015). In cases where the issue lies with the size of firms, local governments can support regional companies in their growth and international market expansion (Storey, 2017). State intervention has proven effective in achieving this objective (Finchelstein, 2017).

3.5.4. Policy Recommendations: High Cost of Finance

We have elaborated on the various factors that can result in low returns on economic activity, hindering the region's ability to attract substantial private investment and foster entrepreneurship. However, even if a region has stable returns to economic activity, the amount of private investment and entrepreneurship may be low if the cost of finance is high. Profitable business opportunities lose their economic interest if a significant amount of profits must be

devoted to covering the costs of the loans' interests. That situation is why the GD has a high cost of finance as an explanatory variable for the low levels of investment and entrepreneurship. The high cost of finance is explained in the GD either by a negative international finance situation or a bad local finance circumstance.

j) Bad international finance

A region experiencing a significant burden in attracting Foreign Direct Investment (FDI) can often be attributed to the high cost associated with international finance (Alfaro & Chauvin, 2020). According to our analysis, Cantabria finds itself in a challenging situation concerning this variable. It is worth noting that most policies aimed at reducing the cost of international finance are beyond the scope of regional jurisdiction (Bodea & Hicks, 2015). Nevertheless, specific place-based policies can offset the cost and incentivise international investors. A practical approach in this arena is the establishment of Special Economic Zones (Moberg, 2015). Evidence indicates that such policies stimulate an increase in foreign direct investment, workers' wages, and firm productivity (Wang, 2013). Prominent examples of this policy can be observed in the Canary Islands Special Zone (ZEC) in Spain or the Katowice Special Economic Zone (KSSE) in Poland.

Alternatively, another viable place-based policy option for regions encountering difficulties with international finance involves providing subsidies or grants targeted explicitly at international companies (Driffield, 2004). However, the effectiveness of such policies varies depending on the specific industrial characteristics of regions, yielding mixed results (Devereux et al., 2007). A third potential strategy is the creation of sectorial clusters within an economic activity where the region exhibits the potential to attract international investments (Garanti & Zvirbule-Berzina, 2013). This approach has demonstrated positive outcomes by enhancing performance, innovation capacity and competitiveness, thereby attracting international investments (Ketels & Memedovic, 2008).

k) Bad local finance

Furthermore, apart from international finance, a region may face challenges concerning its local finance situation. Within our analysis, this holds for Huelva, Tenerife, and Cádiz. To address this issue, specific place-based policies can be implemented. Firstly, it has been established that fostering competition among banks operating in the region is crucial to ensure affordable credit and favourable financial conditions (di Patti & Dell'Ariccia, 2004). One

effective place-based policy to facilitate this, is for the government to provide credit through a public institution, encouraging investment and entrepreneurial activities in the region. For instance, the Official Credit Institute (ICO), a finance institution owned by the Spanish government, offers a program that lends money to SMEs at lower interest rates compared to market offerings, thus stimulating their growth (García-Vaquero, 2013). However, distressed regions do not receive prioritised focus for such support in the actual program. A second policy that has shown effectiveness is promoting a culture of savings among the region's residents, enabling banks to have greater liquidity and reducing the cost of loans (Borsch-Supan, 2003; Niculescu-Aron & Mihăescu, 2012).

3.5.5. Final Remarks and Limitations

The findings of this study indicate that the GD framework, customised for regional applications, proves to be a reliable tool for identifying suitable place-based policies required by a region. This contribution is significant since the existing literature lacks a well-established methodology for determining the most appropriate place-based policy for specific areas based on their socioeconomic conditions. There is a consensus among scholars that place-based policies can effectively address specific situations and assist regions or areas caught in a development trap (Barca et al., 2012; Rodríguez-Pose & Wilkie, 2017; Shenoy, 2018). However, it is essential to acknowledge that the success of place-based policies is based on their careful choosing and design (Bentley & Pugalis, 2014). We posit that the failure of such policies may stem from a lack of thorough analysis of a region's needs. Going beyond previous research, our study proposes a model that helps to select appropriate place-based policies.

It is worth mentioning that our study's main limitation relates to the use of a limited set of indicators as GD variables, where only one indicator is considered per category. Consequently, the overall comprehension of a region's economic situation, as depicted in Table 6, could be enhanced by including multiple variables within each category. Furthermore, it could be argued that specific indicators within a category can be substituted by others. Additionally, a comprehensive analysis and comparison of regions would require the utilisation of several indicators for each group. However, for the sake of simplicity, we have utilised only one indicator per category. Future extensions of this study could contribute by conducting a broader analysis to gain a deeper understanding of the binding constraints faced by each region and the corresponding place-based policies needed to address them.

3.6. Conclusion

This chapter enhances the academic discourse on regional economic development by introducing an analytical framework designed to achieve a dual objective: firstly, to identify the binding constraints that reduce regional economic growth, particularly in regions in a situation of development trap, and secondly, to propose place-based policy interventions aimed at overcoming these constraints. By extending the Growth Diagnostics (GD) framework, traditionally applied at the national level, to a regional context, this study introduces a region-specific GD approach, drawing upon and expanding the groundwork laid by Hausmann, Rodrik and Velasco (2008). Our innovative framework aims to provide a more nuanced understanding of regional economic dynamics, thereby facilitating the identification of growth impediments and the formulation of tailored policy solutions.

Our research endeavours not only to expand the conventional GD framework but also to refine it, thus enabling the model to address the complex dynamics of regional economic growth. By integrating region-specific variables, such as the regional development trap, the framework allows for a more precise identification of growth barriers. Moreover, the designed framework enables policymakers to devise and implement policies specifically tailored to each region's reality, moving beyond the "one-size-fits-all" approach that characterises some economic development strategies.

The utility and effectiveness of the revised framework are demonstrated through an empirical analysis of twelve Spanish regions, identified as "below average divergers" due to their poor economic performance over the past two decades. This comparative analysis, utilising a range of indicators across the categories defined in our GD model, reveals the diverse factors impeding economic growth in these regions. Our findings underscore the significance of regional development traps and the importance of considering both the trajectory and the current state of various economic indicators, which are in line with path-dependence theories.

The results from the analysis conducted provide a solid foundation for prescribing a series of place-based policies, crafted in response to the specific binding constraints identified within each region. These policies are designed to address the economic vulnerabilities of each region, thereby unlocking their growth potential. This chapter not only contributes an analytical tool

to the field of regional economic analysis but also lays the groundwork for future research. Potential directions include applying this framework to other regional contexts outside Spain or adapting it to smaller geographical units, such as cities, thereby opening new avenues for understanding and promoting economic development at various spatial scales.

In conclusion, this work significantly contributes to understanding regional growth, equipping academics and policymakers with a framework for conducting comprehensive regional analyses and formulating place-based policy recommendations. By explicitly addressing the dimension of regional development traps, this chapter not only enriches the existing body of knowledge but also identifies promising pathways for future research in the domain of regional economic growth and policy formulation.

CONCLUSION

Revisiting the initial quotation presented at the beginning of the introduction, this thesis has helped to clarify the importance of places besides individuals in shaping economic outcomes and the impact of policy interventions. The findings and inferences drawn from the three chapters advocate for a policy paradigm that prioritises the spatial dimension to fully comprehend the dynamics of socio-economic transformation. In this concluding section, we briefly highlight the policy implications and contributions derived from the tripartite analysis contained within this dissertation.

The inaugural chapter articulates the absence of a one-size-fits-all solution to the challenge of rural depopulation. A territory with a persistent population decline trajectory cannot rely on a singular policy intervention. Instead, a review of the existing literature suggests that a multifaceted strategy encompassing a group of policies across various sectors holds the potential for successful outcomes. The strategic alignment of these diverse policies towards a unified objective significantly enhances the likelihood of their collective efficacy. Furthermore, an effective anti-depopulation initiative should, at least, embody four policy domains—sectoral, fiscal, social, and infrastructural—whose synergistic application could yield favourable results. An integrated approach that strengthens these four dimensions within a specific rural context has been identified as a viable blueprint for reducing population decline.

The second chapter posits that the integration of a territorial perspective into fiscal systems increases the effectiveness of conventional individuals-centred redistribution mechanisms. The adoption of place-based fiscal redistributive measures is recognised as a valid approach to mitigate disparities between urban and rural areas. Despite the existence of more cost-efficient alternatives discussed within the chapter, carefully crafted adjustments in fiscal redistribution mechanisms raise the capacity for immediate reduction of income differences, such as those between the urban and rural areas that the study explores. Moreover, the chapter emphasises the imperative for a detailed examination of the specific regional conditions prior to the deployment of any policy action, given the regional heterogeneity evidenced. This refutes the notion of a universal or general solution for narrowing urban-rural income disparities.

The final chapter concludes that the identification and implementation of place-based policies should be dependent upon each region's unique constraints to economic growth. The deployment of a framework as the improved regional Growth Diagnostics designed and used in the chapter is essential for discerning the appropriate place-based policies. The regional

specificities must be analysed in detail to inform policy decisions. Special attention to the dimension of 'regional traps' is crucial in identifying binding constraints that constitute an impediment to growth. From infrastructure or human capital deficits to financial, governmental or market inefficiencies, going through employment structure or population dynamics, the constraints to regional economic growth are diverse and region-specific. Nonetheless, the research posits that, for every constraint, customised place-based policies can be formulated and proposed to address the specific challenges encountered.

The specific contributions of the thesis primarily entail three key aspects. The first pertains to a systematic review of existing literature. A model has been devised aimed at providing guidance to policymakers and scholars regarding the formulation of effective strategies to mitigate depopulation based on previous evidence. The second contribution is based on the assessment of the urban-rural income gap in Spain. Calculations have been conducted across various regions and income deciles to unravel the associated heterogeneity. The outcomes are presented in relation to both market and final incomes. Consequently, this contribution also encompasses an examination of the impact of redistributive policies in reducing the urban-rural gap. The third contribution introduces a novel Growth Diagnostics model tailored for analysing the socioeconomic landscape of regions, particularly in situations of development traps. Following an identification of the primary binding constraints to growth in the region, the framework proposes customised place-based policies to address each specific circumstance.

In summation, this thesis underscores the necessity for policies to engage deeply with the particularities of the local or regional realities where policy interventions are applied. An accurate analysis requires examining not only the data from individuals but also the distinctive characteristics of their geographical location that influence the socio-economic development patterns. Policymakers would benefit in their program implementations if these considerations were integrated into their strategic planning and execution.

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ANNEXES

Annex 1. Summary table of the papers included in the systematic literature review

SECTORIAL POLICIES

Author & year	Country	Period	Sample	Method	Results
AGRICULTURE & LIVESTOCK					
Cazcarro et al., 2024	Spain	1910-2011	8122 municipalities	Difference-in-differences	Irrigation projects increase population during an initial period, but the positive effect vanishes after some time. The effect is diverse depending on the construction time.
Tenza-Peral et al., 2022	Mexico	2010-2050	Region of Oasis of Comonú	Dynamic simulation model and a sensitivity analysis	Improving agriculture and livestock yields leads to a reduction or even reversal of depopulation.
Miranda et al., 2006	Spain (Galicia)	1960-2000	2490 parishes and 180 municipalities	Statistical analysis of the EU evaluation guidelines	Land consolidation helps to slow rural depopulation.
Lasanta & Laguna, 2007	Spain (Central Pyrenees)	1986-2001	All municipalities in the Aragonese Pyrenees	Bivariate analysis of correlations	Agricultural subsidies like the CAP help reduce depopulation, although they do not reduce ageing. They also complement income from tourist activities.
Grodzicki & Jankiewicz, 2022	Baltic states	2000-2020	Estonia, Latvia, Lithuania	Time series analysis in the frequency domain.	The CAP positively affects GDP growth, poverty reduction, broadband network access, bed places and employment. These effects of the CAP reduce depopulation.
Morettini, 2023	Italy	1911-1971	1285 municipalities	Ordinary Least Squares regression model	Implementing taxes to livestock activities to achieve environmental goals fosters out-migration, inequality, food insecurity and power conflicts.
Silvestre & Clar, 2010	Spain (Ebro basin)	1900-2001	90 villages	Comparisons of percent changes in compound annual growth.	Irrigation projects have diverse effects. In some cases, they can help to increase population. In others, population is stabilized, or they can cause a slight decline.
ENERGY PRODUCTION					
Duarte et al., 2022a	Spain (Aragon)	2020	97 surveys of 34 questions each	Survey Analysis	Citizens affected by renewable energies do not perceive that their installation helps reduce depopulation or generates sustained employment.

Duarte et al., 2022b	Spain (Aragon)	1996-2018	Campo de Belchite county (9 wind farms)	Synthetic Control Method	Renewable energy implementation fosters depopulation by avoiding other local activities like agriculture or tourism and do not generate stable employment.
Pérez-Sindín López et al., 2023	Spain	1991-2001	Municipalities in Asturias, León, Palencia and Teruel	Nearest Neigbor Matching technique	The closing of coal mines significantly fosters depopulation in rural areas.
Phimister & Roberts, 2012	United Kingdom	2005	North East Scotland region	Regional Computable General Equilibrium Model	Local ownership and local reinvestment of the benefits from renewable energies increase household income and retain population.
Fabra et al., 2023	Spain	2006-2020	3.200 municipalities	Treatment and control regressions to estimate projections	Solar plants generate some employment, although it is not local. Wind plants do not generate any significant change in employment.
TOURISM					
Hashimoto & Telfer, 2010	Japan	2003-2008	Oita prefecture	Case study	The development of the rural tourism sector is effective to reduce depopulation in traditionally agricultural societies.
Vidal-Matzanke & Vidal-Gonzalez, 2022	Spain (inland Castellon province)	2020	16 individuals	Semistrucured interviews	Sports tourism contributes to slow depopulation and develop local business in that sector that generate employment in rural areas.
Cáceres-Feria et al., 2021	Spain (South–West)	2000-2020	Linares de la Sierra village	Case study	Community-based tourism offers a complement to traditional rural tourism that allows the village to maintain the population figures stable.
Alcalá, 2018	Spain	2001-2018	Teruel province	Case study	Decentralized institutions that combine museums and science and take profit from endogenous resources can be effective in reducing depopulation in sparsely populated areas.
Larraz & San-Martin, 2021	Spain (Cuenca, Guadalajara and Madrid)	1900-2011	Rural municipalities near the reservoirs	Comparative analysis of the population in the municipalities	Infrastructures like water reservoirs, if their use is combined with touristic uses, have the potential to develop rural tourism to stop depopulation.

SOCIAL POLICIES

Author & year	Country	Period	Sample	Method	Results
GENERAL SERVICES					
Christiaanse, 2020	Netherlands	2000-2012	Fryslân province	GIS networks analysis	Decline in facilities in rural areas is not in line with demographic changes but with the size of the municipality. Where basic facilities cannot be provided in every municipality, it is important to have a network approach that ensures a reasonable distance. Clustering services in a big municipality is not efficient in retaining the populations of small municipalities.
OECD, 2010	OECD countries	1991-2007	All OECD countries, with a special focus in United Kingdom	Case study comparison	Some important factors for service delivery in rural areas at risk of depopulation are monitoring performance and providing incentives, promoting decentralization and adequate funding, and strengthening local democracy.
Alamá-Sabater, 2021	Spain	2010-2019	542 municipalities of the Valencian region	Spatial population growth model	Instead of trying to have the highest possible number of services in each small municipality, creating clusters of municipalities for service provision is crucial to prevent depopulation.
Paniagua, 2020	Spain	2017-2020	9 initiatives developed in Spain	Theoretical analysis	The smart village concept and technology has the potential to develop solutions against depopulation improving the existing economic sectors.
Náñez Alonso et al., 2022	Spain (Castille and Leon)	2021	Provinces of Palencia, Ávila, Zamora, Segovia, and Soria	Calculation of indexes of accessibility	The multiprovision of services helps reduce depopulation by providing various services with the same infrastructure. The possibility of accessing cash in rural pharmacies implies a significant increase in the accessibility to that service.
Goodwin-Hawkins et al., 2021	Austria, Finland and Wales	2013-2021	Initiatives in Ceredigion (UK), Allerleierei (Austria) and Finland.	Conceptual framework proposition derived from case study analysis	A neo-endogenous approach to the provision of services in rural areas is crucial to reduce depopulation. Local capacities should be mixed with exogenous resources, diverse networks and digital platforms
HOUSING					
Cheng et al., 2019	China	2015	Municipalities in the Fuping County	Construction of a symbiotic index	The parallel development of housing and industry/employment is the basis for gaining population and revitalizing rural areas.

Gkartzios & Norris, 2011	Ireland	1998-2006	267 electoral divisions	Mixed methods: GIS analysis and semistructured interviews	Fiscal incentives for the renovation and construction of houses in rural areas stops population decline, generates temporary employment and increases housing output.
Norris & Winston, 2009	Ireland	1991-2006	9 regions and 3 counties	Statistical data analysis and case studies	Subsidies for housing produce an excess of housing vacancies in rural areas if the subsidy is not directed to first residences instead to any type of residence. To reduce depopulation, subsidies should be focused on permanent habitants.
Hernández-Ramirez et al., 2021	Spain	2018	Huertas village, Sierra de Arracena Mountains	Ethnographic case study	The use and management of redundant housing is a fundamental factor to revitalize villages and reduce depopulation.
Gallent et al., 2002	Europe	1990-2000 (approx.)	10 European countries	Case studies and statistical analysis	Diverse and varied results in the many chapters of the book. Across Europe, the housing market in rural areas is quite different form the housing market in urban areas, with different problems and solutions. A good housing policy is key to stop depopulation.
HEALTH SERVICES					
Henderson & Taylor, 2003	United States (Texas)	1996	484 hospitals in 251 counties	Generalized and zero-inflated Poisson linear models	Since population is the main determinant of having a hospital in a specific area, rural areas tend to be underserved by hospitals and health centres. The presence of a hospital plays an important role in the population growth of a region.
Sørensen, 2008	Denmark	2005	1000 individuals	Fully structured interviews	Most patients in rural areas reject the idea of tele-medicine as a way to deliver services in depopulated areas.
Shipman et al., 2019	United States	2017	618.856 applications	Statistical analysis	There is a lack of professionals who want to provide health services in rural areas. This problem is predicted by the fact that rural individuals are an underrepresented minority in medicine and other related studies.
EDUCATIONAL SERVICES					
Lehtonen, 2021	Finland	2010-2018	2297 schools in 336 municipalities	Difference-in-differences	Maintaining schools in small villages helps retain population and reduce depopulation.
Sørensen et al., 2021	Denmark	2011-2021	8 rural schools	Difference-in-differences and qualitative surveys	Closing schools accelerate the speed of depopulation in rural areas both in the short and long run.

Lovén et al., 2021	Sweden	1990-2013	63.000 individuals in 21 municipalities	Difference-in-differences	Maintaining universities in small regions helps reduce depopulation, keeping individuals who otherwise would have migrated to pursue higher education.
Cedering & Wihlborg, 2020	Sweden (Ydre municipality)	2002-2010	24 individuals affected and 12 policy-makers	Semistructured interviews	Schools in rural areas are more than a place for teaching and learning, they are important community hubs that strengthen the life in the village. Closures that do not consider this dimension contribute to declining rural areas.
Kłoczko-Gajewska, 2020	Poland	2004-2016	29 individuals	Semistructured interviews	School closures in small villages contribute to the decline of structural and cognitive social capital, that is among the factors that explain depopulation of some rural areas.
SOCIOCULTURAL SERVICES					
Mount & Cabras, 2016	United Kingdom	Not specified	715 municipalities	Structural Equations Model	Village bars/pubs are complementary to the provision of other services and the serve as community meeting points. Maintaining village pubs is effective in reducing depopulation.
Iversen et al., 2021	Denmark	2020	27 individuals	Semistructured qualitative interviews	Facilities and meeting places in rural areas play an important role in the increase of the self-assessed quality of life. The closing of those facilities and places contribute to depopulation.
NATALITY & IMMIGRATION					
Collantes et al., 2013	Spain	1991-2008	22 provinces	Estimations and contrafactual techniques	International migration helps reduce depopulation or even increase population in rural areas in the short run.
Bayona-i-Carrasco & Gil-Alonso, 2012	Spain	1996-2009	480 municipalities	Typology constructions	International migration does not reduce depopulation in rural areas. This happens only in municipalities whose main economic sector is rural tourism or those that are near to urban areas.
Brainerd, 2014	Central and Eastern Europe	1970-2010	7 countries	Statistical analysis	Policies to encourage fertility are only modestly effective in increasing the number of children per marriage.
Cook et al., 2022	Russia, Poland & Hungary	2000-2019	3 countries	Statistical analysis	Pro-natalist policies have limited impact on fertility.

Cobano-Delgado & Llorent-Bedmar, 2020	Spain (Celtiberian Range)	Not specified	280 individuals	Mixed methods (Qualitative and quantitative data collection)	Women have higher migration rates from rural to urban environments since they have more job opportunities, basic services and leisure opportunities. The migration of women and masculization of rural areas is one of the key factors explaining depopulation.

FISCAL POLICIES

Author & year	Country	Period	Sample	Method	Results
GENERAL PUBLIC INVESTMENT PROGRAMS					
Esparcia et al., 2015	Spain	2011	13 individuals (team managers and chairpersons)	Focus groups	LAGs play an important role in fostering economic development in rural depopulated areas in Spain. However, they face the risk of becoming an instrument of power and clientelism.
Bosworth et al., 2015	England	2012-2013	549 individuals from 64 LAGs	Interviews and questionnaires	The LEADER program generates a diversity of projects and a diversity of outcomes. The model works in promoting networking, supporting innovation and taking a bottom-up economic development approach in remote areas.
Bruckmeier, 2002	Germany	1994-1999	LAGs in the West part of the country	Case study	The LEADER program is contributing to sustainable rural development, but it can improve its ability to keep population in rural areas by improving innovation and governance systems.
Scott, 2010	United Kingdom	Not specified	15 LAGs in Northern Ireland	Semistructured interviews	Adaptation to the LEADER methodology was at fist difficult, but further adjustments of the program are viewed by practitioners as a potential for rural development.
Serra et al., 2023	Spain	2002-2012	Municipalities in Extremadura and Andalusia	Logistic probabilities estimation	The PER subsidy for rural unemployment helps to reduce depopulation in those municipalities where the citizens receive the funds.
Monturano et al., 2023	Italy	2014-2020	269 municipalities	Staggered difference-in-differences	Financial aid from the SNAI program significantly increases the number of businesses created in depopulated areas, contributing with positive spillovers too.

Navarro-Valeverde et al., 2021	Spain	2015-2020	70 depopulated municipalities in Andalusia region	Diagnosis of the Local Development Strategies and SWOT analysis.	A risk of LAGs is that they focus on the more dynamic and populated municipalities, leaving aside those depopulated municipalities that precisely are more in need of the LEADER aid.
Jofre-Monseny, 2014	Spain	1981-1991	Municipalities in Extremadura and Andalusia	Regressions with border identification strategy.	Subsidy transfer programs to rural partially employed individuals reduce depopulation. In absence of the subsidy, there was a population loss of 15% for that period, while with the subsidy, there was a population gain of 3%.
TAX CUTS PROGRAMS					
Keane & Garvey, 2006	Ireland	1997-2003	48 local employment offices	Panel data with fixed effects regression	Fiscal incentives for construction activities generate employment creation in sparsely populated areas.
Bennmarker et al., 2009	Sweden	2001-2004	More than 50.000 workers	Difference-in-differences	The reduction of social security contributions in depopulated areas do not increase employment in existing businesses, but they increase the creation and attraction of businesses. Salaries also rise.
Ku et al., 2020	Norway	2000-2006	880.812 workers	Difference-in differences	The reduction of social security contributions in depopulated areas increase both employment and salaries in those regions.
Kettlewell & Yerokhin, 2017	Australia	1921-1961	More than 250 municipalities	Difference-in-differences and discontinuous regression models	The creation of tax-free zones in depopulated areas produce an increase of the population living in those regions.
Lynch & Zax, 2011	United States (Colorado)	1990-2000	55.334 establishments	Heckit regressions	The creation of tax-free zones creates employment in depopulated regions, in contrast with urban environments, where this policy does not create employment.
Rybalka et al., 2018	Norway	1997-2014	All the workers affected by the tax reductions	Difference-in-differences, regression kink design, GMM estimators, Fixed effects and Between effects.	The reductions of the social security contributions increase employment and wages in depopulated areas, helping those territories to gain population. Existing firms create more employment, but also new firms are created.
Behaghel et al., 2015	France	1996-2009	Firms and employments in 789 low-density cantons	Regression Discontinuity Design	Tax exemptions that are not generous enough for firms do not create employment or wage increases in rural depopulated areas.

INFRASTRUCTURE POLICIES

Author & year	Country	Period	Sample	Method	Results
TRANSPORT INFRASTRUCTURES					
Levkovich et al., 2020	Netherlands	1970-2018	78 municipalities	Ordinary Least Squares regressions	The construction of highways improves accessibility and produces the migration of individuals from urban to rural areas.
Adler et al., 2020	Europe	1990-2012	26 EU countries (All except UK and Ireland)	Instrumental variables regressions	Transport infrastructure increases market access. "An increase in market access by 1% increases regional population by 0.6%, GDP by 0.2%, and employment by 0.7% on average." Benefits are higher when connecting those regions with less market access.
Lu et al., 2022	China	2016	227 prefectural cities	Geographically weighted regressions considering instrumental variables	National, provincial and municipal roads narrow the urban–rural income gap by facilitating rural labour mobility and increasing rural incomes. This makes rural areas more attractive for living.
Bjarnason, 2021	Iceland	2000-2020	Total population of Fjallabyggð municipality	Statistical analysis	"Improved road infrastructure coincides with a break in long-term population decline through parity in net migration and positive changes in the composition of the population of sparsely populated areas."
DIGITALIZATION AND CONNECTIVITY					
Esteban-Navarro et al., 2020	-	2016-2020	28 studies	Scoping literature review	Connectivity enhancement is effective in promoting economic development of rural remote areas. This digital inclusion is a potential tool for retaining population in these areas.
Lehtonen, 2020	Finland	2010-2018	Population grid cells of 1 km in all the country	Difference-in-Differences	The availability of broadband connection reduces the depopulation of remote and sparsely populated rural areas. However, broadband infrastructure cannot alone solve the structural problems of rural areas.

Briglauer et al., 2019	Germany	2010-2014	All municipalities in the Bavaria region	Difference-in-Differences	Increasing broadband coverage with state aid decreases the depopulation of sparsely populated areas.
Salemink et al., 2017	-	2013	157 studies	Systematic literature review	Digital connectivity can compensate for the lack of physical connectedness in some depopulated areas. However, less physically connected areas usually also have less digital connectivity,

Annex 2. PRISMA 2020 flow diagram for new systematic reviews
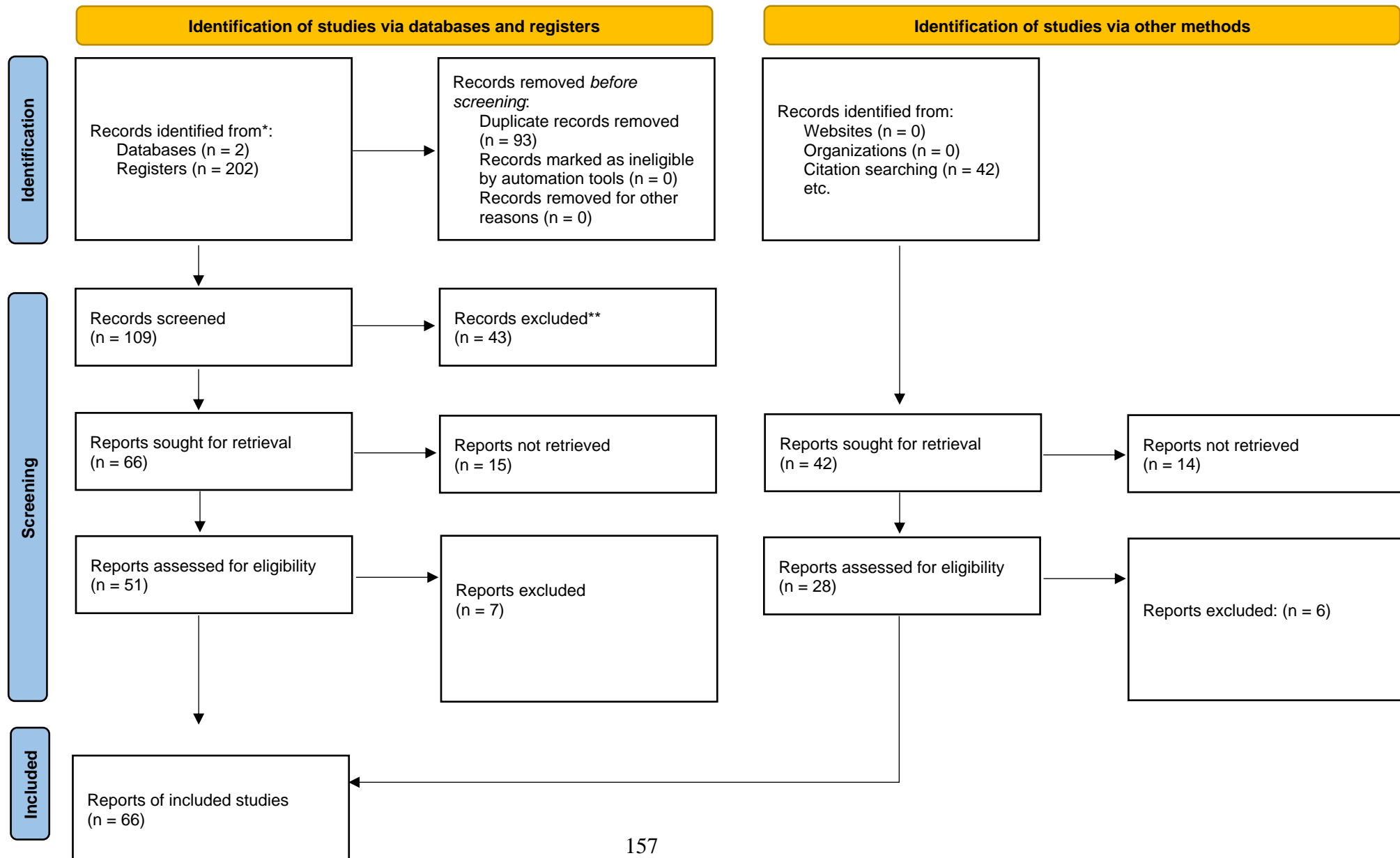
Identification of studies via databases and registers

Identification of studies via other methods

Identification

Records identified from*:
Databases (n = 2)
Registers (n = 202)

Records removed *before screening*:
Duplicate records removed (n = 93)
Records marked as ineligible by automation tools (n = 0)
Records removed for other reasons (n = 0)

Records identified from:
Websites (n = 0)
Organizations (n = 0)
Citation searching (n = 42)
etc.

Screening

Records screened
(n = 109)

Records excluded**
(n = 43)

Reports sought for retrieval
(n = 66)

Reports not retrieved
(n = 15)

Reports sought for retrieval
(n = 42)

Reports not retrieved
(n = 14)

Reports assessed for eligibility
(n = 51)

Reports excluded
(n = 7)

Reports assessed for eligibility
(n = 28)

Reports excluded: (n = 6)

Included

Reports of included studies
(n = 66)

Annex 3. Data Descriptive Analysis

Tables 8 and 9 show the number of individuals by the degree of urbanization (urban, intermediate, or rural areas) and by income decile for market income and final income, respectively. The data for the two income types point to an even distribution of individuals across deciles and territories without having an intense concentration of individuals in a specific type of territory.

Table 8. Number of individuals in each market income decile and territory

	$0^{th} - 1^{st}$	$1^{st} - 2^{nd}$	$2^{nd} - 3^{rd}$	$3^{rd} - 4^{th}$	$4^{th} - 5^{th}$	$5^{th} - 6^{th}$	$6^{th} - 7^{th}$	$7^{th} - 8^{th}$	$8^{th} - 9^{th}$	$9^{th} - 10^{th}$
Urban	5616	6670	6907	7269	6691	6648	6674	7027	7272	7547
Intermediate	3901	3375	3000	3166	3357	3380	3509	3453	3422	3312
Rural	4791	4264	4407	3874	4258	4282	4123	3833	3613	3449

Table 9. Number of individuals in each final income decile and territory

	$0^{th} - 1^{st}$	$1^{st} - 2^{nd}$	$2^{nd} - 3^{rd}$	$3^{rd} - 4^{th}$	$4^{th} - 5^{th}$	$5^{th} - 6^{th}$	$6^{th} - 7^{th}$	$7^{th} - 8^{th}$	$8^{th} - 9^{th}$	$9^{th} - 10^{th}$
Urban	6994	6566	6029	6370	6683	6789	6950	6991	7448	7494
Intermediate	3220	3478	3557	3484	3399	3436	3431	3456	3315	3099
Rural	4092	4269	4722	4449	4231	4084	3924	3866	3541	3716

Figure 16. Median income for each Spanish region

a) Market income, urban areas. b) Market income, rural areas.

c) Final income, urban areas. d) Final income, rural areas.
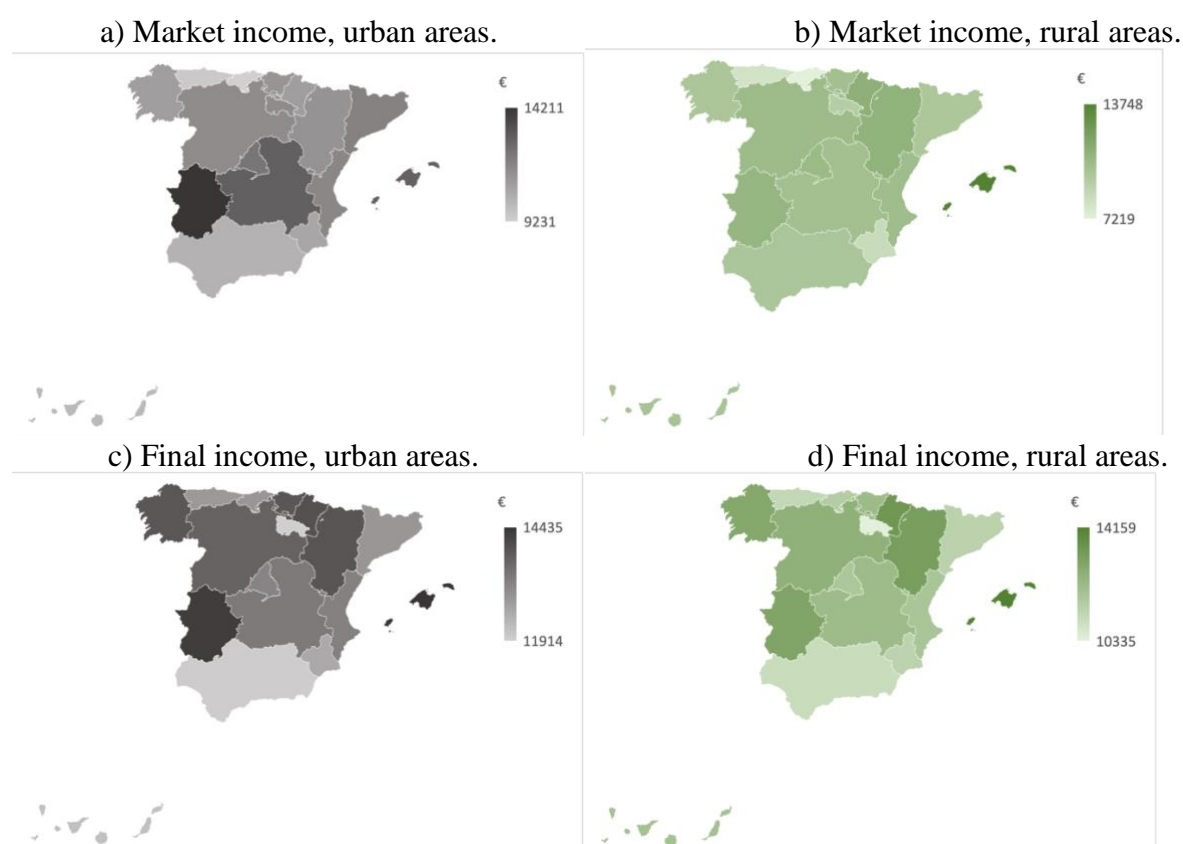
Annex 4. Correlation matrix with significance levels

Variables	Log market income	Log final income	Age	Gender	Urban	Intermediate	Rural	Full-time worker	Part-time worker	Autonomus	Unemployed	Primary sector	Secondary sector	Tertiary sector	Public sector
Log market income	1.000														
Log final income	0.658***	1.000													
Age	-0.024***	-0.049***	1.000												
Gender	0.001	-0.006**	0.051***	1.000											
Urban	0.051***	0.034***	0.011***	0.015***	1.000										
Intermediate	-0.001	-0.004	-0.050***	-0.002	-0.533***	1.000									
Rural	-0.054***	-0.034***	0.035***	-0.014***	-0.604***	-0.352***	1.000								
Full-time worker	0.426***	0.318***	0.003	-0.025***	0.008***	-0.001	-0.008***	1.000							
Part-time worker	0.056***	0.024***	-0.008***	0.031***	0.006**	-0.001	-0.006**	-0.132***	1.000						
Autonomus	0.116***	0.047***	0.011***	-0.023***	-0.015***	0.001	0.015***	-0.155***	-0.052***	1.000					
Unemployed	-0.039***	-0.024***	-0.002	0.006**	-0.002	-0.002	0.004*	-0.198***	-0.066***	-0.078***	1.000				
Primary sector	0.031***	-0.031***	0.002	-0.015***	-0.033***	0.002	0.035***	0.091***	-0.008***	0.188***	-0.043***	1.000			
Secondary sector	0.185***	0.124***	-0.002	-0.043***	-0.008***	0.003	0.006**	0.360***	-0.003	0.104***	-0.095***	-0.041***	1.000		
Tertiary sector	0.255***	0.170***	-0.001	-0.008***	0.015***	-0.004	-0.013***	0.387***	0.257***	0.280***	-0.149***	-0.064***	-0.142***	1.000	
Public sector	0.253***	0.212***	0.012***	0.023***	0.007***	0.000	-0.007***	0.410***	0.112***	-0.026***	-0.103***	-0.044***	-0.098***	-0.154***	1.000

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Annex 5. Quantile regression results for market income

	(1) OLS Log market income	(2) 1st decile Log market income	(3) 5th decile Log market income	(4) 9th decile Log market income
Age	0.000622***	0.00105***	0.000357*	0.000519**
	(4.14)	(3.38)	(2.17)	(2.60)
Gender	0.00541	0.0179	0.00439	-0.00801
	(0.98)	(1.57)	(0.73)	(-1.10)
Urban–intermediate gap	-0.0184**	-0.0317*	-0.0200**	-0.0233*
	(-2.61)	(-2.17)	(-2.59)	(-2.49)
Urban–rural gap	-0.0569***	-0.0869***	-0.0619***	-0.0430***
	(-8.07)	(-5.93)	(-8.02)	(-4.59)
Secondary education	0.179***	0.194***	0.186***	0.160***
	(16.12)	(8.40)	(15.25)	(10.80)
Tertiary education	0.491***	0.487***	0.495***	0.488***
	(42.99)	(20.52)	(39.62)	(32.17)
Household size (2)	-0.252***	-0.285***	-0.274***	-0.246***
	(-23.84)	(-13.00)	(-23.70)	(-17.53)
Household size (3)	-0.417***	-0.427***	-0.450***	-0.441***
	(-38.53)	(-18.98)	(-37.98)	(-30.67)
Household size (4)	-0.483***	-0.479***	-0.527***	-0.526***
	(-44.05)	(-21.04)	(-43.90)	(-36.12)
Household size (5)	-0.591***	-0.622***	-0.633***	-0.612***
	(-46.01)	(-23.30)	(-45.01)	(-35.87)
Part-time worker	-0.404***	-0.620***	-0.362***	-0.253***
	(-45.17)	(-33.38)	(-37.02)	(-21.31)
Full time autonomous	-0.141***	-0.289***	-0.149***	0.0123
	(-17.55)	(-17.29)	(-16.87)	(1.15)
Part-time autonomous	-0.294***	-0.542***	-0.247***	-0.0985*
	(-8.78)	(-7.80)	(-6.74)	(-2.22)
Secondary sector	0.302***	0.383***	0.319***	0.231***
	(21.45)	(13.09)	(20.72)	(12.34)
Tertiary sector	0.241***	0.291***	0.243***	0.211***
	(17.96)	(10.42)	(16.54)	(11.81)
Public sector	0.367***	0.506***	0.375***	0.254***
	(25.55)	(16.94)	(23.86)	(13.29)
Andalusia	-0.0781***	-0.0855***	-0.0867***	-0.0788***
	(-6.40)	(-3.37)	(-6.48)	(-4.85)
Aragon	-0.0235	0.0235	-0.0307	-0.0729**
	(-1.40)	(0.68)	(-1.67)	(-3.28)
Asturias	-0.103***	-0.142***	-0.103***	-0.0644**
	(-5.72)	(-3.82)	(-5.26)	(-2.70)
Balearic Islands	-0.0122	-0.00794	-0.00643	-0.0248
	(-0.68)	(-0.21)	(-0.33)	(-1.04)
Canary Islands	-0.0749***	-0.0620	-0.0611**	-0.0963***
	(-4.26)	(-1.70)	(-3.18)	(-4.12)
Cantabria	-0.0567**	-0.0747	-0.0916***	-0.0137
	(-3.03)	(-1.92)	(-4.48)	(-0.55)
Catalonia	-0.00165	0.0115	-0.00231	-0.0176
	(-0.15)	(0.51)	(-0.20)	(-1.22)
Extremadura	-0.106***	-0.123***	-0.0972***	-0.0852***
	(-6.54)	(-3.67)	(-5.49)	(-3.97)
Galicia	-0.0297*	-0.00652	-0.0372*	-0.0524**
	(-2.06)	(-0.22)	(-2.36)	(-2.74)
Castille and Leon	-0.0283*	0.0330	-0.0318*	-0.0879***
	(-1.96)	(1.11)	(-2.02)	(-4.60)
Castilla-La Mancha	-0.0478**	-0.00810	-0.0462**	-0.0701***
	(-3.07)	(-0.25)	(-2.72)	(-3.39)
Murcia	-0.0864***	-0.0774*	-0.0910***	-0.111***
	(-5.37)	(-2.32)	(-5.17)	(-5.18)
Navarre	0.0243	0.0669	0.0391	-0.0219
	(1.26)	(1.68)	(1.86)	(-0.86)
La Rioja	-0.0412*	-0.00949	-0.0404*	-0.0511*
	(-2.20)	(-0.24)	(-1.98)	(-2.06)
Valencian Com.	-0.0403**	0.0108	-0.0479**	-0.0775***
	(-2.90)	(0.37)	(-3.14)	(-4.19)
Basque Country	-0.00375	0.0254	-0.0105	-0.0290
	(-0.25)	(0.81)	(-0.64)	(-1.45)
Survey year 2018	0.0313***	0.0458**	0.0210*	0.0269*
	(3.91)	(2.75)	(2.40)	(2.52)
Survey year 2019	0.0493***	0.0605***	0.0431***	0.0408***
	(6.33)	(3.74)	(5.06)	(3.94)
Survey year 2020	-0.00230	0.0993***	-0.0185*	-0.0890***
	(-0.29)	(6.11)	(-2.16)	(-8.57)

_cons	9.671***	8.809***	9.766***	10.49***
	(431.23)	(189.14)	(398.01)	(352.19)
N	54099	54099	54099	54099
R-squared	0.1955	0.1009	0.1209	0.1302

Note 1: *t* statistics in parentheses. * p<0.05; ** p<0.01; *** p<0.001.
Note 2: Pseudo R-squared are notified in the case of quantile regressions

Annex 6. Quantile regression results for final income

	(1) OLS Log final income	(2) 1st decile Log final income	(3) 5th decile Log final income	(4) 9th decile Log final income
Age	-0.000637***	-0.000805***	-0.000679***	-0.000477**
	(-7.04)	(-4.84)	(-6.32)	(-3.19)
Gender	0.0111***	0.0169**	0.0104**	0.000589
	(3.34)	(2.77)	(2.64)	(0.11)
Urban–intermediate gap	-0.0208***	-0.0229**	-0.0190***	-0.0234***
	(-4.92)	(-2.93)	(-3.76)	(-3.34)
Urban–rural gap	-0.0414***	-0.0403***	-0.0443***	-0.0304***
	(-9.75)	(-5.16)	(-8.78)	(-4.32)
Secondary education	0.0853***	0.0843***	0.0861***	0.0887***
	(12.76)	(6.85)	(10.84)	(8.02)
Tertiary education	0.279***	0.226***	0.270***	0.318***
	(40.65)	(17.90)	(33.13)	(28.02)
Household size (2)	-0.154***	-0.103***	-0.169***	-0.175***
	(-24.32)	(-8.83)	(-22.43)	(-16.62)
Household size (3)	-0.218***	-0.113***	-0.244***	-0.289***
	(-33.52)	(-9.41)	(-31.54)	(-26.87)
Household size (4)	-0.262***	-0.127***	-0.295***	-0.365***
	(-39.81)	(-10.48)	(-37.74)	(-33.51)
Household size (5)	-0.277***	-0.134***	-0.318***	-0.377***
	(-35.84)	(-9.45)	(-34.61)	(-29.50)
Part-time worker	-0.196***	-0.211***	-0.187***	-0.152***
	(-36.42)	(-21.35)	(-29.23)	(-17.04)
Full time autonomous	-0.113***	-0.128***	-0.122***	-0.0592***
	(-23.40)	(-14.35)	(-21.19)	(-7.38)
Part-time autonomous	-0.173***	-0.218***	-0.145***	-0.0798*
	(-8.61)	(-5.89)	(-6.08)	(-2.40)
Secondary sector	0.283***	0.298***	0.282***	0.236***
	(33.38)	(19.12)	(28.03)	(16.84)
Tertiary sector	0.263***	0.270***	0.257***	0.236***
	(32.46)	(18.10)	(26.76)	(17.61)
Public sector	0.341***	0.370***	0.345***	0.275***
	(39.44)	(23.26)	(33.61)	(19.25)
Andalusia	-0.0740***	-0.0950***	-0.0675***	-0.0862***
	(-10.07)	(-7.02)	(-7.73)	(-7.09)
Aragon	0.0369***	0.105***	0.0445***	-0.0419*
	(3.67)	(5.65)	(3.72)	(-2.52)
Asturias	-0.0401***	-0.00882	-0.0419**	-0.0648***
	(-3.72)	(-0.44)	(-3.27)	(-3.63)
Balearic Islands	0.0330**	0.0617**	0.0375**	0.00259
	(3.06)	(3.10)	(2.92)	(0.14)
Canary Islands	-0.0262*	0.0596**	-0.0149	-0.101***
	(-2.48)	(3.06)	(-1.19)	(-5.79)
Cantabria	0.0292**	0.0551**	0.0203	-0.0156
	(2.60)	(2.67)	(1.52)	(-0.84)
Catalonia	-0.0311***	0.0351**	-0.0293***	-0.109***
	(-4.78)	(2.93)	(-3.79)	(-10.12)
Extremadura	-0.00640	0.0455*	0.00488	-0.0770***
	(-0.66)	(2.54)	(0.42)	(-4.78)
Galicia	0.0824***	0.107***	0.0808***	0.0764***
	(9.49)	(6.69)	(7.84)	(5.31)
Castille and Leon	0.0137	0.0836***	0.0160	-0.0459**
	(1.58)	(5.25)	(1.56)	(-3.20)
Castilla-La Mancha	-0.0143	0.0540**	-0.0146	-0.0744***
	(-1.53)	(3.13)	(-1.32)	(-4.81)
Murcia	-0.0292**	0.0352*	-0.0335**	-0.107***
	(-3.02)	(1.98)	(-2.92)	(-6.71)
Navarre	-0.00526	0.0664**	0.00765	-0.106***
	(-0.45)	(3.12)	(0.56)	(-5.53)
La Rioja	-0.0904***	-0.0956***	-0.0707***	-0.0985***
	(-8.04)	(-4.62)	(-5.30)	(-5.30)
Valencian Com.	-0.0209*	0.0341*	-0.0195*	-0.0926***
	(-2.50)	(2.21)	(-1.96)	(-6.68)
Basque Country	-0.0152	0.0747***	-0.0176	-0.104***
	(-1.67)	(4.49)	(-1.64)	(-6.96)
Survey year 2018	-0.0207***	-0.0483***	-0.0217***	0.0155
	(-4.29)	(-5.44)	(-3.79)	(1.94)
Survey year 2019	0.0397***	0.0443***	0.0370***	0.0397***
	(8.47)	(5.13)	(6.65)	(5.12)
Survey year 2020	-0.0525***	0.0118	-0.0802***	-0.0955***
	(-11.16)	(1.37)	(-14.35)	(-12.27)

_cons	9.491***	8.885***	9.536***	10.07***
	(703.85)	(357.98)	(595.37)	(451.41)
N	54145	54145	54145	54145
R-squared	0.1930	0.0877	0.1158	0.1318

Note 1: *t* statistics in parentheses. * p<0.05; ** p<0.01; *** p<0.001.
Note 2: Pseudo R-squared are notified in the case of quantile regressions