

UNIVERSIDAD COMPLUTENSE DE MADRID
FACULTAD DE CIENCIAS ECONÓMICAS Y EMPRESARIALES



TESIS DOCTORAL

Tres artículos sobre nivelación fiscal: convergencia, sostenibilidad y reforma

Three essays on fiscal equalisation: convergence, sustainability, and reform

MEMORIA PARA OPTAR AL GRADO DE DOCTOR

PRESENTADA POR

Andoni Montes Nebreda

DIRECTORES

Beverly George Dahlby

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PROGRAMA DE DOCTORADO EN ECONOMÍA

*“Las personas geniales empiezan grandes obras,
las personas trabajadoras las terminan”*

[Leonardo Da Vinci]

AGRADECIMIENTOS

Describir el final de la tesis doctoral como el cierre de una etapa vital suena a chiché. En mi caso han sido en realidad varias etapas, ya que he vivido periodos muy separados en estos cinco años, no solo geográficamente, pero también por las personas que me han acompañado. Quiero agradecer a todas ellas, mencionadas o no en estas líneas, su complicidad para que esta tesis – y este doctorando- hayamos llegado a buen puerto.

El primer agradecimiento, no solo por cortesía, es para mis directores de tesis, a Bev, Jorge y Julio. Gracias por muchas cosas. Por vuestra generosidad, al haber confiado en mi sin conocerme de nada. Por vuestra exhaustividad en las revisiones de los textos, para conseguir una tesis de calidad. Pero, sobre todo, por vuestra paciencia y por saber reconducir mi tendencia a la dispersión. Esta tesis es tan vuestra como mía.

Tuve la suerte de pasar los primeros meses como doctorando en el ICEI. Gracias a Isabel y Jesús por la acogida. Allí compartí horas de despacho y sobremesas en el comedor, con mis hoy amigos Raquel, Dani, Celia y Julián. También empecé a dar clase desde el primer día compartiendo aulas con Jorge y Alfonso.

I left to Leuven very early in my PhD to carry out my first research stay. André and the whole department of Economics made me feel part of them. At KU Leuven I learned how an Economics department should work. Will, Adriana and Sara became really good friends instantly and reminded me how much I missed living abroad. Us estimo moltíssim, chiquets.

Estos años, como para todos, han estado muy marcados por la pandemia. La COVID-19 provocó que volviera a Durango, lo que habría sido impensable en cualquier otro contexto. Tuve la suerte de poder incorporarme a Ituna primero y al departamento de Políticas Públicas después. Esker mila Joseba eta Edu, zuen eskuzabaltasunagatik. Han Sofia, Susana, Alaitz eta Jon ezagutzeko zortea izan nuen ere. Baina norbait faltan botatzen badut Sarrikotik urrun nagoanean, hori da Itsaso, elkar kafetxoak -hutsak, ez bakarrak-, pozak eta tristurak partekatzea.

Once the public health situation got better, and thanks to Sean, I got the chance to carry out my second research stay at the OECD. We both worked side by side on multiple projects that lead to some publications and workshops. It is always a pleasure to collaborate with Sean, thanks for being so supporting. A pesar de mis expectativas sobre la ciudad, París me sorprendió muy positivamente gracias a los fines de semana con mi cuadrilla del Colesp. Los infinitos planes de Sandra y Elena y las conversaciones con Lu y mi inseparable Ainhoa son también parte de esta tesis.

Después de tantas vueltas, este doctorado termina como empezó, en Madrid. Lo hace por culpa de (o gracias a) “el señor”. Pocas personas saben escuchar y me entienden como tú. Tenemos vidas paralelas que de vez en cuando se cruzan para poder dejar de pensar todo lo que tu me manques.

Haciendo memoria para redactar estas líneas he sido más consciente aún de lo bien acompañado que he estado durante estos años. Algunos amigos ya estaban antes de emprender este viaje, como Andoni, Pello, “las aldaperas”, Alba, Glo, Manu, Ramón, Laura o Kath. Otros muchos han venido después, pero estarán para siempre, como mis mellizos Ainhoa eta Asier, Laura y Crispi, e Inés. Es también el caso de la mejor cuentacuentos que la vida ha cruzado en mi camino y con quien espero escribir la mejor de las historias juntos.

Como me gusta extenderme tan poco como comer dulce, voy cerrando estos agradecimientos. Debo esta tesis y mi vocación por la Hacienda Pública a mis admirados profesores Encarni y Jesús, el espejo en el que mirarse. Beti eskertuta egongo naiz arlo akademikoan nire anai nagusia denari, Mikel. Milesker zure laguntza eta aholku zintzoagatik.

Pero, sobre todo, a mis padres, a aita y a ama.

Izpi txiki-txikiren bat

Agertuz doa gaurkoan

Poztasun handi batek besarkatzen nau

Mesedez ozen esan

Negua joan egin dela

Nire arima hotzak ez du sinizten eta

[Zea Mays]

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ABBREVIATIONS

2SLS-IV: Two Stage Least Squares

adjpop: Adjusted Population

BADESPE: Spanish Public Sector Economics Database

CCAA: Autonomous Communities

CG: Central Government

CI: Confidence Interval

CoR: Committee of Regions

CoV: Coefficient of Variation

EAFRD: European Agricultural Fund for Rural Development

EAGGF: European Agricultural Guidance and Guarantee Fund

EC: European Commission

EEA: European Environmental Agency

EFT: Ecological Fiscal Transfers

EPA: Active Population Survey

ERC: Esquerra Republicana de Catalunya

ERDF: European Regional Development Fund

ERP: European Regional Policy

ESF: European Social Fund

EU: European Union

EUR: Euro

FE: Fixed Effects

FEDEA: Fundación de Estudios de Economía Aplicada

FFPC: Fiscal and Financial Policy Council

FFCAA: Funding Fund for Regions

FGLS: Feasible Generalised Least Squares

FGSPF: Fundamental Public Service Guarantee Fund

FLA: Regional Liquidity Fund

GDP: Gross Domestic Product

GHG: Greenhouse Effect Gas Emission

GMM: Generalised Method of Moments

GVA: Gross Value Added

ICF: Interterritorial Compensation Fund

IGAE: General Controller of the Central Administration

INE: Spanish Statistics Institute

IV: Instrumental Variable

JRC: Joint Research Centre

kg: kilogram

kW: kilowatt

LDA: Latent Dirichlet Allocation

LEZ: Low Emission Zone

LSI: Local Sustainability Index

LSI+: Extended Local Sustainability Index

M: million

NO₂: Nitrogen Dioxide

NUTS-2: Nomenclature of Territorial Units for Statistics (Regions)

O₃: Ozone

OCTE: Tax Coordination Body of the Basque Country

OECD: Organisation for Economic Cooperation and Development

OLS: Ordinary Least Squares

PAYT: Pay as Your Throw

pc: *per capita*

PCA: Principal Component Analysis

PIT: Personal Income Tax

PM: Particulate Matter

PSOE: Partido Socialista Obrero Español

QMV: Qualified Majority Voting

QoG: Quality of Government

RCP: Representative Concentration Pathways

RE: Random Effects

RFS: Regional Funding System

SDG: Sustainable Development Goal

SNG: Subnational Government

US: United States of America

VAT: Value Added Tax

Regions

AND: Andalucía

ARA: Aragón

AST: Principado de Asturias

BAL: Balearic Islands

CAN: Canary Islands

CANT: Cantabria

CAT: Cataluña

CLM Castilla-La Mancha

CyL: Castilla y León

EXT: Extremadura

GAL: Galicia

MAD: Comunidad de Madrid

MUR: Región de Murcia

RIO: La Rioja

VAL: Comunitat Valenciana

ABSTRACT

This doctoral dissertation, named after “Three essays on fiscal equalisation: convergence, sustainability, and reform” is composed of three chapters. All of them address issues surrounding fiscal equalisation, both at regional or local level, and from a different perspective and methodological approach.

Should fiscal equalisation and regional policy goals and tools be disentangled?

We exploit the mixture of policy goals and instruments of the Spanish Regional Funding System (RFS) to test whether equalisation transfers have an impact on regional convergence. Using Random Effects (RE) and two-stage least squares estimation with instrumental variables (2SLS-IV) models and data for 15 regions for the period 2002-18, we find that both fiscal equalisation and regional transfers show a significant concave convergence-promoting effect, which is larger for regional transfers. However, funding excess/deficit caused by overlapping tools and objectives in the RFS does not have a significant relationship with regional convergence. These results are in line with the Tinbergen rule, since it is more cost-effective to promote regional convergence through regional policy funds.

Going green through local fiscal equalisation

Success of centrally set environmental objectives requires the engagement of subnational governments. However, they often do not have the capacities or the incentives to apply ambitious climate mitigation and adaptation policies. Indeed, stricter environmental policies can lead to a decrease in local revenue collection as a consequence of the reduced activity resulting from the correction of externalities. To address this issue, in the line of Ecological Fiscal Transfers, we propose the inclusion of incentives linked to environmental objectives in local equalisation that would compensate for the opportunity costs faced by municipalities. In particular, we suggest greening fiscal equalisation by including a multidimensional index of local environmental performance that could be complemented by a green expenditure needs component as criteria for the allocation of equalisation grants. To illustrate how this proposal would work, we examine the financial effect that environmental fiscal equalisation would have had across Basque municipalities for the 2016-2019 period. As a main result, we find that less sustainable cities could lose up to the 5% of their per capita transfers, while small and most sustainable municipalities could win up to 13% of their per capita allocations.

Coalitions and Blockades in the Negotiation of the Spanish Regional Funding System Reform: Narrative Evidence from Game Theory.

After decades of frequent reform, or instability, of the regional funding system in Spain, the model has not been modified since 2009. Despite calls from some regions to carry out changes, Central Government has not even opened discussions for negotiating a new reform. Therefore, instability has been replaced by coalitions blockade. Why? We follow a narrative game theory approach to respond to this question. On the one hand, there have been changes in drivers endogenous to the RFS, such as the conclusion of the decentralisation process and of asymmetric information (that led to coalitions formation), together with the expected end of the status quo clause. On the other

hand, exogenous drivers, such as political fragmentation, the Catalan conflict, fiscal rules, and macroeconomic cycle have altered incentives for actors not to move. We identify three regional coalitions and conclude that a comprehensive reform that changes decision-making rules, leaves some elements out of political discussion, that compensates wins and losses from isolated changes, together with rebuilding Central Government-Cataluña coalition, and limiting frequency of reforms could contribute to overcome current paralysis.

RESUMEN

Esta tesis doctoral, titulada “Tres artículos sobre nivelación fiscal: convergencia, sostenibilidad y reforma”, se compone de tres capítulos. Todos giran en torno a la nivelación fiscal, a nivel regional o local, aplicando diversos enfoques y metodologías diferentes en el análisis.

¿Tendrían que Separarse los Objetivos e Instrumentos de Nivelación Fiscal y de Política Regional?

Explotamos la mezcla de objetivos e instrumentos presentes en el Sistema de Financiación Autonómica en España para testar si las transferencias de nivelación tienen un impacto sobre la convergencia regional. Empleando modelos de efectos fijos y mínimos cuadrados ordinarios en dos etapas con variables instrumentales y datos para las 15 comunidades autónomas de régimen fiscal común para el periodo 2002-2008, encontramos que, tanto las transferencias de nivelación, como las transferencias de política regional, favorecen la convergencia con un efecto significativo y cóncavo, que es mayor en el caso de las transferencias de política regional. Sin embargo, el exceso/déficit de financiación causada por el solapamiento de instrumentos y objetivos del Sistema de Financiación Autonómica no muestra una relación significativa con la convergencia regional. Estos resultados apoyan la Regla de Tinbergen, ya que promover la convergencia mediante la política regional sería más coste-efectivo.

Haciéndose Verde mediante la Nivelación Fiscal Local

El éxito de los objetivos ambientales depende de la implicación de los gobiernos subnacionales. Sin embargo, estos no siempre cuentan con las capacidades o los incentivos para aplicar políticas de mitigación o adaptación climática ambiciosas. De hecho, políticas ambientales más estrictas podrían reducir la recaudación tributaria local a consecuencia de la reducción de la actividad resultante de la corrección de externalidades. Para abordar este problema, en línea con las Transferencias Fiscales Ecológicas, proponemos incorporar incentivos relacionados con los objetivos ambientales en la financiación local para compensar el coste de oportunidad a los que se enfrentan los ayuntamientos. En concreto, sugerimos “hacer verde” la nivelación fiscal usando un Índice Ambiental Local multidimensional, que podría complementarse con un componente verde de necesidades de gasto, como criterio para repartir las transferencias de nivelación. Para ilustrar esta propuesta, examinamos los efectos financieros que podría tener sobre los ayuntamientos vascos en el periodo 2016-2019. El principal resultado es que las ciudades vascas menos sostenibles podrían perder hasta el 5% de sus transferencias, mientras que los municipios pequeños y más sostenibles podrían ganar hasta un 13% de transferencias.

Coaliciones y Bloqueos en la Negociación de la Reforma del Sistema de Financiación Autonómica en España: Evidencia Narrativa desde la Teoría de Juegos

Tras décadas de reformas frecuentes, de inestabilidad, el Sistema de Financiación Autonómica en España no se ha modificado desde 2009. A pesar de los llamamientos de las regiones para afrontar cambios, el Gobierno Central no ha abierto la discusión para negociar un nuevo modelo, a pesar de que han transcurrido 10 años desde la finalización prevista de su aplicación, en 2014. En consecuencia, la inestabilidad generada por esta situación puede decirse que ha abierto paso a

coaliciones de bloqueo. ¿Por qué ha sucedido esto? Para tratar de responder a esta pregunta, seguimos una aproximación narrativa y de Teoría de Juegos. Por un lado, encontramos que se han producido cambios en los determinantes endógenos del Sistema de Financiación Autonómica, como la culminación del proceso de descentralización o el fin del escenario de información asimétrica que llevó a la formación de coaliciones de regiones, junto con el esperado fin de la aplicación de la denominada cláusula del *statu quo*. Por otro lado, determinantes exógenos, como la fragmentación política, el conflicto catalán, las reglas fiscales, o el ciclo macroeconómico, han alterado los incentivos para que una parte importante de los actores prefieran mantenerse en la situación actual a apoyar la reforma del sistema. En el análisis realizado, identificamos tres coaliciones de regiones y concluimos que una reforma integral que cambie las reglas del proceso de decisión, que deje fuera de la negociación política algunos aspectos técnicos, que compense las ganancias y pérdidas generadas por cambios aislados en el modelo, junto con el restablecimiento del eje impulsor Gobierno Central – Cataluña y la limitación de la frecuencia de las reformas, podría contribuir a superar la actual parálisis.

INTRODUCTION

1. Fiscal equalisation, core in research on Fiscal Federalism

Fiscal Federalism has become more and more popular in the last decades. The number of decentralised countries and the intensity of their fiscal and financial self-government has increased during recent decades (OECD, 2021). Multilevel governance, which is as diverse as decentralised institutional models are (Revelli and Bracco, 2020), is guided by the subsidiarity principle, inspired by Stigler (1957) and Oates (1972), which suggests that policy responsibilities should be attributed to the lowest layer of government possible. This requires from a high degree of tax decentralisation, and from an effective fiscal intergovernmental transfer framework that narrows down vertical fiscal gaps (Boadway and Keen, 1996) across government tiers, but also horizontal imbalances across jurisdictions. The main goal of fiscal equalisation schemes is to allow subnational governments (SNGs) to provide a similar level of local public goods/services, even if their fiscal capacity is very uneven, when a similar level of taxation is charged.

The arguments that justify the public sector to pursue fiscal equalisation are related to the traditional functions of government, as attributed by Musgrave in his seminal paper in 1959. In fact, fiscal equalisation systems are one of the many tools available for the public sector to carry out resource reallocation (Bucovetsky and Smart, 2006; Buettner, 2006; Smart, 2007), macroeconomic stabilization, and redistributive duties (Musgrave, 1959).

The own nature of fiscal decentralization entails differences in the net fiscal residuum (as defined by Buchanan, 1950) of citizens across jurisdictions, failing to achieve the optimal outcome that could be attained in a centralised institutional context (Boadway and Keen, 1996). This means that decentralization fails to reach horizontal equity and to treat every citizen equally (Boadway, 2001). Furthermore, unequal net fiscal benefit is a source of inefficiencies, such as mobility distortions and cross-jurisdictional externalities, which allow to support fiscal equalisation not only from an equity perspective, but also from an efficiency point of view, despite diverging views, such as those by Boadway and Tremblay (2012). In addition, for some authors, fiscal equalisation is also meant to correct vertical imbalances resulting from unevenly attributed tax and expending powers across levels of government (Castells, 1988; López-Laborda, 1991; Boadway and Tremblay, 2006). However, as the second generation of the Theory of Fiscal Federalism highlights (Oates, 2005), its aims are, not only economic, but also of political nature. Accordingly, for net contributor jurisdictions, equalisation schemes could be interpreted as part of the price they are willing to pay to be part of the federation and thus, benefit from its existence (Alesina and Spolaore, 2005; Vanschoonbeek, 2020). Hence, fiscal equalisation chases political economy goals too, such as political stability.

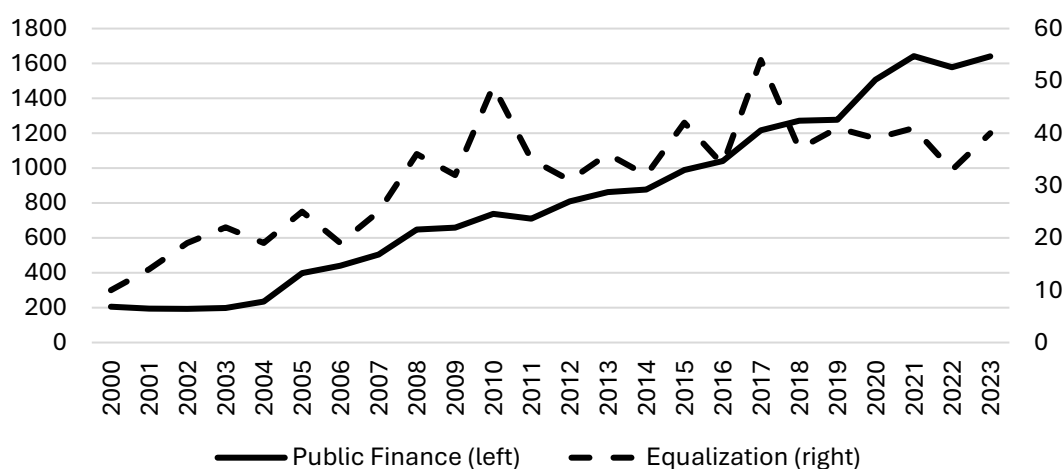
Once convenience for equalisation is examined and its goals are set through the democratic process, the next step resides in dealing with design dilemmas. Policymakers, aware of the impossibility to reach a first-best scenario, should design the most efficient second-best equalisation tool possible to pursue pre-defined equalisation goals. This entails taking decisions and negotiating whether to equalise fiscal capacities or needs, to what degree should this be done, or on which type of grants to use. These elements, among other, will determine the equalisation formula, which has a direct behavioural impact on self-interested SNG's budgetary activity (Smart, 1998; Dahlby, 2002; Dahlby and Warren, 2003; Buettner, 2006), but that could also impact SNGs decisions in other policy areas.

Finally, fiscal federalism literature has also focused on the consequences fiscal equalisation has on the economy. On the one hand, the Tiebout hypothesis, related to tax competition and interjurisdictional mobility and, on the other hand, the rate and base tax-back problems and the

flypaper effect, linked to SNG’s fiscal policy, are among the most commonly addressed effects. However, these topics exceed the scope of this dissertation.

In terms of popularity, literature on fiscal equalisation has grown during the last couple of decades in parallel to the field of public finance, to which it belongs. Although, according to the data by Web of Science, the evolution of the number of papers on equalisation published has followed a more unstable path, it has shown a more constant growth in citations. Note that when we refer to equalisation it is circumscribed to fiscal equalisation, since economic levelling of incomes or development levels is tackled not by fiscal equalisation but regional policy (Boadway and Shah, 2007), as it will be clarified in Chapter 1. Even if there are other kinds of intergovernmental transfers, we do focus on equalisation grants because they are the most sizable, controversial and difficult to address due to their complex behavioural implications, mainly on recipients.

Figure 1. Number of articles published by topic



Source: own elaboration based on data from WoS Core Collection in field of Business Economics. Equalisation also includes results for “Equalisation”.

As fiscal equalisation mechanisms are of widespread use across federations and fiscally decentralised countries, it is subject of discussion on the academia. Comprehensive research on the theoretical base of equalisation schemes can be found at Boadway and Flatters (1982), Boadway and Wildasin (1984), Usher (1995), Mieszkowski and Musgrave (1999), Boadway (2004), Martinez-Vazquez and Searle (2007) and Boadway and Shah (2007, 2009). And for a more policy-oriented practitioners’ guide on equalisation see Shah (1994, 2006), Boadway and Hobson (1998), Boadway and Shah (2007, 2009) and OECD (2021).

2. Three essays to respond three research questions on fiscal equalisation

After a deep review of the main issues surrounding fiscal equalisation, some research question emerged and gaps in the literature were identified. That led to the elaboration of this dissertation, composed of three chapters linked by their focus on the same policy tool: fiscal equalisation. In addition, the three chapters exploit the case of Spain, covering both, general regime system of regional funding (Chapters 1 and 3), and *foral* regime local funding (Chapter 2). Spain represents an interesting country case (Padovano, 2007) due to the diversity of fiscal equalisation arrangements enforced and the current consolidated stage of its fiscal federalism model, after more than four decades of evolution. The main aim of this dissertation lies in contributing to better understand fiscal equalisation tools and suggest technically and politically feasible ways to

improve their results in terms of equity, efficiency, and environmental sustainability. In addition, this thesis pursues to help building the foundations for agreement on a new reform in Spain.

In particular, Chapter 1 addresses equity and disentangles fiscal equalisation and regional policy transfers to explore the relationship between each transfer programme and regional convergence. Chapter 1 tries to respond to the question of whether Tinbergen rule should be applied in this area and each tool should follow a separate goal. For its part, Chapter 2 focuses on efficiency. It argues that current lack of internalization of cross-jurisdictional environmental externalities lowers incentives for SNGs to enforce more ambitious environmental protection policies. Next, it suggests how fiscal equalisation could become greener and contribute to correct this efficiency problem. Finally, Chapter 3 tackles the political economy of fiscal equalisation reform. Fiscal equalisation is the core of the Spanish regional funding system. After more than a decade since it was amended for the last time and since it should have been reviewed, previous instability (León, 2009; Bandrés and Cuenca, 2016; Utrilla, 2020; Bosch et al., 2022) has been replaced by blockade, in particular by coalitions blockade. Causes of both opposite contexts are dissected in order to identify what led to current paralysis.

Chapter 1: Should fiscal equalisation and regional policy goals and tools be disentangled?

As previously introduced, the aim of fiscal equalisation is not reducing regional disparities in economic development levels but ensuring that a minimum common level of quality and access to decentralised public services is guaranteed across jurisdictions despite uneven distribution of fiscal capacity and expenditure needs. In contrast, it is regional policy that targets the former goal. However, this clear distinction is not always reflected in actual policies, neither by literature (Pérez et al., 2020), that sometimes mix both tools and objectives (Spahn, 2007). While separately understanding and evaluating complex policies, such as fiscal equalisation and regional policy, is already difficult, when they are intertwined, as it is the case in Spain, makes out of this task a real challenge.

Examining the relationship between regional policy transfers and regional convergence is the objective of a broad literature stream (De la Fuente and Vives 1995; Fagerberg and Verspagen, 1996; Boldrin and Canova 2001; Cappelen et al. 2003; Rodríguez-Pose and Fratesi, 2004; Ederveen et al., 2006; Dall’erba and Le Gallo 2008; Becker et al., 2010; Becker et al., 2012; Pellegrini et al., 2013; Blöchliger et al., 2016; Kramer et al., 2019; Bisciari et al., 2020; Capella-Ramos et al., 2020; San Juan Mesonada and Sunyer, 2020). Yet, it is also relevant to analyse whether fiscal equalisation is also correlated with lower levels of regional economic disparities, since it could have a long-term effect on it through a more even public service provision, such as education or healthcare (Padovano, 2007).

Opposite to overall convergence promoting results identified for regional policy, literature has found that fiscal equalisation leads to larger cross-regional economic disparities in most cases (Padovano, 2007; Kessler and Lessmann, 2010; Blöchliger et al., 2016; Chan and Petchey; 2016; Hailemariam and Dzhumashev, 2019; Liu et al., 2022). Conclusions that are nuanced for Germany (Baskaran et al., 2016; Weddige-Haaf and Kool, 2017), which as Spain represents another example of mixed policies. However, to our knowledge, there was no case study on fiscal equalisation and convergence for Spain yet.

This first chapter exploits the mix of goals and tools of the Spanish regional funding system by feeding Random Effects and Two Stage Least Squares models with the data for 15 Spanish regions during the 2002-2018 period, covering two regional funding models (2001 and 2009). Results find that both fiscal equalisation and regional transfers show a significant concave convergence promoting effect, being that effect larger for the latter. However, the funding

excess/deficit caused by overlapping tools and objectives in the RFS does not have a significant relationship with regional convergence. Therefore, the main argument employed by some regional leaders to defend the re-ranking phenomenon would melt away. These results support the application of the Tinbergen rule, since according to them it would be more cost-effective to promote regional convergence through regional policy funds than through fiscal equalisation.

This chapter brings several contributions to the field of study of fiscal equalisation. First, it helps to clarify which transfers of the Spanish regional funding system pursue fiscal equalisation objectives and which ones are actually regional policy. Second, it covers a gap on the literature, as it is the first comprehensive study exploring the relationship between main intergovernmental transfer programmes in general, and of fiscal equalisation in particular, and regional convergence in Spain. Finally, policy recommendations that suggest the Tinbergen rule should be applied are provided.

This chapter opens the path for a future research agenda that includes exploiting the character of a region as a net recipient or net contributor as an identification strategy following San Juan Mesonada and Sunyer (2020) to design a Regression Discontinuity Design exercise, as in Pellegrini et al. (2013). In addition, comparative short-term versus long-run effects of transfers on regional convergence and looking into geographic spillover effects would be of high relevance too. Finally, because of the key role of institutional quality as a mediating factor (Kyriacou et al., 2015; Rodríguez-Pose and Garcilazo, 2015; Charron et al., 2022), it would be highly useful to develop a database with yearly figures for Quality of Government at the regional level.

Chapter 2: Going green through local fiscal equalisation

Internationally and supranationally agreed environmental targets are later translated into national level objectives. However, responsibilities required to implement the necessary policies to achieve those targets are, most of the times, local (OECD, 2020). Enforcing ambitious environmental protection policies in the field of natural landscape, biodiversity and ecosystem protection, energy consumption, water quality, waste production and management, or air quality, requires incentives and capacities for subnational governments to do so. However, under current local funding systems at which property taxes are the main own-revenue source (OECD, 2021), there is an opportunity cost of protecting the environment for local governments environment (Azzoni and Isai, 1994; Ferraro, 2002; Adams et al., 2010; Karsenty et al., 2014; Canan and Ceyhan, 2020), in terms of foregone tax revenue (Ring, 2008b; Busch, 2021). In addition to this externality issue, limited economic, human, and technical capacities also apply in the case of small municipalities.

Current local funding systems do not compensate the opportunity cost of implementing the ambitious environmental policies required to meet committed targets (Azzoni and Isai, 1994; Ferraro, 2002; Adams et al., 2010; Karsenty et al., 2014; Canan and Ceyhan, 2020). In particular, fiscal equalisation formulas neglect this element when calculating nor fiscal capacities (climate mitigation) neither expenditure needs (climate adaptation). In some countries, such as France, Portugal, Brazil, Indonesia or China, Ecological Fiscal Transfers (Ring, 2002, 2008a, 2008b; Mumbunan et al., 2012; Santos et al., 2012; Irawan and Tacconi, 2016; Busch et al., 2021) have been introduced with this aim. However, they lack the necessary scale and comprehensiveness fiscal equalisation has. In response to this issue, this second chapter develops a detailed proposal by using the case of the Basque local equalisation system.

The first contribution of the chapter is the design of a Local Sustainability Index that measures local performance in environmental protection and climate mitigation in seven fields: water, air quality, energy, transport and mobility, touristic pressure, soil use and waste; and thus, serves as

a proxy of the potential tax base loss associated to policy interventions. By way of illustration, this index is computed for the period 2016-2019 for all 251 Basque municipalities, by applying both Ordinary Least Squares and Principal Component Analysis. The second contribution is a detailed proposal on how to implement green fiscal equalisation, in this case in the Basque Country. As suggested, this new green component of fiscal equalisation would alter the 5% of currently paid transfers to Basque municipalities, similar to the Portuguese case (Santos et al., 2012). This first element is complemented by introducing an expenditure needs component linked with a climate adaptation based on the Basque Local Climate Change Vulnerability and Risk Index. This would result into a comprehensive tool that would covers both mitigation and adaptation policy areas and fiscal capacity and needs components of fiscal equalisation.

Results range from up to 5% loses in per capita received transfers in less sustainable municipalities, to up to 13% wins in per capita allocations in most sustainable and small municipalities. The outcome would be not only more efficient because of the internalization of current environmental externalities, but also more equitable due to a more accurate measurement of both fiscal capacity and expenditure needs. At the same time, it would foster the implementation of the measures required to comply with the committed green agenda.

Among the limitations for research in this field, there is the lack of reliable granular environmental data, this is at the local level and for a broad range of variables and periods. Therefore, further research could contribute to develop that data in order to extend the analysis for a larger set of jurisdictions and for a more extensive timeframe. In addition, once equalisation schemes start applying this approach in the future, the behavioural change caused by this policy could be evaluated, for instance by calculating elasticities and carrying out not only static, but also dynamic simulations.

Chapter 3: Coalitions and Blockades in the Negotiation of the Spanish Regional Funding System Reform: Narrative Evidence from Game Theory

The last chapter of this dissertation touches a topic that is transverse to both previous chapters: how to gather the necessary political agreement to pass a new reform of the regional funding system. During the last decades, since democracy was restored in Spain, institutions have gone through a quite fast and deep decentralisation process. This context, together with large vertical imbalance that generated large transfer dependence of regions from the central government and horizontal inequalities in terms of funding, led to immediate regional demands for reform, and thus, to almost constant revisions of the funding framework instability (León, 2009; Bandrés and Cuenca, 2016; Utrilla, 2020; Bosch et al., 2022). Indeed, most models lasted around five years.

In contrast to previous instability, since the last reform was approved in 2009 there have been virtually no moves towards introducing new changes in the regional funding model. This chapter follows a narrative approach to identify two types of drives of this blockade: endogenous and exogenous. On the one hand, there have been changes in drivers endogenous to the RFS, such as the conclusion of the decentralisation process and asymmetric information (that led to coalitions formation), together with the expected end of the status quo clause. On the other hand, exogenous drivers, such as political fragmentation, the Catalan conflict, fiscal rules, and macroeconomic cycle have altered incentives for actors not to move. As a consequence of all these causes, the Central Government has not yet opened discussions to address the reform of the system, that should have taken place in 2014.

The first contribution of this chapter lies in its use of game-theoretical chain store model (Selten, 1978), to explain the past and present dynamics of negotiations of regional funding system in Spain, completing and updating research by Leon (2009). Following this methodology, self-interested positions (for/against) of non-benevolent institutions across the following axis are

defined: end of status quo, less redistribution, more weight of provision cost variables other than population in the spending needs formula, more tax autonomy, more tax harmonization, the end of extraordinary funds, debt relief, and political alignment with Central Government. This combination of narrative approach and game theory allows to identify three separated regional coalitions of shared interests. First, a group of pro-status quo rural and small regions known as “Zaragoza Declaration” signatories. Second, the so-called Mediterranean coalition of young regions. And finally, the coalition of the “Castillas”, aged and large regions.

The second contribution of this last chapter lies in the elaboration of policy recommendations that could increase the political feasibility of a reform. Indeed, in the view of the lack of many overlaps between coalitions interests and positions, it is difficult to imagine marginal reforms. In contrast, a comprehensive reform that compensates wins and losses from isolated changes is suggested. In addition, consolidation of extraordinary funds, debt relief, rebuilding the Central Government-Catalonia coalition, and changing the institutional rules of the process, in particular those of the Fiscal and Financial Policy Commission, represent feasible alternatives to make a reform more likely.

Further research could complement the narrative and game theory approach applied with new qualitative evidence from interviews to the actors involved and explore a comparative approach of the dynamics of RFS negotiations in other federal and decentralised countries.

In sum, this dissertation, structured in three chapters, explores the diverse edges of Spanish regional funding system and Basque local funding systems in order to respond to questions related to territorial fiscal equalisation. The research findings presented in the three chapters of this thesis offer contributions to the literature on the equity, efficiency, environmental sustainability and reform of fiscal equalisation mechanisms. However, it is important to clarify that, despite using these cases to illustrate the discussion, the analysis and extracted takeouts are common, and thus useful, to other fiscal equalisation models at the international level too.

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CHAPTER 1

SHOULD FISCAL EQUALISATION AND REGIONAL POLICY GOALS AND TOOLS BE DISENTANGLED?

1. Introduction

Should regional and fiscal equalisation policy objectives and instruments converge or be kept separate? Traditionally, the literature has recommended applying the “one tool for each goal” approach (Spahn, 2007), in line with the Tinbergen rule (Tinbergen, 1952). According to this view, while regional policy should aim to promote economic development convergence, fiscal equalisation should pursue that all subnational governments (SNGs) can provide a similar level of public services, despite uneven fiscal capacity and expenditure needs. In addition, regional policy has traditionally targeted territories, while fiscal equalisation targeted people through territories. Earmarked transfers are the most common tool for regional policy. Funding is received by SNGs in order to execute previously qualified projects, guaranteeing that jurisdictions will receive more or less funding depending on their development level. In most cases, payments take the form of capital grants, since public investment is widely accepted as growth-enhancing, as opposed to current expenditure (Hailemariam and Dzhumashev, 2019). However, a redefinition of regional policy towards place-based people strategies, such as those described by Neumark and Simpson (2014), could alter this pattern. In contrast, fiscal equalisation transfers are usually embodied by non-earmarked grants. This means that whether they will become current or capital expenditure is under the SNG’s discretion.

Calls for separate tools to pursue different goals do not neglect the fact that fiscal equalisation transfers can impact regional convergence. In fact, intuitively, as Padovano (2007) suggests for the Canadian and Spanish systems, we could expect less unequal provision of healthcare and education brought by fiscal equalisation to affect cross-regional income disparities in the long term. Similarly, from a dynamic perspective, a successful regional policy could also alter the fiscal capacities to be equalised.

However, practice is not always as clear as theory, as in decentralised countries both equalisation and regional policy tools are often so intertwined that they become difficult to distinguish (Spahn, 2007). As an example, German and Spanish Regional Funding Systems (RFSs) include both fiscal equalisation and regional policy transfers. Although, apparently, both countries explicitly set the objectives for each tool in the system and keep them separate, looking at the details reveals that this is not true for the Spanish case. Indeed, fiscal equalisation transfers paid by the Spanish RFS do include elements of regional policy too. Because of the existence of several funds in the RFS transfer scheme, and the *status quo* rule (which guarantees that no region is worse off after each reform of the funding system), regions with lower pre-transfer fiscal capacity end up having a higher post-transfer funding capacity. This phenomenon is known as the “re-ranking effect” (Figure 2) and implies the existence of a funding excess for some regions and funding deficit for others. To the extent that some of the least developed regions are among the most benefited by re-ranking, these additional resources could *de facto* operate as an instrument of regional convergence. This is also how some regional leaders frame this issue to defend re-ranking.

This mixture of policy goals and instruments makes the Spanish case an appropriate case for study. The aim of this paper, and its main contribution, is to determine whether the Spanish RFS scheme of transfers is associated with a regional convergence-promoting effect and, if so, to disentangle whether this effect is caused by fiscal equalisation transfers, in line with Kaufman et al.’s (2003) suggestion for Canada, or rather originates in regional development transfers embedded in the RFS, as Weddige-Haaf and Kool (2017) suggest for Germany. As far as we know, this is a topic that has not yet been addressed in the literature for the Spanish case. We conclude that RFS transfers do indeed seem to have a convergence-promoting effect, and that this is due to

fiscal equalisation and not to the regional policy tools disguised in the system, such as over-funding caused by the re-ranking phenomenon. Still, the size of the effect is larger for explicit regional policy tools than for fiscal equalisation. Therefore, if the public sector is willing to promote regional convergence, it is more cost-effective to do so through explicit regional policy instead of through fiscal equalisation. Consequently, in line with Tinbergen's rule, we believe it is more appropriate to use a specific tool to achieve each of the two targets. Furthermore, separating equalisation and regional convergence grants is also advisable for reasons of simplicity and transparency, a key element in improving citizens' perception of inter-territorial redistribution.

The rest of the paper is structured as follows. Section 2 reviews the previous literature. Section 3 provides a framework to disentangle fiscal equalisation and regional policy tools when their genuine nature is unclear. We do so by coining the term “over-funding”. Section 4 then presents our methodology and data. We identify four iterations of our model, with several robustness checks (Annex B) to ensure the results hold. Section 5 is devoted to reporting and discussing the results, in conversation with the previous literature. Finally, Section 6 concludes by reflecting on the implications of our results for the “one tool for each goal” debate and the broader question of whether evolution or Copernican revolution is required to design the future of fiscal equalisation and regional policy.

2. Policy tools and regional convergence. What does the literature suggest?

2.1 Regional policy and convergence

Recent research shows that although cross-country economic disparities in the European Union (EU) have decreased, within countries regional disparities have grown. Indeed, while economic integration (monetary union, common market and globalisation) might have contributed to decreasing cross-country differences, they could have also helped foster within-country divergences due to the “capital effect” (through agglomeration benefits, non-physical input such as foreign direct investment, human capital, accessibility or institutional quality) (Blöchliger et al., 2016; Kramer et al., 2019; Bisciari et al., 2020).

The regional convergence literature has been particularly prolific during the last decades in the context of the European Regional Policy (ERP) cost-benefit analysis (e.g. Rodríguez-Pose and Fratesi, 2004; Ederveen et al., 2006; Becker et al., 2010). However, their conclusions are very dependent on the assumptions, model specification, data used or period chosen. In fact, while some report positive and significant coefficients on economic convergence (De la Fuente and Vives 1995; Cappelen et al. 2003, Pellegrini et al., 2013; Capella-Ramos et al., 2020), others find a concave relation (Becker et al., 2012), and some do not find any significant impact or find evidence supporting just the opposite (Fagerberg and Verspagen, 1996; Boldrin and Canova 2001; Dall'erba and Le Gallo 2008).

The main outcomes of this research stream suggest that while regional policy programmes could have corrected part of the market outcome, the business cycle is still the largest determinant of regional convergence-divergence dynamics (Kramer et al., 2019). In fact, data for the EU (Kramer et al., 2019; Bisciari et al., 2020), the Organisation for Economic Cooperation and Development OECD (Blöchliger, 2016), and Spain (Figure 3) show that while economic growth reduces the regional gap, crisis widens it. Furthermore, the ability of the ERP to contribute to regional growth and thus close the gap could be mediated by the business cycle, through employment indicator

differentials, as found by San Juan Mesonada and Sunyer (2020) for Spanish regions during the 2000-06 and 2007-13 Multiannual Programming Periods. In addition, they argue that the impact of funds decreases together with an increase in regions' public leverage levels, which they suggest could be caused by difficulties related to the execution of funds. They also identify the existence of spillover effects between adjacent regions.

Finally, institutional interactions with regional policy have also received attention. Rodríguez-Pose and Garcilazo (2015) used regional quality of government (QoG) survey data (Charron et al., 2022) in order to apply fixed effects and generalised method of moments (GMM) models to measure the impact of ERP across the 1996-2007 period. They conclude that institutional quality has a determinant effect on the size of that effect, particularly for regions receiving more than €80 per capita yearly. Furthermore, results suggest that after reaching the threshold of €120 per capita yearly, the most efficient way to improve the effectiveness of funds is by improving government quality and not by increasing the size of transfers.

2.2 Fiscal federalism and regional convergence

The Fiscal Federalism literature has also explored the issue of regional convergence. Specifically, it has tested the hypothesis that fiscal decentralisation, from both the expenditure and revenue sides, has an impact on economic territorial differences. Martínez-Vázquez et al. (2017) survey a relevant selection of the literature on the topic, concluding that most studies for OECD member countries show a correlation between decentralisation and regional convergence (Lessmann, 2009; Kyriacou et al., 2015), although the relationship appears to be mediated by the level of economic development (Lessmann, 2012) or the quality of governance (Kyriacou et al., 2015), as is also explained for regional policy.

In contrast, Rodríguez-Pose and Ezcurra (2010) do not find this relationship between decentralisation and regional convergence to be significant, but only contingent on pre-existing level of territorial inequalities, initial level of income and fiscal redistributive capacity of the countries in the sample, as Liu et al. (2022) and Ong et al. (2023) also find for the impact of grants in China. Also opposed to the general conclusions drawn from the above survey, Blöchliger et al. (2016) explain that expenditure decentralisation is associated with larger regional disparities because peripheral regions cannot offer capital agglomeration benefits, and thus lack the capacity to catch up on their own. This negative effect was also found by Lessmann (2012), but only for developing countries. Blöchliger et al. (2016) argue that the divergence-promoting effect would only be compensated by tax autonomy and balanced decentralisation, which are associated with lower disparities due to the incentive they provide for growth-oriented policies and budgetary efficiency. For its part, Sorens (2014) finds that instead of tax autonomy, regional economic self-rule promotes convergence while exploiting spatial diffusion of growth.

Importantly, Martínez-Vázquez et al. (2017) raise awareness of the main obstacle to research on the issue: endogeneity (reverse causality). Nonetheless, researchers have used a wide range of econometric techniques to address this issue. On the one hand, Rodríguez-Pose and Ezcurra (2010) uses lags of decentralisation degree as an instrumental variable (IV), and similarly, Lessmann (2012) employs colonial origin and composition of society as an IV, also considered by Kyriacou et al. (2015) a proxy for institutional quality. On the other hand, this last tackles endogeneity by utilising two-stage feasible generalised least squares (FGLS) while exploiting the cross-country dimension of the data by using GMM.

Fortunately, scholars have also paid attention to the role of intergovernmental transfers in regional income differentials, a research stream to which this paper will attempt to contribute to by elaborating on the transfer classification. Contrary to the overall convergence-promoting results presented for regional policy, the literature has found in most cases that fiscal equalisation leads to larger cross-regional economic disparities (Padovano, 2007). The causality channels explaining this negative link range from distorted public spending budgetary decisions (Blöchliger et al., 2016, for the OECD; Chan and Petchey, 2016, for Australian full equalisation; Hailemariam and Dzhumashev, 2019, for Canadian partial equalisation; Liu et al., 2022, for grants in China), to reduced migration (Kessler and Lessmann, 2010). However, Kaufman et al. (2003) contradict this by confining the effect to the (Canadian) federal employment insurance scheme instead, while finding that fiscal equalisation generates a convergence-promoting impact.

Besides, there is some evidence for the German federation, whose RFS, like Spain's, mixes pure fiscal equalisation and regional development transfers. Baskaran et al. (2016) find that intergovernmental transfers are irrelevant or even harmful for economic growth since a large share of them is devoted to subsidising declining industries, which would hamper structural change and spoil long-term growth. Weddige-Haaf and Kool (2017) find that while horizontal tax equalisation would be ineffective in promoting regional growth and convergence, federal supplementary grants would have a positive effect on closing the gap between receiving and non-receiving German *Länder*. Furthermore, they find that Federal regional policies have a larger impact than European when it comes to closing the regional gap between *Länder*.

Finally, despite Gil-Serrate et al.'s (2011) extensive research on the relationship between tax autonomy levels and regional growth for Spain, to our knowledge there is still no case study on decentralisation and convergence or the role of intergovernmental transfers. Indeed, Padovano (2007) calls for further research on country-specific fiscal institutions, and particularly points towards Spain (and Canada) when warning that even if their fiscal equalisation schemes are meant to tackle budgetary availability across SNGs, they also affect regional incomes, which makes them interesting cases to look at. Aiming to cover this research gap, and following Padovano's suggestion and Sorens' (2014) calls for focusing on the specific nature, redistributive power and equalisation degree of transfer systems, this paper will explore the relationship between regional convergence and different types of intergovernmental transfers (as in Capella-Ramos et al., 2020, for EU funds), mainly fiscal equalisation and regional development transfers.

3. The Spanish Regional Funding System: when fiscal equalisation becomes regional policy

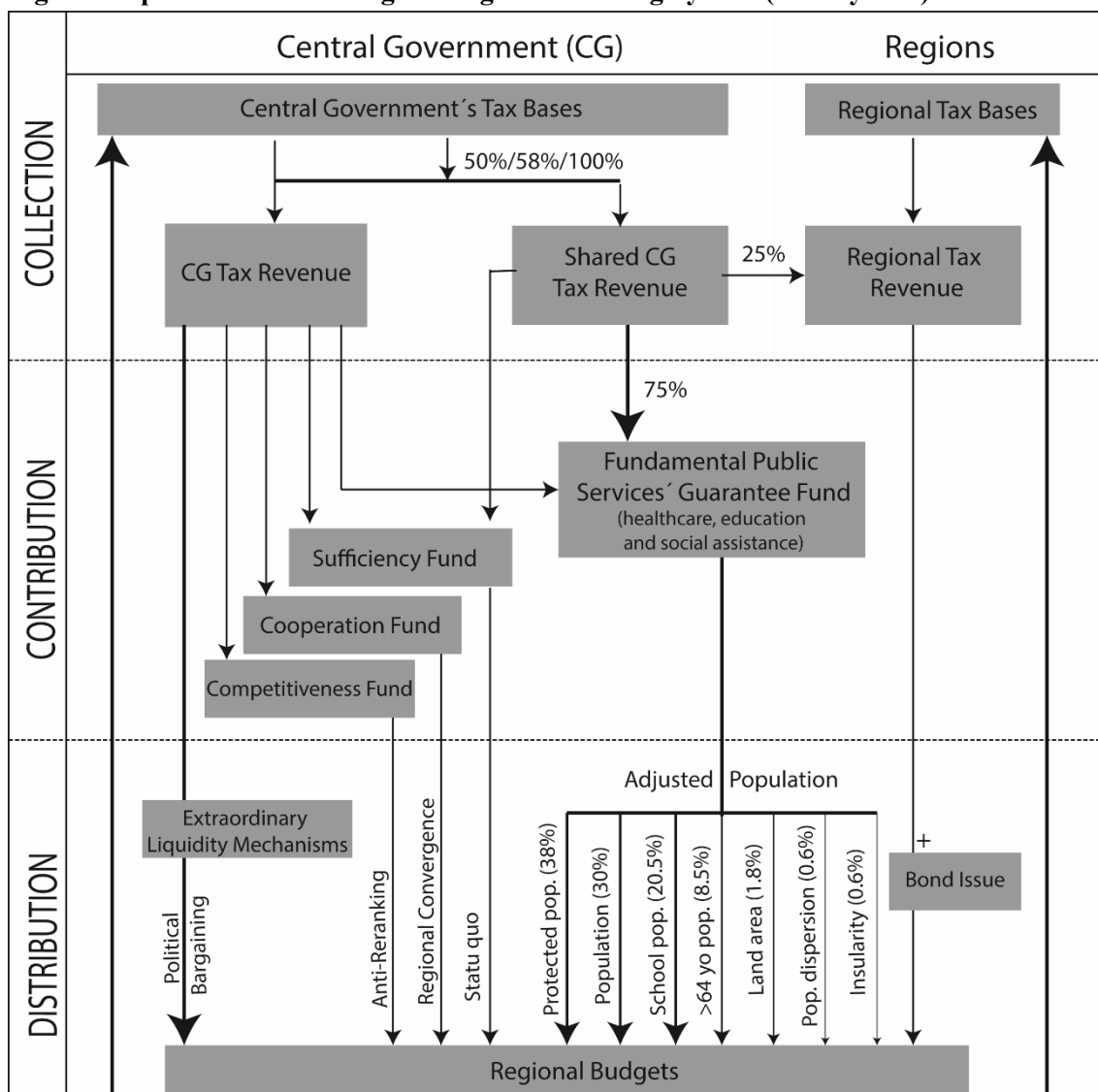
The Spanish Constitution provides a clear framework to differentiate fiscal equalisation and regional policy objectives and tools. On the one hand, art. 158.1 regulates a transfer to guarantee that all regions can provide, at least, a minimum level of "fundamental public services": healthcare, education and social care. On the other hand, art. 158.2. establishes the Interterritorial Compensation Fund (ICF), devoted to fostering public investment, with the objective of "correcting economic imbalances across regions". However, the fact is that fiscal equalisation and regional policy funds appear intertwined in the Common Regime RFS (i.e., excluding Navarra and the Basque Country, which are governed by a special "foral" fiscal regime). As shown by Figure 1¹, in the RFS in force since 2009, intergovernmental transfers are carried out through four

¹ For a discussion of the Spanish RFS, see López-Laborda et al. (2023).

funds, which are financed by contributions from the tax revenue of both regions and the central government, and which are distributed by means of different needs-based criteria. The first, the Fundamental Public Service Guarantee Fund (FGSPF), is defined with a clear focus on fiscal equalisation. The second, the Global Sufficiency Fund, is intended to ensure that no region is worse off after a reform of the RFS (*status quo* clause). Finally, two funds are wrongly named after Convergence Funds. On the one hand, the Cooperation Fund actually represents a regional policy tool. This is similar to the special-need supplementary federal grants for eastern and small less-developed *Länder* granted by the German RFS, and substituted in 2020 after the SolidarPakt II expired (Scheller, 2017). On the other hand, the Competitiveness Fund aims to alleviate cross-regional differences in per adjusted population² funding generated by the rest of the funds. Although simpler than the current one, the RFS applied before 2009 was also characterised by a certain confusion between objectives and instruments. Expenditure needs were calculated separately for three groups of services (health, social services and the rest) and there was a single equalisation transfer, called the Sufficiency Fund. But this model also introduced elements related to regional policy and applied the *status quo* clause.

² The “adjusted population” expenditure needs measure used by the Spanish RFS corrects the number of inhabitants in each region by a cost intensity index based on age brackets and geographical variables (Figure 1 Distribution).

Figure 1. Spanish Common Regime Regional Funding System (2009 system)



Source: by the authors.

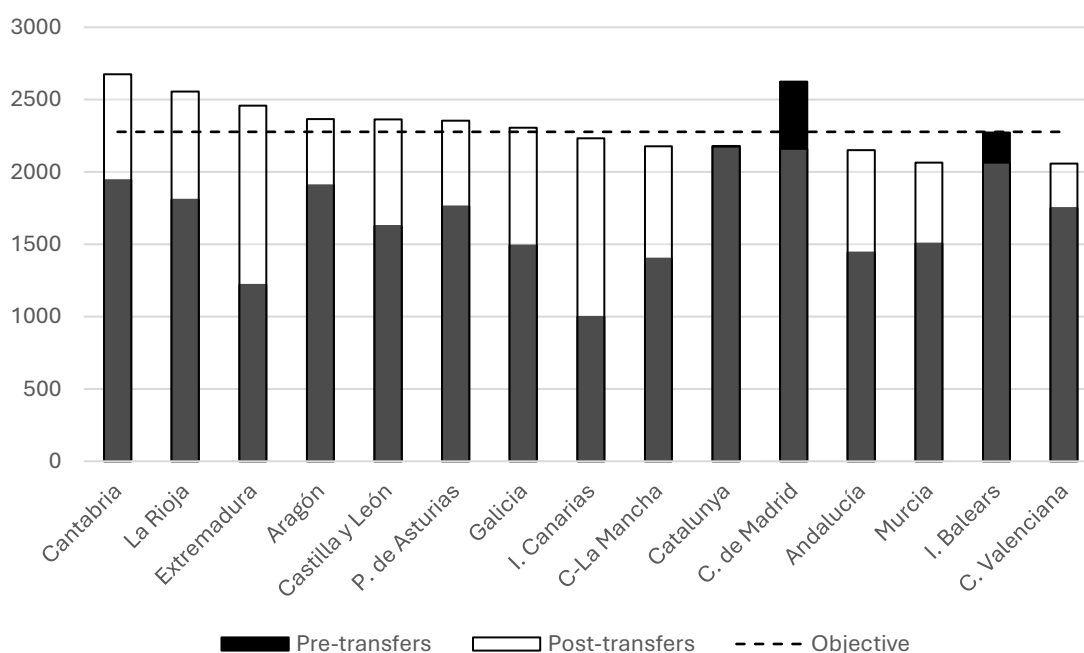
In contrast to explicit regional policy transfers (the domestic ICF and EU regional funds), which are earmarked for public investment, all RFS grants are unconditional grants, meaning that regional governments can choose the policy area in which they are spent and whether they are devoted to fund current or capital expenditure. However, on average, capital spending only represents around 10% of regional budgets for the analysed period.³

Because of the application of the various funds and, above all, of the *statu quo* rule (see Figure 1 Distribution), regions with higher pre-transfer revenue-raising capacity per adjusted population end up with lower funding capacity than some regions with lower revenue-raising capacity after all transfers are distributed (Figure 2). If it is assumed, as in some of the literature, that the adjusted population is a good indicator of the regions' overall spending needs, this re-ranking would imply

³ The design of the RFS is negotiated between the central and regional governments. However, Central Government is responsible for managing both the RFS and allocations of the ICF through a yearly national budget. Allocations of the RFS are paid in monthly instalments. Two years later ($t+2$), only after national tax revenue accounts are settled, regions might receive (pay back) an extra transfer if collected revenue in t was higher (lower) than initially expected.

over-funding for some regions and under-funding for others. To the extent that some of the least developed regions are among the most benefited by over-funding (and some of the most developed are among the most disadvantaged), these additional resources could operate as a de facto instrument of regional convergence. This is also the main argument used by some regional leaders to defend maintenance of re-ranking. Even if the Convergence Funds explained above would not be part of the RFS, the re-ranking phenomenon alone would be enough of an argument to support the existence of a regional policy content in the RFS. In this paper we define over- or under-funding for a region as the difference, positive or negative, between the region's total funding capacity (after transfers from the RFS) per adjusted inhabitant and the average funding capacity per adjusted inhabitant of all regions. Thus, we assume that the Spanish RFS is pursuing (as the German RFS also does) a quasi-full equalisation objective, in contrast to partial equalisation alternatives, such as the Canadian or Swiss, or a full equalisation system, such as the Australian.

Figure 2. (Pre-transfer) Fiscal Capacity Index versus (Post-transfer) Spending Capacity Index (2002-18 average) (€ per adjusted inhabitant)



Source: by the authors.

4. Methodology and data

4.1. Methodological framework

We test how transfers paid by the Spanish RFS affect regional convergence. To this end, we have chosen the squares deviation towards the weighted mean of GDP per capita ($dev(GDPpc)$) as the dependent variable. The literature makes use of alternative regional convergence measurement options such as the coefficient of variation (CoV), Gini or Theil indexes (Monfort, 2008), which are useful for cross-country analysis. However, they cannot be used in case studies as ours, since they do not allow for cross-observation variation. Therefore, $dev(GDPpc)$ is the feasible option closest to the CoV most used in previous literature (Ezcurra and Rodriguez-Pose, 2014; Kyriacou

and Roca-Sagalés, 2014; Kyriacou et al. 2015; Sacchi and Salotti, 2014; Tirado et al. 2016). The dependent variable is defined as follows:

$$dev(\overline{GDPpc})_{it} = GDPpc_{it} - \overline{GDPpc}_t$$

where i identifies a region and t a year.

We successively present three different propositions linked to three econometric models, using as the main objective independent variables those described in the following equations –in their quadratic form to capture non-linear effects (Becker et al., 2012)-. The principal difference between the three models is how the main independent variable is defined. In other words, which intergovernmental transfers are considered and how transfers are classified, following Padovano’s (2007) and Soren’s (2014) calls for further research according to the nature of the grants.

Proposition 1: More generous RFS transfers are correlated with smaller regional divergences.

$$[dev(\overline{GDPpc})]^2 = \beta_0 + \beta_1 transferadjpop + \beta X + e \quad (1)$$

In Model 1, *transferadjpop* is defined as all intergovernmental transfers per adjusted population received by Spanish regions within the framework of the RFS. It is not clear what the sign between the aggregate RFS transfers and regional convergence should be, as there might be channels working in opposite directions. On the one, decentralisation could widen regional economic divergences through lower centralised redistribution if compared with the centralised solution. On the other hand, it could reduce them through higher growth induced by a more efficient public intervention, due to a better match between local preferences and needs and policies, or Tiebout-kind migration. Transfers should hinder both effects by restoring some degree of centralised redistribution and limiting the mentioned efficiency gains. Nevertheless, if properly designed, it could also be efficiency-improving due to externality correction, such as interregional spillovers or limits to congestion. In addition, while most of the transfers in the RFS respond to equalisation objectives, a small part is associated with regional policy objectives, which may also favour convergence.

Proposition 2: Vertical transfers generate a larger impact on regional convergence than horizontal grants.

$$[dev(\overline{GDPpc})]^2 = \beta_0 + \beta_1 horizontal + \beta_2 vertical + \beta X + e \quad (2)$$

In Model 2, we separate RFS transfers depending on their vertical or horizontal nature, following Padovano’s (2007) and Soren’s (2014) suggestion for looking at the specific nature of transfers. *Vertical* transfers consist of the share of FGSPF and Sufficiency Fund⁴ transfers funded by the central government, in addition to the rest of transfers of the RFS (Cooperation Fund, Competitiveness Fund, and other small adjustments such as Healthcare Guarantees, and Compensation for Bilingual Regions), as all are paid by the central government. *Horizontal* transfers include the rest of the RFS grants. Our hypothesis is that vertical transfers should generate a larger effect of closing regional divergences, as RFS transfers that pursue regional policy objectives are of a purely vertical nature. This would be consistent with Weddige-Haaf and Kool’s (2017) findings for regional growth in Germany. Yet, as both vertical and horizontal

⁴ Figures for the Sufficiency Fund are adjusted to reflect homogeneous competencies, that is, excluding the specific competencies of some regions, such as their own police force or regional language.

transfers contribute to determine funding excess, horizontal transfers could also have some impact, even if more limited.

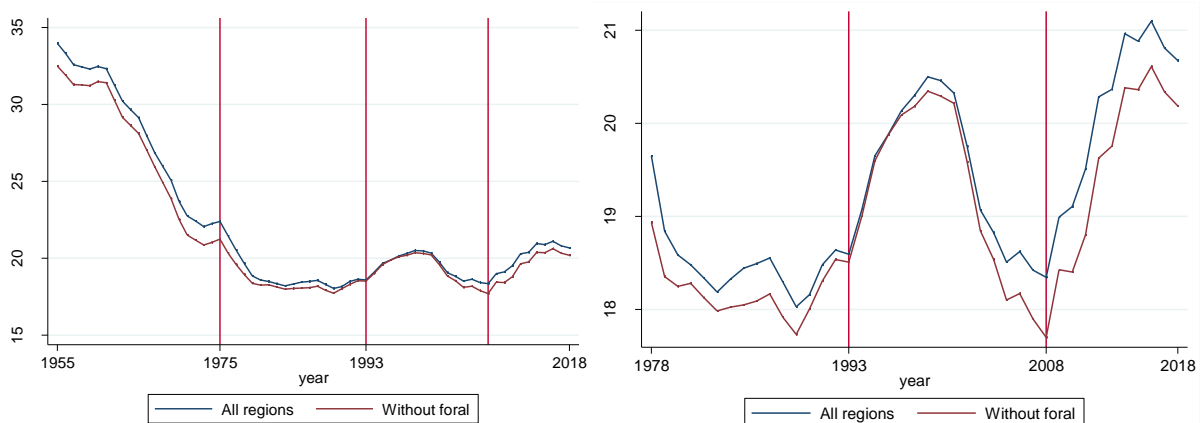
Proposition 3: Genuine fiscal equalisation transfers should not be related with regional disparities, not at least to the same extent as funding excess and pure regional policy.

$$[dev(\overline{GDPPc})]^2 = \beta_0 + \beta_1 \text{genuineeqtransfer} + \beta_2 \text{fexcess} + \beta_3 \text{regpolpc} + \beta X + e \quad (3)$$

In order to focus on the relationship between fiscal equalisation and regional convergence, in Model 3 we separate the different types of transfers embedded in the RFS. This model includes the transfer classification that sets a strict definition of equalisation transfers according to their real objective, disregarding how they are denominated by the Spanish RFS. Independent variables in Model 3 are defined as follows: *genuineeqtransfer* are genuine fiscal equalisation transfers per adjusted population; *fexcess* represents funding excess per adjusted population, and reflects the distance of a region's funding from the average regional funding capacity per adjusted inhabitants; and *regpolpc* is the sum of regional policy executed in each region -at the national level: ICF; or at the EU level: European Regional Development Fund (ERDF), Cohesion Fund, European Agricultural Fund for Rural Development (EAFRD)/European Agricultural Guidance and Guarantee Fund (EAGGF) and European Social Fund (ESF)- which has not been considered up to this point. Again, our initial hypothesis in Proposition 3 is based on Weddige-Haaf and Kool (2017) results. We expect to find no correlation between genuine equalisation grants and regional convergence, as the aim of these transfers is to ensure a common minimum level of regional fundamental public services is provided. Alternatively, we believe that funding excess and regional policy should be strongly linked to regional convergences as their main goal is to address them.

In addition, the variable vector represented by **X** includes some of the control variables most commonly found in the previous literature. As explained above, economic growth has traditionally been seen as one of the determinant variables explaining regional economic divergences. Figure 3 suggests that this could also be true for this case. Both in 1993 and 2008 recession episodes coincided with increases in CoV of GDP per capita. Inversely, the long economic growth period of the early 2000s overlaps with a reduction on this variable. Indeed, Gil-Serrate et al. (2011) recognised that the fact of using that period of strong growth could have biased their results. We try to solve that issue by extending the period covered by our panel thanks to better data availability.

Figure 3. Evolution of regional divergences (coefficient of variation - CoV) in Spain (concentrating on the democratic period)



Source: by the authors.

Following the previous literature's findings on the relevance of institutional factors on regional convergence (Kyriacou et al., 2015; Rodríguez-Pose and Garcilazo, 2015), we add controls for regional (NUTS-2) QoG using Charron et al.'s (2022) QoG EU Regional dataset. While figures for this indicator were only available for 2010, 2013, 2017 and 2021, the literature acknowledges that variations across time are relatively stable. Therefore, data have been extrapolated backwards for the missing years. In addition, we add another institutional control -regional degree of tax autonomy- as in Blöchliger et al. (2016). On top of that, we control for the share of the adult population (over 25-64 years old) with a tertiary education (Active Population Survey (EPA) from the Spanish National Statistics Office (INE) and agricultural gross value added (GVA) shares from the Fundación de Estudios de Economía Aplicada (FEDEA), following the seminal paper on regional development and culture by Tabellini (2010). Finally, population size, unemployment rate (EPA from the INE) and degree of tax autonomy are also included as controls.

One of the main issues highlighted in the previous literature, and which is commonplace in economics, is the presence of endogeneity (Kessler and Lessmann, 2010; Rodríguez-Pose and Ezcurra, 2010; Lessmann, 2012; Kyriacou et al., 2015; Blöchliger et al., 2016; Martínez-Vázquez et al., 2017). Indeed, researchers have long discussed whether equalisation transfers determine regional economic divergences or if, on the contrary, regional economic divergences determine how transfer schemes are designed and funds distributed. Although both hypotheses are feasible, Beramendi (2007) is among the few to argue for the predominance of the latter, since he believes it is pre-existing patterns of inequality that determine the design of intergovernmental fiscal arrangements, and through them, distributive effects of decentralisation. In contrast, most authors follow the former approach and consider that decentralisation schemes primarily respond to political factors (Knight, 2002, for the United States; Gil-Serrate et al., 2011 for Spain; and Baskaran et al., 2016 for the German equalisation system). Blöchliger et al. (2016) tests this causality direction and confirms that it is the intergovernmental fiscal framework that affects convergence, and not the other way around.

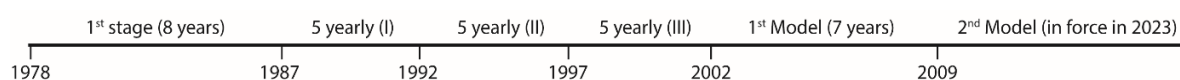
Although the above conclusion suggests that no treatment is needed, we follow the most widespread approach in this literature to address potential reverse causality, that is, the use of two-year lagged IV as in Rodríguez-Pose and Ezcurra (2010) –three-year lagged for equalisation transfers (Kessler and Lessman, 2010), due to a more indirect or long-term relationship. As explained in more detail in Annex B, Ordinary Least Squares (OLS) and Random Effects (RE) methodologies are applied for the estimations and a series of robustness checks are conducted, following Baskaran et al. (2016). Following the abovementioned literature, our preferred estimation is the two-stage least squares estimation with instrumental variables (2SLS-IV). Therefore, these estimates are at the centre of the results discussion in section 5.

4.2 Data

Estimates carried out here are based on a balanced panel-structure database that includes macroeconomic regional data from RegData by FEDEA and the INE. Additionally, fiscal budgetary data for SNGs were obtained from FEDEA, the Spanish Treasury's Spanish Public Sector Economics Database (BADESPE), complemented with RFS settlement report data and the General Controller of the Central Administration's (IGAE) budgetary execution data, as in San Juan Mesonada and Sunyer (2020). Finally, historic ERP payments were obtained from the European Commission's Cohesion Data website.

With regard to the observations considered in the analysis, our database includes data for 15 out of the 17 Spanish Autonomous Regions (and two Autonomous Cities). We have excluded both autonomous cities of Ceuta and Melilla due to their nature as outliers in most of the variables used, as well as the “foral” regions of the Basque Country and Navarra. The panel data covers the 2002-18 period, since RFS data became available for the most recent settlement in the system. As shown in Figure 4, this temporal context coincides with the first (2002) and second (2009) fully comprehensive RFS. This means that our balanced panel has 255 observations.

Figure 4. Evolution of the Spanish Regional Funding System



Source: by the authors.

5. Results

5.1. Regional Funding System transfers and regional convergence

According to our results for Model 1 (Table 1), Proposition 1 is confirmed. Intergovernmental transfers distributed by the Spanish RFS, whatever their goal, are related, *ceteris paribus*, to a decrease, on average, in regional economic divergences, as an increase of €1 per adjusted population in the amount of transfers paid is correlated with a decrease of up to 0.02 points in regional divergence (0-100 index), according to OLS and 2SLS estimates (Table 1, columns 2-4). Although the results on the size of the effect differ across iterations of the model, the sign and significance of the variable are consistent overall. The estimates remain robust to the introduction of control and IVs, as well as year dummies, which are significant only up to 2008 (when the system changed, and the economic recession started).

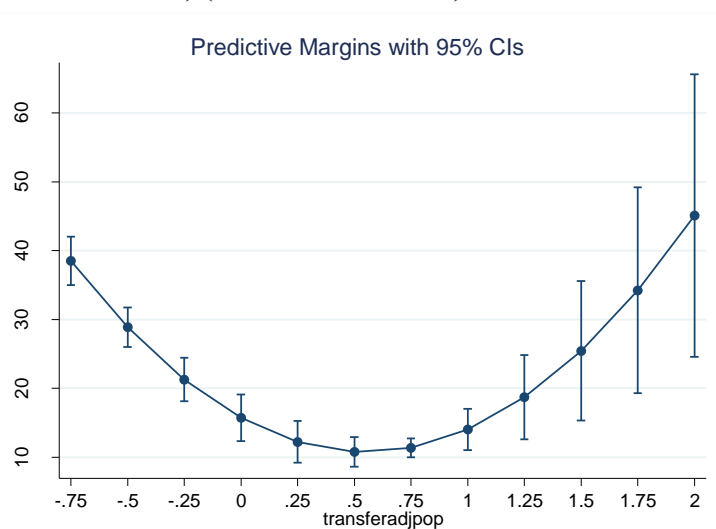
Table 1. Estimates for Model 1. Transfers of the Spanish Regional Funding System

[dev(GDPpc)] ² (0-100)	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS-IV	RE	RE-IV
transferadjpop (k€)	-4.859 (7.171)	-16.95*** (5.193)	-17.52*** (1.798)	-18.10*** (1.406)	-6.272*** (1.625)	-4.067** (1.716)
transferadjpop ² (k€)		15.12*** (4.133)	16.72*** (1.788)	16.39*** (3.156)	7.919*** (1.288)	6.297*** (1.598)
growth (%)			0.721 (0.427)	0.758* (0.418)	-0.192 (0.202)	0.0174 (0.151)
QoG			0.248** (0.105)	0.206** (0.0813)	0.0640 (0.0623)	0.0292 (0.0271)
taxaut (%)			0.320*** (0.0567)	0.295*** (0.0799)	0.145*** (0.0417)	0.117*** (0.0378)
edusup (%)			0.653*** (0.160)	0.648*** (0.178)	0.294 (0.200)	0.364*** (0.106)
agrisharegva (%)			1.613*** (0.249)	1.739*** (0.227)	0.460* (0.259)	0.250 (0.189)
unemplrate (%)			1.196*** (0.170)	1.172*** (0.258)	0.657*** (0.126)	0.452*** (0.0805)
pop (u)			9.41e-07*** (2.72e-07)	8.81e-07*** (2.55e-07)	1.60e-06*** (6.14e-07)	1.57e-06*** (3.37e-07)
Constant	18.51*** (4.360)	18.86*** (3.358)	-58.30*** (9.820)	-58.10*** (8.878)	-16.79** (7.612)	-16.00** (6.280)
Year dummies	YES	YES	YES	YES	YES	YES
Observations	255	255	255	210	255	210
R ²	0.070	0.374	0.837	0.850		
Number of id					15	15

Note: Robust standard errors are shown in parentheses: *** p<0.01, ** p<0.05, * p<0.1

However, the negative link between intergovernmental transfers and regional divergences gradually decreases as the size of transfers increases (Figure 5). In fact, although intergovernmental transfers are associated with a lower level of regional disparities, as long as transfers increase, the relationship becomes weaker and eventually changes to the opposite sign. The same concave outcome was found for regional policy by Becker et al. (2012) and Rodríguez-Pose and Garcilazo (2015). The turning point of this U-shaped relationship is found to be at €541.57 net transfers per adjusted population. From this point onwards, every €1 increase in intergovernmental transfers is associated with higher regional economic disparities. As observed in Table A1 (Annex A), 9 out of 15 regions received, on average, more than that amount in the period 2002-18.

Figure 5. Results for Model 1 (column 4) (two-stage least squares estimation with instrumental variables - 2SLS-IV) (X in thousands of €)



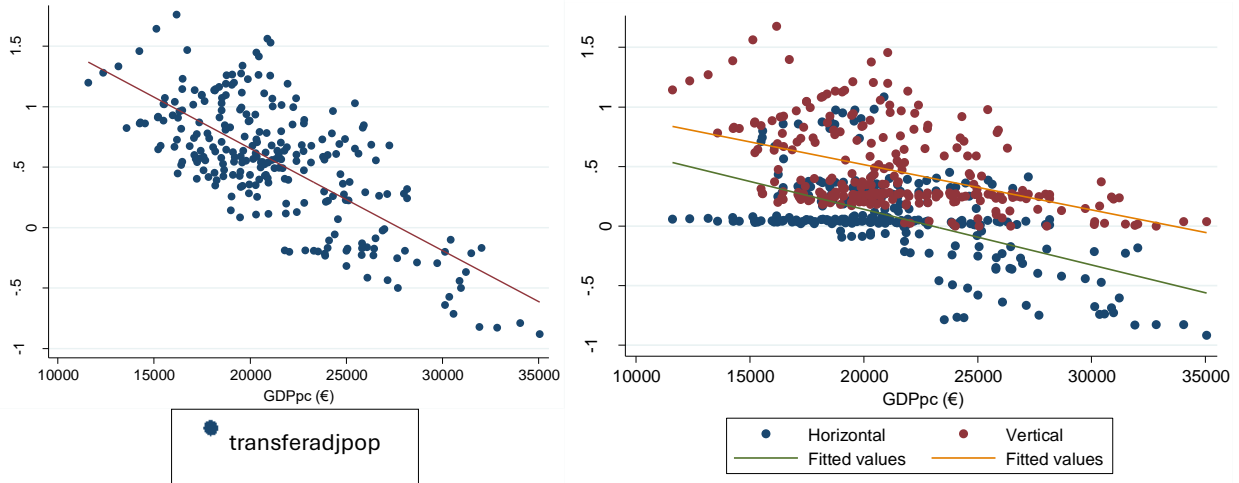
Source: by the authors.

Among control variables, as expected, the share of tertiary education, and more significantly, the unemployment rate, show a small but divergence-increasing impact. Less significant and negligible in size is the pro-divergence effect of agricultural share on GVA, which we use as a proxy for extension of rural territory. In contrast, and consistent with the regional economics literature, the growth rate shows a convergence-promoting sign. However, its estimates are only significant in one of the iterations (column 5) of the estimation. Finally, and surprisingly, institutional quality and the degree of tax autonomy show the opposite sign to what was expected, if compared with Kyriacou et al. (2015), Blöchliger et al. (2016) and Sorens (2014), respectively. Indeed, our estimates suggest that both institutional quality and tax autonomy would relate to increases in cross-regional divergences. Finally, the impact of regional population size, although significant in almost every specification of our models, shows in every case negligible numbers.

The results obtained for Model 2 (Table 2), where we break down net transfers per adjusted population provided by the Spanish RFS into two components, depending on their horizontal or vertical nature (Figure 6), allow us to conclude that Proposition 2 holds true. We find that vertical transfers, not horizontal, are those more strongly associated with regional convergence (Table 2). Horizontal transfers have a non-significant pro-convergence effect, and even if they slightly recover significance jointly with their squares, the slope of the curve that represents the relationship evolves negatively so rapidly, that at the levels equalisation currently works, the overall effect is negative for convergence (Figure 7a), in line with the results of most of the

literature, and particularly with Weddige-Haaf and Kool (2017). In fact, the coefficient associated with the quadratic term is far larger than that for the linear term. Coefficients for vertical transfers are larger and more significant, which suggest that the global U-shape link observed for intergovernmental grants is mainly due to grants of a vertical nature (Figure 7b). For controls, the interpretation made for Model 1 does not change substantially.

Figure 6. Correlation between gross domestic product (GDP) per capita and net transfer per adjusted inhabitant (RFS, homogeneous competencies adjusted) (Y in thousands of €)



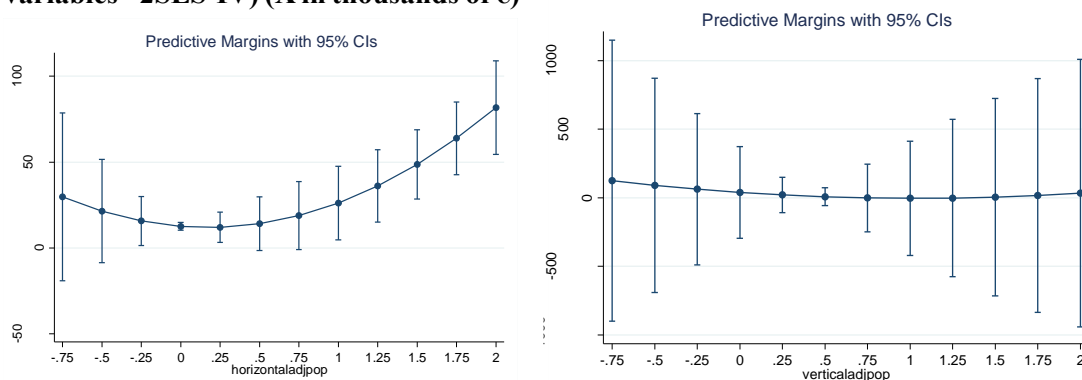
Source: by the authors.

Table 2. Estimates for Model 2. Horizontal and vertical transfers of the Spanish Regional Funding System

[dev(GDPpc)] ² (0-100)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	2SLS-IV	RE	RE-IV
horizontal (k€)	-5.013 (8.440)	-6.178 (7.270)			-7.219*** (1.463)	-7.321 (23.28)	-1.381 (1.733)	-0.115 (2.736)
horizontal ² (k€)		18.20* (9.166)			17.69*** (1.959)	20.94* (12.59)	6.009* (3.488)	22.36*** (4.460)
vertical (k€)			-7.128 (10.081)	-52.79** (18.04)	-34.18*** (8.202)	-83.48 (432.3)	-9.479 (7.535)	-57.86 (37.78)
vertical ² (k€)				36.12*** (11.00)	26.64*** (2.894)	40.49 (50.94)	10.01*** (3.135)	44.64*** (10.37)
growth (%)					0.974** (0.422)	1.054 (0.983)	-0.0840 (0.160)	0.536 (0.450)
QoG					0.252** (0.0976)	0.205** (0.0876)	0.0492 (0.0751)	0.00131 (0.0900)
taxaut (%)					0.228* (0.123)	-0.379 (7.251)	0.126 (0.0817)	0.143 (0.620)
edusup (%)					0.734*** (0.152)	0.403 (2.775)	0.297 (0.211)	0.439** (0.189)
agrisharegva (%)					1.653*** (0.254)	1.713 (1.375)	0.328 (0.254)	1.356*** (0.321)
unemplrate (%)					1.097*** (0.194)	0.479 (3.377)	0.589*** (0.167)	0.144 (0.316)
pop (u)					1.01e-06*** (2.56e-07)	9.06e-07 (3.01e-06)	1.94e-06*** (6.85e-07)	1.36e-06*** (4.63e-07)
Constant	16.52*** (2.698)	16.41*** (2.634)	20.87*** (6.516)	31.47*** (6.666)	-48.66*** (16.26)	32.06 (892.4)	-13.16 (11.30)	-8.041 (74.69)
Year dummies	YES	YES	YES	YES	YES	YES	YES	YES
Observations	255	255	255	255	255	210	255	210
R ²	0.043	0.205	0.048	0.311	0.822	0.705		
Number of id							15	15

Note: Robust standard errors are shown in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Figure 7. Results for Model 2 (two-stage least squares estimation with instrumental variables - 2SLS-IV) (X in thousands of €)



Source: by the authors.

These results can be explained by the fact that, although vertical transfers are more evenly distributed across regions than horizontal transfers (see Table A1 in Annex A and Figure 6b), they are larger in size than horizontal transfers (see Table A1), which reinforces their equalising effect. In addition, it should be remembered that all RFS transfers with seemingly regional policy objectives are of a vertical nature, insofar as the two RFS Convergence Funds are financed exclusively with resources provided by the central government.

5.2. Fiscal equalisation, regional policy and convergence

At first glance, it seems that the results obtained for Models 1 and 2 oppose the previous literature, which suggests that equalisation transfers prevent regional economic divergence (Padovano, 2007; Kessler and Lessmann, 2010; Blöchliger et al., 2016; Chan and Petchey, 2016, 2017; Hailemariam and Dzhumashev, 2019). However, it should be noted that up to this point not only have pure fiscal equalisation transfers been considered, but also all kind of grants included in the Spanish RFS.

In order to focus on the relationship between fiscal equalisation and regional convergence, we estimate Model 3. The results, reported in Table 3, reveal interesting findings, confirming Proposition 3. First, funding excess presents a non-significant pro-convergence relationship. Second, both genuine equalisation and regional policy transfers show a significant concave pro-convergence relationship (Figure 8), with the size of the effect being larger for explicit regional policy tools. Two main reasons could explain these results. First, explicit regional policy transfers have a more direct impact since they are devoted to funding programmes for regional development and growth, such as infrastructure. In contrast, fiscal equalisation is mainly spent on providing fundamental regional public services such as healthcare or education, which have a more indirect effect on regional development and growth, and thus on closing regional income gaps. Second, and linked to the previous argument, as the methodology detailed in Section 4 assumes, fiscal equalisation is expected to affect regional disparities in the longer run, in contrast to a more medium-term impact of explicit regional policy tools, which would contribute to partly diluting the relevance of the former.

To sum up, the whole set of transfers included in the RFS have a concave –inverse U-shaped– regional convergence-promoting effect (Model 1). This effect is mainly due to vertical as opposed to horizontal grants (Model 2). The underlying argument is not just that vertical transfers are larger in size, but also that all RFS transfers with seemingly regional policy objectives are of a vertical nature. Finally, we find that the concave-convergence-promoting effect of RFS transfers estimated

in Model 1 is due to fiscal equalisation transfers, and not to the funding excess.⁵ However, despite its relevance, its impact is smaller than of explicit regional policy tools (Model 3).

Moreover, when we integrate funding excess with explicit regional development transfers, the size of the effect of these on convergence is reduced (see Tables B1 and B2 in Annex B). This outcome refutes the main argument used by some regional leaders to defend re-ranking, and shows that funding excess does not have the intended effect, but is a mix of non-explicit goals.

These results, which hold true after robustness checks (see Annex B), are consistent with Kaufman et al. (2003), because they contradict the majoritarian conclusion on the divergence-promoting effect of intergovernmental grants by confining the effect to the (Canadian) federal employment insurance scheme instead, while finding that fiscal equalisation generates a convergence-promoting impact. They also agree with Padovano's (2007) intuition that the Spanish fiscal equalisation system does alter regional incomes. However, our results contradict those found by Weddige-Haaf and Kool (2017) for Germany. They dissected fiscal equalisation and federal supplementary grants for solidarity with Eastern *Länder* and found that while horizontal tax equalisation was ineffective in promoting regional growth (as in Baskaran et al., 2016) and convergence, federal supplementary grants had a positive effect to close the gap between recipient and non-recipient *Länder*.

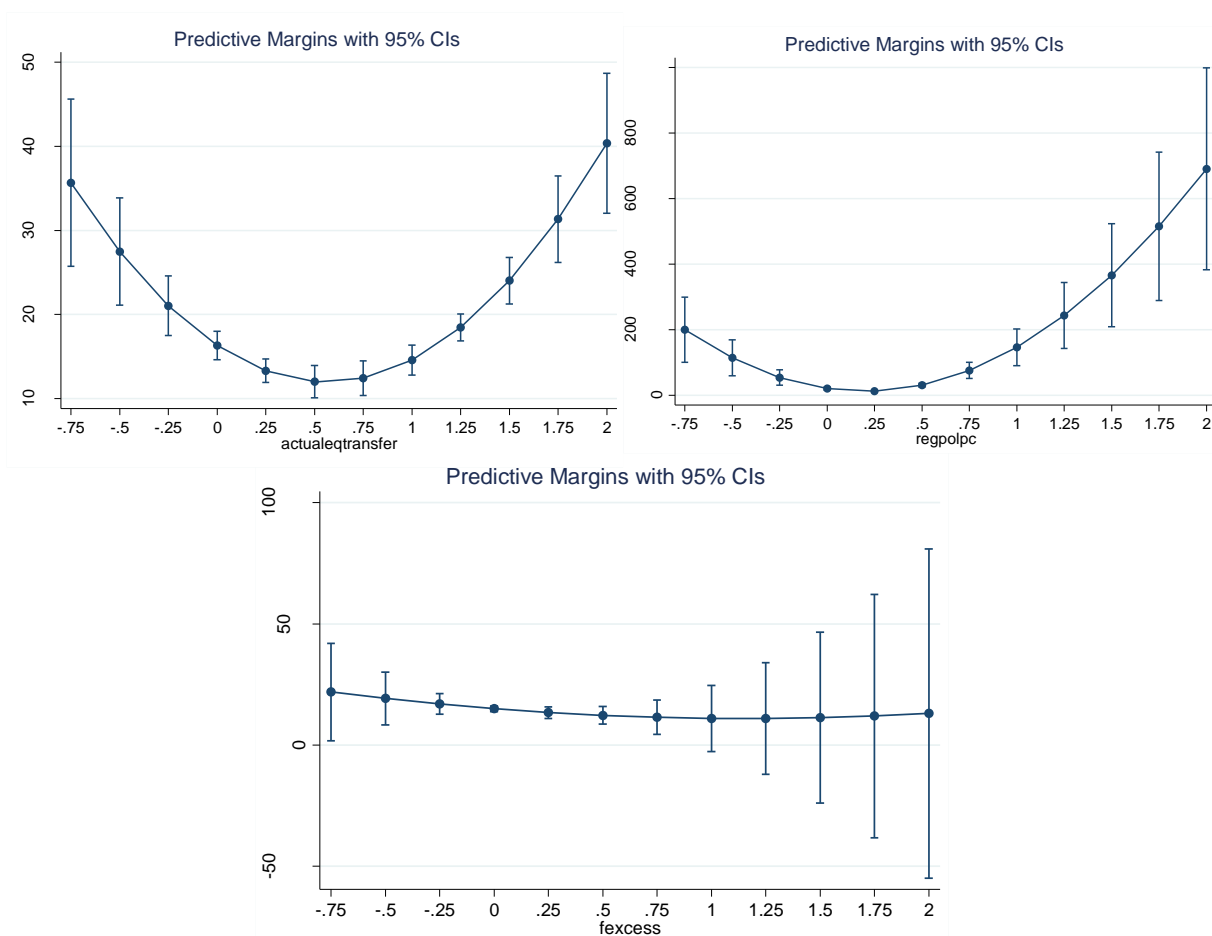
⁵ The model was also estimated by solely including funding excess as an independent variable, yielding the same result. None of the iterations showed significant coefficients.

Table 3. Estimates for Model 3. Genuine fiscal equalisation transfers, funding excess and regional policy

[dev(GDPpc)] ² (0-100)	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS-IV	RE	RE-IV
genuineeqtransfer	-17.91** (6.970)		-20.82*** (3.155)	-15.48*** (4.013)	-7.344*** (1.162)	-15.48*** (2.781)
genuineeqtransfer ²	16.59** (5.895)		17.58*** (2.005)	13.75*** (2.828)	7.967*** (1.163)	13.75*** (1.956)
fexcess		-10.52 (8.572)	1.456 (3.540)	-6.955 (6.658)	1.231 (3.331)	-6.955 (5.230)
fexcess ²		-19.13 (13.07)	-7.049 (5.724)	2.983 (10.99)	9.490 (5.930)	2.983 (10.75)
regpolpc			-22.72* (12.11)	-82.76*** (26.03)	-24.12*** (7.129)	-82.76*** (24.59)
regpolpc ²			64.10*** (18.40)	209.0*** (51.43)	42.99*** (10.82)	209.0*** (50.55)
growth (%)			0.443 (0.432)	0.626* (0.366)	-0.267 (0.260)	0.626* (0.364)
QoG			0.230** (0.106)	0.139** (0.0706)	0.0294 (0.0584)	0.139* (0.0724)
taxaut (%)			0.368*** (0.0638)	0.206** (0.0891)	0.125** (0.0498)	0.206** (0.0836)
edusup (%)			0.586*** (0.188)	0.807*** (0.147)	0.364 (0.223)	0.807*** (0.152)
agrisharegva (%)			1.554*** (0.203)	1.567*** (0.248)	0.470** (0.229)	1.567*** (0.168)
unemplrate (%)			1.269*** (0.182)	1.075*** (0.187)	0.746*** (0.129)	1.075*** (0.158)
pop (u)			8.69e-07** (3.09e-07)	8.44e-07*** (2.29e-07)	1.43e-06*** (5.24e-07)	8.44e-07*** (2.19e-07)
Constant	19.68*** (4.121)	16.91*** (2.794)	-55.55*** (10.98)	-44.71*** (8.640)	-12.20* (7.057)	-44.71*** (7.640)
Year dummies	YES	YES	YES	YES	YES	YES
Observations	255	255	255	210	255	210
R ²	0.294	0.089	0.837	0.833		
Number of id					15	15

Note: Robust standard errors are shown in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Figure 8. Results for Model 3 (two-stage least squares estimation with instrumental variables - 2SLS-IV) (X in thousands of €)



Source: by the authors.

6. Conclusions and policy implications

What should be the rationales and objectives of intergovernmental fiscal transfers for regional policy? Should we call for evolution or Copernican revolution? Should fiscal equalisation and regional policy goals and tools converge, or should they be separated according to the Tinbergen rule's "one tool for each goal" approach? Within the context of this debate, this paper set out to test whether Spanish RFS transfers are associated with a regional convergence-promoting effect, and if so, to disentangle whether this effect is caused by fiscal equalisation transfers, in line with Kaufman et al.'s (2003) suggestion for Canada, or rather originates in regional development transfers embedded in the RFS, as Weddige-Haaf and Kool (2017) suggest for Germany. Theoretically, the distinction between fiscal equalisation and regional policies seems straightforward enough: while fiscal equalisation should guarantee that all territories can provide a minimum level of public services despite their heterogenous tax capacity and expenditure needs, regional policy should pursue a reduction in cross-regional economic disparities. However, when considering the practice of some countries, such as Germany or Spain, whose RFS mix both goals, they need to be examined more closely. Furthermore, Padovano (2007) suggested Canadian and Spanish fiscal equalisation systems do alter regional income levels. Therefore, to respond to the "one tool for each goal" discussion, we first need evidence on the actual impact on regional

convergence of all kinds of transfers (Sorens, 2014). This paper has tried to find this, by looking into the effect of transfers paid within the Spanish RFS on regional convergence.

We exploit the mixture of policy goals of the Spanish RFS in order to break down the impact of both tools on regional economic divergences. In conclusion, according to our results, while funding excess presents a non-significant pro-convergence relationship, both genuine equalisation and regional policy transfers show a significant concave pro-convergence relationship, with the size of the effect being larger for explicit regional policy tools.

In our view, these results are fully consistent with the principle of "one instrument for each goal". The pro-convergence effect of equalisation transfers is only a by-product of them, as they will particularly benefit the poorest regions, but this does not justify the mix of instruments and objectives. Our results strongly suggest that if the public sector is willing to promote regional convergence, it is more cost-effective to do so through explicit regional policy than through fiscal equalisation. However, both domestic and European regional policy instruments should carefully analyse in which side of the concave curve they locate. Indeed, as suggested by Rodríguez-Pose and Garcilazo (2015), once a certain level of transfers has been reached, it might be more useful to adopt other strategies rather than increasing grant allocations.

Contradicting the mainstream position of regional leaders, funding excess is not linked to regional convergence, and therefore it should be corrected. It is therefore more appropriate to design equalisation transfers correctly, according to their main objective, removing those elements that do not have a clear purpose and integrating those that have a regional policy purpose with regional development transfers. This would imply that the wrongly denominated Convergence Funds, currently integrated in the RFS, should go back to forming part of the ICF. This would help to make the real degree of fiscal equalisation more explicit, put an end to the re-ranking problem, and allow for a more accurate analysis of the real impact of regional policy on regional convergence. Furthermore, for reasons of visibility, this separation of instruments will foreseeably contribute to enhancing citizens' perception of inter-territorial redistribution, which is essential for improving the country's social cohesion. Despite the institutional context-specific nature of the analysis, these recommendations could be relevant for other decentralised or federal countries where fiscal equalisation and regional policy tools and objectives appear mixed.

Possible extensions to this article could be along the lines of the work carried out by Hailemariam and Dzhumashev (2019). Indeed, by exploiting the character of a region as a net recipient or net contributor as an identification strategy, a Regression Discontinuity Design exercise could be designed, as in Pellegrini et al. (2013). Comparative short-term versus long-run effects of transfers on regional convergence could be also of high relevance. In addition, geographical spillover effects could be considered, as in San Juan Mesonada and Sunyer (2020). Finally, we consider that due to the highly relevant role of the institutional quality variable on regional economics literature it would be extremely useful to develop a panel database with yearly figures for QoG at the regional level, for use in future research on this topic.

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ANNEX A - Descriptives

Table A1. Main Average Statistics (2002-18) (EUR)

Region	Population (pop)	Adjusted population	GDP per capita	Transfers per adjusted population (transferadjpop)	Horizontal Transfers (horizontal)	Vertical Transfers (vertical)	Funding per capita	Tax autonomy (taxaut)
Andalucía	8,132,456	7,929,581	16,954.65	721.11	201.41	519.70	2,265.61	34.16%
Aragón	1,305,425	1,393,807	24,307.12	454.69	19.62	435.07	2,400.19	41.70%
Asturias	1,059,145	1,130,423	19,980.00	582.97	76.48	506.49	2,351.31	38.54%
Balearic Islands	1,054,035	1,066,285	24,537.65	-216.91	-474.62	257.71	2,308.83	60.08%
C-La Mancha	2,000,800	2,115,952	17,847.29	783.50	227.46	556.04	2,267.94	32.20%
Canary Islands	2,012,678	2,114,030	19,496.94	1,236.08	558.34	677.74	2,297.45	22.83%
Cantabria	574,762	590,884	20,922.24	714.42	168.62	545.80	2,689.93	37.36%
Cataluña	7,239,352	7,179,246	26,553.88	-0.76	-215.43	214.67	2,296.01	52.71%
Castilla y León	2,491,811	2,709,552	20,860.41	735.40	167.92	567.48	2,412.47	34.20%
Extremadura	1,083,403	1,156,672	15,604.06	1,242.41	468.95	773.46	2,506.69	26.70%
Galicia	2,735,097	2,944,259	19,514.29	797.16	209.90	587.26	2,341.52	32.54%
Madrid	6,218,361	5,936,879	30,302.24	-460.35	-522.78	62.42	2,294.91	59.98%
Murcia	1,408,998	1,377,817	18,718.53	565.21	141.87	423.35	2,200.39	38.49%
La Rioja	309,519	329,112	24,224.88	715.78	186.38	529.41	2,575.00	36.51%
C. Valenciana	4,820,471	4,762,254	20,032.29	303.54	-24.84	328.38	2,133.27	45.41%

* Transfers and per adjusted population funding are adjusted for homogenous competencies

Transfers = Fundamental Public Services Guarantee Fund + Sufficiency Fund + Cooperation Fund + Competitiveness Fund + Health Guarantee Fund + Extra Health Transfer (2006-2010) + Third Additional Disposition Compensation (It is paid to regions that do not reach the average of the per adjusted inhabitant funding level after all transfers are calculated) + Linguistic Policy Adjustment.

Horizontal Transfers = Share of the FPSGF funded by each region and the negative transfer of the Sufficiency Fund.

Funding per capita = Total Funding Provided by the Regional Funding System (i.e., transfers plus ceded taxes; thus, it does not include fully owned taxes).

Tax Autonomy = Share of funding not received through net transfers (both fully owned taxes and the share of the FPSGF funded by each region is considered as own revenues e.g. PIT and VAT regional revenues).

By the authors.

Table A2. Statistics related to Funding Excess (Average 2002-18) (EUR)

Region	Funding per adjusted population	Fiscal equalisation objective	Funding Excess (+)/ Deficit (-) (<i>fexcess</i>)	Regional Policy per capita (<i>regpolpc</i>)
Andalucía	2.150,35	2.277,44	-127,09	229,34
Aragón	2.366,02		88,58	123,86
Asturias	2.354,77		77,33	266,49
Balearic Islands	2.063,80		-213,64	49,40
C-La Mancha	2.177,81		-99,63	272,88
Canary Islands	2.233,53		-43,91	172,30
Cantabria	2.675,13		397,69	178,45
Cataluña	2.175,88		-101,56	58,15
Castilla y León	2.364,40		86,96	216,52
Extremadura	2.458,40		180,96	436,96
Galicia	2.305,24		27,80	277,10
Madrid	2.159,71		-117,73	44,27
Murcia	2.064,14		-213,30	186,40
La Rioja	2.555,44		278,00	93,98
C. Valenciana	2.056,97		-220,46	123,81

Funding Déficit/Excess = Funding per adjusted population – Fiscal Equalisation Objective

*Funding per adjusted population and transfers are adjusted for homogenous competencies.

By the authors.

ANNEX B – Methodological details and robustness checks

Methodological details

As explained in Section 4.1, although reverse causality-led endogeneity should not emerge in the specification of the models, following the previous literature we opt for a prudent approach and address it by using lagged independent variables. We use a two-year lagged main exogenous variable as the instrument (IV) to address this issue (Rodríguez-Pose and Ezcurra, 2010). However, for equalisation transfers, as in Kessler and Lessmann (2010), we use three-year lagged IV instead. Undoubtedly, as the impact fiscal equalisation transfers could have on regional convergence would only take place through pro-growth effects of healthcare and education, following a more indirect path than regional policy funded projects, it would only be observed in the longer term. We believe these are good instruments as they comply both with relevance (correlated and significant) and exclusion requirements. Indeed, it is very unlikely that considering how fiscal equalisation transfer systems are designed, negotiated, and agreed, regional disparities in $t+3$ would retroactively determine to any relevant extent the size or the sign of net transfers distributed. Moreover, this is likely to be true when considering that the system is only settled when tax revenue becomes definitive in $t+2$.

For the econometric estimation method, we will first use Ordinary Least Squares (OLS), to follow with Random-Effects (RE) in order to take advantage of panel data. Although Fixed Effect is widely used in the literature to explore regional panel data, as in Kessler and Lessman (2010) we conduct the Hausmann test and find that error terms across regions are not uncorrelated with regressors, meaning that the use of Fixed Effects should be rejected, and that Random Effects should be applied instead as it is the consistent and more efficient choice. Accordingly, as in Kessler and Lessmann (2010), Two Stage Least Squares (2SLS) (and RE-IV) will be the approach chosen to include IV in our estimations. In all cases, we cluster errors by region.

Year dummies have been included in all the iterations of the models to capture potential time-related effects that are not already considered in the models, and that otherwise could be absorbed by coefficients linked to main exogenous variables (Kessler and Lessman, 2010; Baskaran et al., 2016; Weddige-Haaf and Kool, 2017).

Robustness checks

Several robustness checks have been carried out in order to test whether results hold. The first exercise assumes that funding excess is in fact part of regional policy, thus estimating the Model 3 with *fexcess* and *regpolpc* gathered as just one variable (Annex B, Table B1). Second, we exclude from our estimates the Canary Islands, where a particular regime is applied (Annex B, Table B2). This is in line with the robustness check strategy applied by Baskaran et al. (2016) when dropping the three German city states, treated differently by the equalisation formula. Both exercises yield very similar results, also to those of Model 3 (Table 3). While fiscal equalisation transfers are significantly associated with a concave regional convergence promoting effect (Figure B1a), coefficients are larger for the variable that gathers explicit regional policy tools and funding excess. However, the difference in magnitude of both is not as large as in Model 3, since funding excess –which was insignificant then– now would be compensating downwards the larger effect of explicit regional policy tools, such as European Regional Funds or the Spanish Interterritorial Compensation Fund. (Figure B1b).

Table B1. Model 3. Robustness check results. Funding excess and regional policy are reported together

[dev(GDPpc)] ² (0-100)	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS-IV	RE	RE-IV
genuineeqtransfer	-17.91** (6.970)		-22.33*** (2.388)	-20.68*** (3.057)	-6.644*** (1.631)	-3.103 (2.206)
genuineeqtransfer ²	16.59** (5.895)		18.99*** (2.132)	17.83*** (3.141)	7.514*** (1.215)	6.822*** (1.485)
fexcess+regpolpc		-15.92 (12.88)	-1.287 (3.404)	-12.37 (8.159)	-3.783 (3.116)	-3.510 (4.575)
(fexcess+regpolpc) ²		23.75 (25.93)	12.94 (8.075)	29.86** (12.95)	13.53*** (3.892)	20.11*** (5.326)
growth (%)			0.549 (0.397)	0.755* (0.419)	-0.223 (0.257)	0.0922 (0.172)
QoG			0.208* (0.108)	0.130 (0.0820)	0.0345 (0.0616)	0.000762 (0.0323)
taxaut (%)			0.359*** (0.0636)	0.245*** (0.0943)	0.109** (0.0482)	0.0795 (0.0495)
edusup (%)			0.565** (0.194)	0.728*** (0.192)	0.377* (0.207)	0.515*** (0.112)
agrisharegva (%)			1.721*** (0.278)	2.023*** (0.318)	0.345 (0.252)	0.362* (0.213)
unemplrate (%)			1.229*** (0.198)	1.113*** (0.267)	0.679*** (0.121)	0.480*** (0.101)
pop (u)			1.03e-06*** (3.28e-07)	9.94e-07*** (2.83e-07)	1.54e-06** (5.99e-07)	1.74e-06*** (3.07e-07)
Constant	19.68*** (4.121)	17.38*** (3.983)	-55.45*** (11.72)	-51.91*** (10.92)	-14.11* (7.265)	-19.71*** (6.755)
Year dummies	YES	YES	YES	YES	YES	YES
Observations	255	255	255	210	255	210
R ²	0.294	0.080	0.822	0.829		
Number of id					15	15

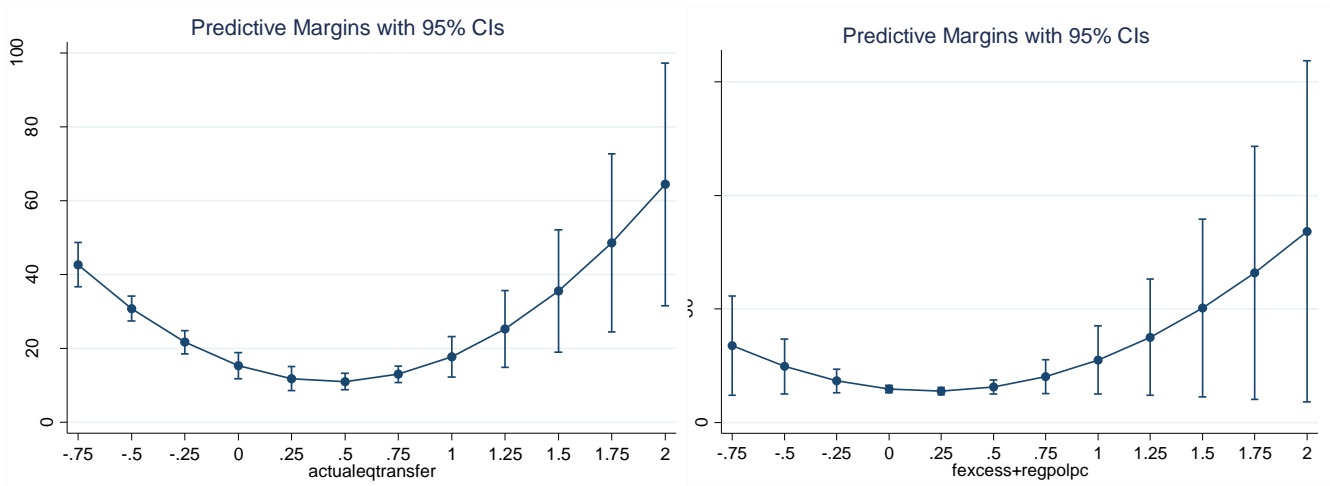
Note: Robust standard errors are shown in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table B2. Model 3. Robustness check results. Funding excess and regional policy are reported together, Canary Islands excluded

[dev(GDPpc)] ² (0-100)	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS-IV	RE	RE-IV
genuineeqtransfer	-20.26*** (5.044)		-20.41*** (2.603)	-19.80*** (2.443)	-5.892*** (1.896)	-4.760* (2.610)
genuineeqtransfer ²	25.18*** (4.210)		22.95*** (2.330)	22.17*** (5.075)	5.532*** (1.832)	8.956*** (2.602)
fexcess+regpolpc		-15.59 (13.36)	-2.234 (4.388)	-9.068 (6.571)	-7.318*** (2.436)	-4.388 (4.671)
(fexcess+regpolpc) ²		22.35 (26.46)	12.66 (8.737)	21.91* (11.94)	14.15*** (3.678)	19.41*** (5.096)
growth (%)			0.727* (0.389)	0.758 (0.469)	-0.275 (0.248)	0.162 (0.185)
QoG			0.109 (0.106)	0.0559 (0.0831)	0.0647 (0.0625)	0.00198 (0.0406)
taxaut (%)			0.435*** (0.0569)	0.344*** (0.0639)	0.0392 (0.0550)	0.106* (0.0615)
edusup (%)			0.759*** (0.146)	0.837*** (0.138)	0.340* (0.200)	0.518*** (0.117)
agrisharegva (%)			1.516*** (0.320)	1.665*** (0.344)	0.119 (0.242)	0.337 (0.276)
unemplrate (%)			1.320*** (0.199)	1.236*** (0.251)	0.650*** (0.121)	0.613*** (0.101)
pop (u)			6.27e-07 (3.59e-07)	6.02e-07* (3.62e-07)	1.46e-06** (6.51e-07)	1.46e-06*** (3.28e-07)
Constant	18.40*** (4.436)	18.31*** (4.040)	-60.46*** (10.44)	-58.50*** (7.981)	-6.868 (7.271)	-21.73*** (7.978)
Year dummies	YES	YES	YES	YES	YES	YES
Observations	238	238	238	196	238	196
R ²	0.437	0.078	0.850	0.865		
Number of id					14	14

Note: Robust standard errors are shown in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Figure B1. Robustness check results for Model 3, when reporting *fexcess* and *regpolpc* jointly and without Canary Islands (two-stage least squares estimation with instrumental variables - 2SLS-IV) (X in thousands of €)



By the authors.

CHAPTER 2

GOING GREEN THROUGH LOCAL FISCAL EQUALISATION

1. Introduction

Ecological transition is one of the challenges policymakers are trying to address within the United Nations' Sustainable Development Goals (SDG) agenda. The pre-pandemic momentum of increased environmental awareness facilitated international agreement on more stringent green objectives. The signature of the Paris Agreement, or the launching of the European Green Deal, are important examples of this trend.

Climate change is a global problem to be tackled by measures at the global level. However, other environmental issues, such as natural landscape, biodiversity and ecosystem protection, energy consumption, water quality, waste production and management, or air quality, have a pre-eminently local scale. Although most objectives in these areas are set at the international or national levels, following a top-down approach, responsibility for the design and implementation of the policies required to attain them is shared across several levels of government or falls on cities (OECD, 2020).

Therefore, success in achieving environmental goals requires local governments' engagement with the green agenda. Current results, however, are not promising, as only a few municipalities have implemented comprehensive plans for ecological transition. In fact, central mandates for compulsory plans, political willingness, and city size are the main drivers for their existence (Tang et al., 2010; Reckien et al., 2018). This can be explained both by the incentive scheme that guides local governments' policymaking and their limited capacities, particularly in the case of smaller municipalities. Following the political economy approach adopted by the Second-Generation Theory of Fiscal Federalism, local governments' objective function can be assumed to depend on the size of their budget (Niskanen, 1971) and the welfare of residents within their jurisdiction (Oates, 2005). In this framework, municipalities may refrain from taking more ambitious and decided environmental protection measures in order to protect their budgetary capacity, since local tax bases (e.g. real estate or car ownership) could be negatively affected by environmental protection policies (Ring, 2008b; Busch, 2021) which may hinder economic activity (Azzoni and Isai, 1994; Ferraro, 2002; Adams et al., 2010; Karsenty et al., 2014; Nikitina, 2019; Canan and Ceyhan, 2020). The loss of tax revenue resulting from the reduction in activity associated with the correction of externalities can be interpreted as the opportunity cost that local governments face when implementing effective environmental policies.

Following the rationale for households' income compensations suggested by the political economy literature (Clinch et al., 2006; Caratini et al., 2019) to gather popular support for the ecological transition, which is at the core of the European Green Deal (Montes and Moreno, 2022), some countries have created conditional intergovernmental grant frameworks for subnational governments, which are allocated on the basis of a diverse range of environmental variables. They are the so called Ecological Fiscal Transfers (EFT). Although they are still uncommon, their use is on the rise, having been already adopted in Indonesia (Mumbunan et al., 2012; Ardiansyah and Jotzo, 2013), Portugal (Santos et al., 2012), India, France, China (Busch et al., 2021), and some Brazilian states (Ring, 2008a; May et al., 2013; Droste et al., 2017) and German regions (Ring, 2008b). However, most experiences in this line have been of limited scale and have been implemented as *ad hoc* earmarked grant schemes, rather than as part of comprehensive fiscal equalisation schemes. Consequently, large-scale and systematic linkages between budget and environmental goals have not yet been introduced (Busch et al., 2021; Smoke and Cook, 2022).

Most schemes compensate municipalities for increased expenditure needs related to the establishment and management of local protected areas, for the interjurisdictional positive spillovers generated by so called “ecosystem services” (Ring, 2008b; Loft et al., 2014), or for the opportunity cost on revenue losses caused by the implementation of more severe environmental protection policies (Busch et al., 2021). This paper proposes fiscal equalisation as an appropriate tool to scale-up the path opened by EFTs, and to set more adequate incentives for local municipalities to better align their policies with international and national ecological agendas. First, we propose using the fiscal capacity component of fiscal equalisation as the instrument to support mitigation, thus compensating municipalities for the negative impact (opportunity cost) local environmental policies could generate in their own tax revenue. In addition, we suggest complementing the above component with an indicator of increased expenditure needs related to climate change adaptation, based on risks linked to extreme climate events. In order to illustrate the proposal, we make use of the rich variety of environmental variables integrated in a database for 251 Basque municipalities to build and apply a synthetic multidimensional green indicator. Then, we examine the budgetary impact of the proposed environmental fiscal equalisation reform. We find that less sustainable cities could lose up to 5% of their per capita transfers, while small and more sustainable municipalities could increase their per capita allocations by up to 13%.

The paper is structured as follows. Section 2 gives context on the green local agenda. Section 3 introduces Ecological Fiscal Transfers and discusses the pros and cons of introducing environmental components into fiscal equalisation schemes. Section 4 provides a thorough justification of our proposal of introducing an environmental component into local equalisation systems, both from the side of fiscal capacity (mitigation) and expenditure needs (adaptation). The following sections are devoted to developing the proposal and applying it to the Basque local equalisation system, for which sufficient information is available. To this aim, Section 5 briefly describes the Basque local funding system. Section 6 explains the methodology used to build a synthetic multidimensional green indicator (the Local Sustainability Index), presents some descriptive statistics, and estimates the impact the reform proposal would have had on Basque municipalities’ funding during the 2016-2019 period. In Section 7, results are assessed together with the budgetary effects of this environmental fiscal equalisation proposal in terms of winners and losers. Finally, Section 8 concludes, gathering some policy recommendations and suggestions for further research.

2. The green local agenda

The global scope of Climate Change has led to the adoption of international agreements to reduce Greenhouse Effect Gas Emissions (GHG) to contain global warming to 1.5° C degrees by the end of the XXI century, as in the Paris Agreement. At the supranational level, European Union member states have committed to reach ambitious reductions of GHG for 2030 and to be net carbon neutral in 2050. Due to the large geographical externalities of climate mitigation policies, the scope of most important measures to pursue these targets, such as green investments on environmental infrastructure or innovation, are being designed and implemented far from subnational governments (SNGs) (Martinez-Vazquez, 2021).

However, the environmental agenda is not limited to climate change, and in fact involves a full range of other environmental challenges. Among them, are those relating to natural landscape, biodiversity and ecosystem protection, energy consumption, resources, water, waste production and management, or air quality. In contrast to global warming, these problems are more localised,

as shown by Table 1. Consequently, attaining ecological transition commitments will require the engagement of local governments. In fact, according to the OECD (2020), at least 105 of the 169 SDGs targets will not be attained without subnational governments' involvement.

Table 1. Environmental policy responsibility attribution across levels of government

Policy area	Target-setting	Design	Implementation	Funding
Climate change (decarbonization)	International, supranational, national	National	National	Supranational, national
Energy saving (consumption)	Supranational, national	National	Regional, local	National, regional
Land use, resources, biodiversity and ecosystem protection	Supranational, national	National	Regional, local	National, regional, local
Water	Supranational, national	National, regional	Local	National, regional, local
Waste management	Supranational, national	National, regional	Local	Local
Air quality	Supranational, national	National	Local	Local

Source: own elaboration, based on De Mello and Ter-Minassian (2023) and Dougherty and Montes-Nebreda (2023).

Local involvement on the green agenda could just mean coordination and harmonisation of practices. However, in those policy areas in which subnational governments have shared or exclusive responsibility to design and implement policies, their incentives and capacity to pursue targets, which are often designed in a top-down basis, are even more relevant. Indeed, according to OECD (2020) data, SNGs are responsible for almost 60% of total public investment, including investment related to ecological transition, and for around 40% of public expenditure executed at the OECD.

An example of the top-down approach is the mandate set by the Spanish Climate Change Law (art. 14.3.a) for cities of more than 50,000 inhabitants, and smaller ones (>20,000 inhabitants) with bad air quality statistics, to implement Low Emission Zones (LEZ) by 2023. For that purpose, municipalities will receive 2,916 million euros in support from European Union's Next Generation Funds, as stated by the Spanish Recovery, Transformation and Resilience Plan (Spanish Government, 2020). In addition, the Central Government's guidelines for LZEs implementation, encourages municipalities to introduce congestion charges as a complementary policy (MITECO, 2021).

However, despite the importance of subnational governments' role on attaining environmental targets, figures for regions and cities' compliance with SDGs show there is still work to do. For instance, in 2019 only 20% of OECD regions had achieved 2030 targets on responsible consumption (SDG12), no region had achieved 2030 objectives on climate action (SDG13), and 70% of cities had not achieved any of the 17 SDGs targets for 2030. These figures are even more worrying when realising that environment-related SDGs are reportedly the top priority for 73% of SNGs, according to OECD-CoR survey data (OECD, 2020).

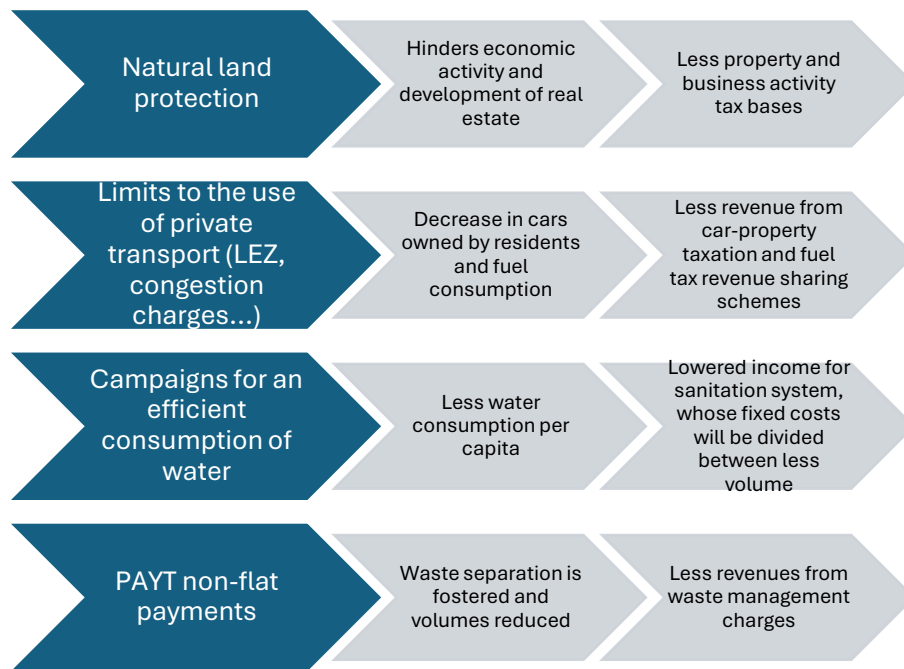
There are two main channels that explain why, although SNGs are sensitive and committed to environmental issues, this is not translated into outcomes. The first one has to do with the lack of incentives. Currently, local policy agendas are not guided by an incentive scheme that rewards

environmental action. Consequently, there is an agenda misalignment across levels of government. The second-Generation Theory of Fiscal Federalism has extensively addressed this phenomenon by making use of public choice theory and political economy to explain policymakers' behaviour and analyse its determinants (Oates, 2005). The literature has conceptualised this situation as a principal-agent problem (Schick, 1998), where, in contrast to central government's, the utility maximisation formula followed by local policymakers only accounts for local interest, and only for the short term, as in the long-term environmental policies will deliver local wellbeing too (EEA, 2007; Stern, 2007).

For local governments, there is an opportunity cost of protecting the environment (Azzoni and Isai, 1994; Ferraro, 2002; Adams et al., 2010; Karsenty et al., 2014; Nikitina, 2019; Canan and Ceyhan, 2020) in terms of foregone tax revenue (Ring, 2008b; Busch, 2021). The most straightforward case is the impact of sustainable land use policy on local property taxes. Devoting a larger share of the land of a municipality to protected natural spaces, excludes the possibility of using them for residential, industrial or other business-related activities, and thus, it is likely that less property tax will be raised. This is probably the most sizeable channel among those represented in Figure 1, since property taxes represents the largest own-revenue source for cities across the OECD (OECD, 2021). In fact, this is the reason why the most common variable to allocate EFTs is the share of protected natural areas (Busch et al., 2021). In short, as mentioned above, the loss of tax revenue resulting from the reduction in activity associated with the correction of externalities can be interpreted as the opportunity cost of implementing effective environmental policies.

The second channel through which local governments' awareness is not translated into policy action is the limited administrative capacity (Tang et al., 2010; Reckien et al., 2018; OECD, 2023). Particularly smaller municipalities do not have enough means (human, funding, know-how) to carry out their most elemental duties, such as water provision or urban waste management, so they usually need to delegate into supramunicipal entities. When tasks are even more complex, such as designing, implementing, monitoring and evaluating effective measures to contribute to the green agenda promoted by higher levels of government, then more problems arise. Both the former and latter channels could be addressed by compensations through environmental fiscal equalisation schemes.

Figure 1. The opportunity cost of local environmental protection policies for local budgets



Note: PAYT stands for Pay as You Throw waste collection systems.

Source: own elaboration.

3. Ecological fiscal transfers

Due to the increasing salience environmental policy has gained during the last decades, scholars in Federalism have investigated the interactions between that topic and multilevel governance. The outcome is a line of research known as “Environmental Federalism” (Anderson and Hill, 1996; Harrison, 1996; Schberle, 1997). If we focus on the public finance aspect of federalism, some literature has become interested in the correlation between decentralisation levels and environmental policy ambition (Kunze and Shogren, 2008; Ardiansyah and Jotzo, 2013) and its results (Liu et al., 2017; He et al., 2017; Guo et al., 2020; Huang et Zhou, 2020).

However, if we follow the so-called Theory of Fiscal Federalism (Oates, 1972, 1999; Musgrave, 1983), then the main question posed by the previous literature has to do with possible ways in which intergovernmental fiscal relation instruments, particularly transfers, could help address environmental deterioration by supporting environmental protection policies (Ring, 2002, 2008a, 2008b; Mumbunan et al., 2012; Santos et al., 2012; Irawan and Tacconi, 2016; Busch et al., 2021). In our view, this is the key question to address in order to cope with the principal-agent problem of environmental agenda misalignment across levels of government explained in the previous section.

There are several forms to incorporate the environmental perspective in transfer allocation formulas. We will follow the classification criteria laid out by Ring (2002), according to which we could depict indirect or direct implementation of environmental variables. On the one hand, the former would use land extension or population density as proxies to internalise the positive spillovers ecosystem services provide to other jurisdictions and to the country as a whole. While these variables are often incorporated into grant allocation formulas, their actual link to

environmental goals is rather loose. On the other hand, there are at least three more direct ways to incorporate the environmental criteria:

- Earmarking certain share of funds devoted to vertical transfers to ecological and environmental services before any indicator come into play (Ewers et al., 1997; Rose, 1999).
- Including ecological functions as bases for calculating fiscal needs relevant for horizontal allocation (across jurisdiction) (e.g. to compensate regions for environmental damages, such as those caused by mining) (Busch et al., 2021).
- Earmarking a certain share of grants for environmental projects (e.g. waste disposal or water supply). For instance, this is the scope adopted by Next Generation EU funds, since a third of its total amount has to be spent in projects whose aim is to fight climate change. A similar approach has been used by some German lander to allocate funds to municipalities (Ring, 2001, 2002).

Regarding direct policies, a rich literature has been developed, which coined the concept of “Ecological Fiscal Transfers” (EFTs). This particular class of transfers are allocated according to environmental variables in order to compensate subnational governments for implementing environmental protection policies (expenditure needs), for the positive spillovers generated by them - following Olson’s (1969) fiscal equivalence theory- (Ring, 2008b; Loft et al., 2014), and for the opportunity cost (Azzoni and Isai, 1994; Ferraro, 2002; Adams et al., 2010; Karsenty et al., 2014; Nikitina, 2019; Canan and Ceyhan, 2020) represented by revenue they could have raised if, for example, certain land areas would have been assigned to productive economic activities instead (fiscal capacity) (Ring, 2008b; Busch et al., 2021).

Some EFTs implementation cases have been recorded already. The first experience emerged as a response to compensate for opportunity costs in the form of foregone revenues and took place in the Brazilian state of Parana in 1991 (Campos, 2000; May et al., 2012, 2013; Ring, 2008a). For 2020, 18 out of 27 states had adopted similar transfer programmes for municipalities. In the state of Acre, the share of transfers allocated according to environmental criteria reaches a high 20%. Other countries, such as Mongolia and Uganda, have recently introduced EFTs for expenditure needs and externality compensation, respectively, and in Australia, Poland, Switzerland or Ukraine proposals have been made (Busch et al., 2021). For its part, Droste et al. (2018a, 2019) suggested EU and international-level EFT implementation for spillover compensation.

Percentage or changes in natural protected area coverage is the predominant EFT allocation criteria. Also, most EFTs are earmarked grants, meaning that money received must be devoted to local natural conservation policies. Oppositely (and exceptionally), this is not the case in France, Portugal, and in some EFT programmes in India and Indonesia, where their EFTs are general-purpose grants (Busch et al., 2021).

However, there is no consensus on whether EFTs have achieved their goal. Droste et al. (2017) evaluated the Brazilian scheme and concluded that it increased the share of protected natural areas. For its part, Loureiro (2002) limited this positive direct effect to the first decade of the programme, suggesting there was a saturation effect. In contrast, May et al. (2012) found the opposite, and reported that in 10 out of the 13 Brazilian states analysed, the average number of new protected areas declined in absolute terms after the EFT scheme was introduced. Finally, in China, as reported by Busch et al. (2021), and contrary to Gong et al. (2020) and Yan and Honghua (2020), it was found that environmental quality improved in some provinces. Still, the cross-province analysis for the whole China has shown mixed results, with reduced pollution (Cao et

al., 2021; Cheng et al., 2023) and improved water quality -mediated by local spending on environmental protection-, but no increases in natural land cover (Miao and Zhao, 2019).

3.1. Environmental fiscal equalisation

The main goal of equalisation schemes is to enable SNGs to cover their expenditure needs given their fiscal capacity. Fiscal capacity can be defined as the revenue that a SNG can obtain for a given fiscal effort. Expenditure needs can be defined as the amount of public expenditure a jurisdiction has to devote in order to provide a minimum/sufficient/average level of public services. Best practices suggest that potential variables and outcome measures should be used when possible in equalisation schemes (Boadway and Shah, 2007) in order to minimise the room for SNGs (and for the Central Government; Onrubia, 2016) to manipulate the formula in order to attract more transfers (Courchene and Beavis, 1973; Petchey and Levchenkova, 2002 and 2004; Ferede, 2014).

Fiscal equalisation transfers have rarely been used to skew SNGs' agendas towards greener policies. France and Portugal are the only countries that have integrated EFTs in equalisation schemes. In these countries, green variables are not isolated but are mixed with the rest of variables, such as population or geographical data, used to allocate general purpose grants and represent a proxy for lowered fiscal capacity. In the case of the former, EFTs represent 15% of equalisation transfers paid to local governments. Nevertheless, the environmental component (natural protected areas) of the formula is used to determine the allocation of just a negligible 0.02% of total transfers received by French municipalities (Borie et al., 2014; Busch et al., 2021). This only slightly changed in 2019, when the programme increased its coverage by softening requirements to qualify for allocations. In the case of Portugal, the weight of EFTs is more relevant, reaching 5% of the General Municipal Fund, and the allocation variable is the percentage of land under nature protection (Santos et al. 2012; Busch et al., 2021). Droste et al. (2018b) found that Portuguese EFT had a positive impact on local-level protected areas, suggesting that the goal pursued by the policy was achieved.

There are several advantages to implementing intergovernmental incentives through fiscal equalisation in comparison to previously surveyed EFTs. First, they better respect the principle of subsidiarity and local self-government since they do not earmark grants to a specific expenditure function, which is particularly contraindicated in institutional frameworks with high quality of government. In fact, efficiency gains from better information, from policies tailored to local preferences and needs, and from increased accountability require expenditure autonomy (Oates, 1972). Second, grant earmarking is often accompanied by matching requirements (co-funding), which entails the risk of a lower take-up, as it is the case for regional policy funds or investment funding supported by EU grants (European Court of Auditors, 2020). Third, as argued by Cao et al. (2021), EFTs may help to stop the race to the bottom in environmental standards. Precisely, preventing policy competition across jurisdictions is one of the main effects identified for fiscal equalisation (Köthenbürger, 2002).

Fourth, *ad hoc* transfer schemes entail a higher risk of discretionality, in contrast with more transparent, stable, and predictable formula-based fiscal equalisation arrangements (OECD, 2021). In this line, it is recommended to use different fiscal tools for different goals, following the "one tool, one goal" rationale to avoid the risk of using an instrument to pursue contradictory goals or that due to multiple aims, none is achieved. Therefore, since the aim of environmental transfers is to compensate for increased expenditure needs (e.g forest conservation, adaptation to extreme climate events) or decreased fiscal capacity (e.g. opportunity cost of natural land use and

protection, or climate mitigation), and this is the same objective of fiscal equalisation, it is then recommended to use the latter instrument rather than *ad hoc* schemes. In addition, EFTs are often of smaller size than fiscal equalisation frameworks, thus being able to generate more modest behavioural changes on SNGs. And finally, from a political economy perspective, reforming an already existing fiscal instrument is more feasible than creating a new one (Santos et al., 2012). Therefore, amending current fiscal equalisation frameworks would provide environmental incentives with more stability and would make it easier for them to spread across institutional frameworks.

On the contrary, there is one main argument against the inclusion of green components within fiscal equalisation formulas: unconditionality. By definition, fiscal equalisation transfers are unconditioned. Consequently, there is no guarantee that they will be spent on environmental protection policies, which could have a “double dividend” effect (Goulder, 1995). This is the main reason why, traditionally, earmarked EFTs have been more frequently used. It is true that this argument would affect the climate-adaptation expenditure needs component proposed as complementary in this paper. However, the aim of the proposed green fiscal capacity component of fiscal equalisation schemes, which is the core of this article, is not to support expenditure in environmental protection, but to compensate for the loss in tax bases suffered as a consequence, to avoid disincentives for local governments to commit to the green agenda set by higher levels of government.

4. A proposal for greening local fiscal equalisation

4.1. Fiscal capacity equalisation and climate mitigation policies

In both the French and Portuguese models, environmental fiscal equalisation is carried out from the fiscal capacity side. In other words, municipalities with large shares of land covered by protected status receive more funds, and grants are also tied to other proxies for revenue loss. The main argument is compensating local governments for the opportunity cost of protecting the environment. This concept has been extensively used by the literature on Environmental Economics (Azzoni and Isai, 1994; Ferraro, 2002; Adams et al., 2010; Karsenty et al., 2014; Nikitina, 2019; Canan and Ceyhan, 2020). The opportunity cost equates to the economic cost of economic activity restrictions imposed by environmental protection policies. This utility loss for firms and households equals the amount of their surplus eliminated by the internalization of a negative externality through green policies. Lowered firms’ benefits and lower households’ income, and thus lowered fiscal bases within the jurisdiction, reduce its fiscal capacity (defined as the tax revenue raised applying standard effort).

Indeed, municipalities would be compensated for this loss through the environmental fiscal capacity component of an environmental equalisation system. And this is precisely the idea that justifies introducing the environmental component in SNGs’ equalisation schemes.

In a very simplified form, the theoretical framework would be as follows. Assume two municipalities (M1, M2), identical in terms of capital and labour endowments ($K_1=K_2$; $L_1=L_2$), population ($P_1=P_2$) and per capita income/wealth ($R=R_1=R_2$). R represents, at the individual level, the result of short-term maximisation of private surpluses of firms and households. In the long run, due to negative environmental externalities, individual utility function maximising behaviours do not maximise social utility.

Under the assumption that the local tax base (B) is directly related to individual income or wealth, then the tax base of M1 is $B1=P1 \cdot R1$ and that of M2 is $B2=P2 \cdot R2$. Since both municipalities have identical characteristics, then $B1=B2$. If both jurisdictions design and implement a local tax system that requires the same tax effort ($t=t1=t2$) for taxpayers, the corresponding fiscal capacities would equate $T1=t1 \cdot B1$ and $T2=t2 \cdot B2$, and thus, $T=T1=T2$.

We assume that before public intervention, both municipalities have the same environmental problems. However, they implement measures that differ on size, design or implementation effectivity. Therefore, each jurisdiction's intervention will lead to different opportunity costs, C1 and C2. Considering that M1's intervention corrects negative environmental externalities to a larger extent than M2's, then $C1 > C2$.

Consequently, economic capacities become $R-C1$ and $R-C2$, and their tax bases, $B1'=P1 \cdot (R-C1)$ and $B2'=P2 \cdot (R-C2)$, with $B1' < B2'$, and hence $T1' < T2'$. Due to the higher opportunity cost generated by M1's environmental protection policy, an argument to compensate M1 through an adjustment in the fiscal capacity component of the fiscal equalisation formula emerges. The compensation amount (S) should be determined to restore the equality $B1'=B2'$, and subsequently the identity $T1'=T2'$, such that $S=P \cdot (C2-C1) \cdot t$. Otherwise, jurisdictions' incentives to implement ambitious and thus costly environmental policies will be reduced.

4.2. Expenditure needs equalisation and climate adaptation policies

When climate policies are discussed, in addition to mitigation policies that aim to prevent the increase in temperatures, adaptation policies can also be considered. Adaptation policies try to help cities and infrastructures to remain resilient and liveable once temperature increases. While mitigation-oriented environmental policies, such as restrictions on the use of cars or land uses, generate an opportunity cost in terms of revenue losses, as discussed in the previous section, adaptation policies are linked to an increase in expenditure needs. Variables used by most EFT schemes, or the French and Portuguese green fiscal equalisation components, are related to mitigation and prevention, but have little to do with adaptation. However, there are strong arguments supporting consideration of environmental variables related to the expenditure needs component of fiscal equalisation formulas too.

In fact, protecting neighbourhoods from the rise in the level of the sea or rivers or creating cities liveable during longer and hotter summers, require large investments in the present. Although large climate adaptation infrastructure policies are usually carried out and funded by regional or central governments due to their magnitude, when these infrastructures are circumscribed to cities, it is local public budgets that have to support these projects. For instance, if a capital city would decide to reform its streets and urban design in order to alleviate the "Urban heat island effect" it would have to assume its costs. This is why an expenditure need component to support municipalities that have a greater need for climate adaptation could complement the fiscal capacity component previously introduced so both sides of fiscal equalisation would consider environmentally related variables when allocating transfers across municipalities.

As is the case when unemployment, poverty and inequality rates (i.e., variables which can be manipulated by governments) are used to compensate SNGs' increased expenditure needs in social assistance through fiscal equalisation, moral hazard problems could arise when municipalities are compensated for their vulnerability to extreme climate events or their higher need of adaptation to face the consequences of climate change. Periodic evaluation of progress in adaptation policies could be used to build indicators for related expenditure need equalisation that

help address potential moral hazard issues. Yet, the cost of climate inaction is forecasted to be so high (EEA, 2007; Stern, 2007) that receiving more transfers would never compensate damages produced due to insufficient adaptation. Furthermore, even if the impact of local environmental policies is of critical importance, isolated local climate action will not obviate the need for adaptation. Therefore, it seems fair to support more vulnerable municipalities.

In the following sections, inspired by international experiences and the discussion developed in the previous sections, we present our proposal to introduce an environmental component into the local equalisation scheme. We discuss the methodology used to build the Local Sustainability Index, a composite index that incorporates both the opportunity cost in terms of fiscal capacity (LSI) and the increase in expenditure needs (LSI+). First, we justify the use of the variables selected to construct the synthetic LSI. Second, we carry out the regressions (OLS-approach) and Principal Component Analysis (PCA) needed to calculate the value of the index for each municipality. Then, to illustrate the proposal, and due to the lack of data for the rest of Spanish municipalities, we apply the index to the current Basque local equalisation system and provide figures on how fiscal transfers received by Basque municipalities would have changed for the 2016-2019 period under our proposal. In the following section we describe in some detail the local funding systems in the Basque Country.

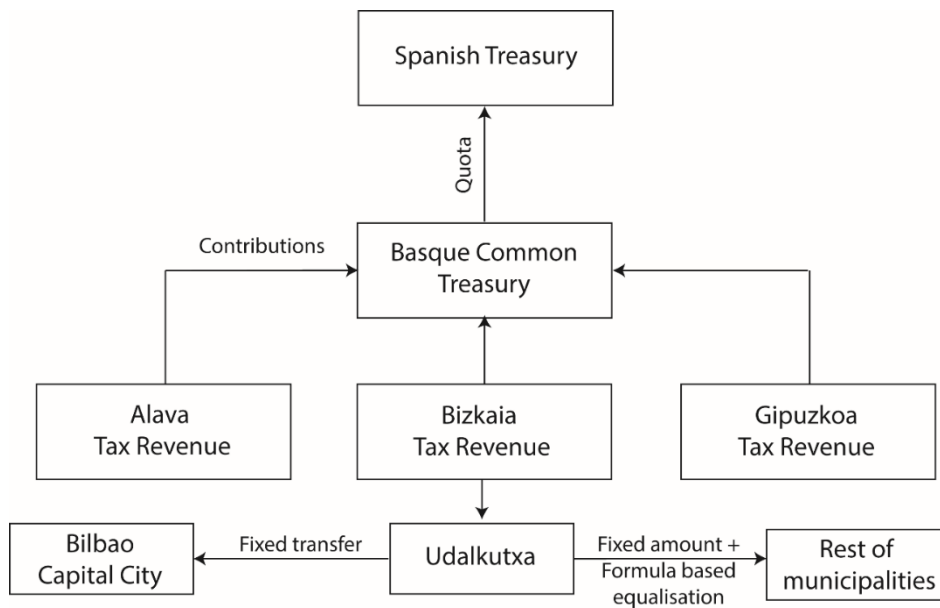
5. Basque Local Funding Systems

The public finances of institutions of this region of Spain are governed under a special funding regime called the “Economic Agreement”. The agreement provides the Basque provinces (Alava, Bizkaia and Gipuzkoa) with a very high degree of tax autonomy, and with freedom to design their own formulas to support municipalities within each of the three jurisdictions. The Economic Agreement defines two types of intergovernmental fiscal relations, illustrated in Figure 2: external and internal. External relations refer to those between Basque institutions and Spanish institutions, such as the “Quota”. Tax revenue collected by the three provincial treasuries is first used to fund the Quota paid by the Basque Regional Government to the Spanish Treasury for public services and goods provided by the Central Government. Internal relations refer to revenue allocation between Basque institutions. Around 70% of funds accrue to the budget of the Basque Regional Government, responsible for the main spending programmes, such as healthcare or education, 18% is retained by provincial governments, and the last 12% is distributed by each province across municipalities within its jurisdiction.

The Economic Agreement recognises Basque provinces’ autonomy to organise their own local funding scheme, in contrast to the homogeneous regime in force for the rest of Spanish municipalities. Therefore, the local equalisation formula in the three provinces differ, although the economic relevance of transfers for local budgets is similar, ranging between the 43% and 53% of local revenue in 2018 (OCTE, 2020). Also, the structure of the three schemes follows a similar rationale. First, the global amount of transfers for local entities is determined according to the revenue expected to be raised by the provincial tax administration. Second, this funding cap is allocated across the capital city, which receives a fixed amount, and the rest of municipalities. This second component is distributed according to the local equalisation formula. Although the three Basque provinces apply a very similar formula, the variables used and weights attributed to them differ. As observed in Figure 3 for the municipal financing fund (*Udalkutxa*) of the province of Bizkaia, grants are mostly based on indicators of expenditure needs, such as population, the

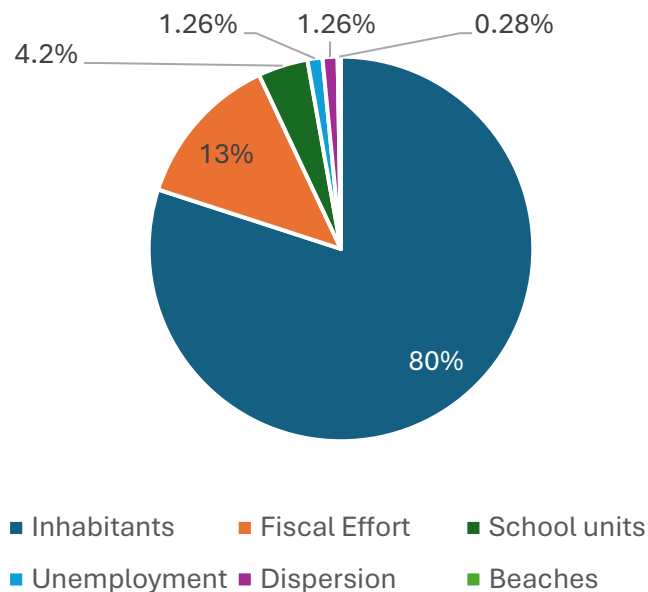
number of school units, unemployment, population dispersion or the existence of beaches. The revenue component is incorporated through the fiscal effort, which represents 13% of the funds transferred. Fiscal effort is defined as the gap between potential and actual revenue in five local taxes, and its inclusion in the formula is meant to introduce incentives against local tax competition. This component represents 5% of transfer allocation in Alava and 3.5% in Gipuzkoa. However, in the latter case an additional 3% is determined according to the inverse of local income as a proxy of fiscal capacity. Transfers received are not earmarked, meaning that municipalities can use them to fund any programme within their jurisdictional competence.

Figure 2. Basque Intergovernmental Fiscal Relations System (and Bizkaia’s municipal financing fund)



Source: own elaboration.

Figure 3. Local Fiscal Equalisation formula of Udalkutxa (Bizkaia)



Source: own elaboration based on OCTE (2020).

6. The Local Sustainability Index

In this section, we further elaborate the proposal for incorporating a green component to local fiscal equalisation scheme by making use of the current local equalisation systems of the Basque Country, described above. Although we would have preferred to use data from all Spanish municipalities, including those who receive their funding through the so-called “common regime” (7,880), data limitations led us to restrict our sample to the 251 Basque municipalities (51 in Araba, 112 in Bizkaia, and 88 in Gipuzkoa).

We will build two indices, one related to changes in fiscal capacity associated to climate mitigation policies (named after “Local Sustainability Index”; hereinafter LSI), and the other additionally related to changes in expenditure needs motivated by climate adaptation policies (LSI+). Composite indicators concentrate complex information and data in just one number, and thus are useful because they allow us to make comparisons based on more than one variable, across different institutional frameworks and time periods. In addition, together with scoreboards and rankings, composite indices are increasingly being used for policy evaluation and communication in all kinds of policy areas, from innovation to sustainability, as they should be easy to interpret (OECD and EC JRC, 2008). Oppositely, usual criticisms focus on the high degree of discretion in their design and argue that aggregation can sometimes lead to important information losses.

6.1 Data and variable selection

We first explain how we have constructed the local environmental performance index LSI, which we will use to re-allocate 5% of the equalisation transfers received by municipalities. The first step in the construction of the LSI is the selection of the variables that will compose it. Our database is based on [Udalmap](#), a data platform developed by the Basque Government that includes local-level data for hundreds of variables, of which 50 are related to the environment. We discard those without availability or variability for the selected period, or without apparent relation with local tax capacity and with green outcomes of local policies. As a result, we have restricted the sample to 18 variables divided into seven different environmental areas whose correlation with fiscal capacity will then be tested. Also, although the availability of some of them ranges from 2005 to 2021, in order to get a comprehensive index, we needed to work with a fully balanced panel, which was only possible for the years 2016-2019. Still, we consider that this period allows us to achieve representative results, since these years cannot be considered outliers in terms of economic or fiscal performance.

Table 2 lists the 18 variables used across the seven environmental domains (water, air quality, energy, transport and mobility, touristic pressure, soil use and waste), provides information about their measurement units and the expected sign or their correlation with environmental desirability, and justifies their link with fiscal capacity. Municipalities have the capacity to influence all these variables through policies that lie within their responsibility, including regulation, provision and taxation. For instance, urban waste generation is related to higher economic activity, and in particular tourism, and thus to higher tax capacity, and can be influenced by local policies, such as “Pay as Your Throw” tax schemes (Gatto and Montes, 2021).

Table 2. Selected variables for the Local Sustainability Index

Name	Measurement Units*	Environmental correlation sign	Justification
Water			
Water demand	litres/inhabitant/day	-	Industry and agriculture are water intense and pose a risk for its quality. Both generate an economic and tax revenue impact. Water management and fees are local. Higher economic activity -> Higher local tax capacity, but at the cost of -> Higher water demand and risk of water pollution
Health quality of consumption water	0-3 Index	+	
Air Quality			
PM10µg/m ³ excess and number of heavy pollution episodes (OMS 2021 thresholds)	Normalised (50% of weight for each indicator)	-	Mobility, housing, and industry are the main air polluter sectors. These activities broaden the local tax base. Municipalities are responsible for urban mobility (e.g. congestion charges, LEZ...), and share responsibilities on urban planning and housing. Higher economic activity, ownership and use of private vehicles, and use of heating -> Higher local tax capacity, but at the cost of -> Worse air quality
NO2µg/m ³ excess and number of heavy pollution episodes (OMS 2021 thresholds)	Normalised (50% of weight for each indicator)	-	
O3µg/m ³ excess and number of heavy pollution episodes (OMS 2021 thresholds)	Normalised (50% of weight for each indicator)	-	
Energy			
Installed photovoltaic power capacity	kW per 10.000 inhabitants	+	Renewable power installations compete with economic activity for the use of land, therefore at the cost of local tax revenue. Energy consumption not only generates local tax revenue but is also a proxy of higher economic activity and income. Energy efficiency certificates are only required for selling and renting real estate, therefore are also correlated with higher local tax capacity. Municipalities share responsibility for land use, energy efficiency implementation and certification on buildings. Higher economic activity and income, and a more dynamic real estate market -> Higher local tax capacity, but at the cost of -> Less available land for renewable energy installations (and more real estate with energy efficiency certificates)
Installed wind power capacity	kW per 10.000 inhabitants	+	
Annual non-industrial electricity consumption	kW per inhabitant	-	
Housing with energy efficiency certificates	% housing units	+	

* Variables are normalised to have zero mean and one unit of standard deviation, to allow data aggregation afterwards.

**Although this variable has not a direct environmental meaning, it has been included to adjust worse performance in the transport and mobility indicator of rural and more remote municipalities for an increased need of car ownership, allowing comparability and following fair ecological transition political economy rationale (Boroumand et al., 2022).

Source: own elaboration, based on Udalmap.

Table 2. Selected variables for the Local Sustainability Index (continuation)

Name	Measurement Units*	Environmental correlation sign	Justification
Transport and mobility			
Vehicles	Vehicles per inhabitant	-	Vehicles and transport sector generate an economic impact and increase local fiscal capacity. Municipalities are responsible for the urban design and the definition of uses of land and public space. More economic activity and income -> Higher local tax capacity, but at the cost of -> Increased vehicles ownership and use and higher share of land devoted to transport and communication infrastructures.
Land dedicated to transport and communication infrastructure (excluding roads)	0-100	-	
Detour to reach the capital of the province* *	0-100	+	
Touristic pressure			
Touristic accommodations	% inhabitants	-	Tourism generates an economic and tax revenue impact Higher touristic activity -> Higher local capacity
Soil use			
Surface covered by forest	0-100	+	Use of soil determines activities that can be carried out, generating (or restricting) economic and tax revenue impact. Municipalities are responsible of defining soil uses. Higher economic activity -> Higher local tax capacity, but at the cost of -> Less soil devoted to natural landscape.
Artificial surface	0-100	-	
Non-developable surface	0-100	+	
Waste			
Urban waste generation	kg/inhabitant/year	-	Large-scale retail and tourism-related activities generate economic and tax revenue impact, but also affect waste generation. Waste management is a local responsibility (e.g. municipalities can raise revenue through fees or PAYT schemes) Higher economic activity (retail, tourism) -> Higher local tax capacity, but at the cost of -> Higher volumes of mixed waste
Urban waste collection separation rate	0-1	+	

* Variables are normalised to have zero mean and one unit of standard deviation, to allow data aggregation afterwards.

**Although this variable has not a direct environmental meaning, it has been included to adjust worse performance in the transport and mobility indicator of rural and more remote municipalities for an increased need of car ownership, allowing comparability and following fair ecological transition political economy rationale (Boroumand et al., 2022).

Source: own elaboration, based on Udalmap.

6.2 Composite Index methodology

Next, we use two alternative methodological approaches, Ordinary Least Squares and Principal Component Analysis (PCA), to select the variables significantly related to local tax revenue and then aggregate them to obtain the LSI.

6.2.1 OLS approach

We first regress local tax revenue per capita on the eighteen variables reported in Table 1. As Table 3 shows, all variables involved in each of the seven sub-indexes are significantly related to tax revenue, except for the PM10 Index and the number of touristic accommodation spots. Also, the sign of the relationships is the expected one, with the only exception of non-developable surface, and renewable energy source installations, as we would have expected to find a negative sign. The positive relationship we find could respond to increased agricultural activity in the former case, and to compensations payments for renewable power installation in the later.

Interpreting the sign of coefficients reported in Table 3 is relevant regarding the justification of the selection of variables used to design the LSI. Indeed, selected variables are supposed to be positively or negatively correlated with fiscal capacity of local governments. However, these signs are not used to calculate the value of LSI sub-components. Since the rationale behind the LSI is to honour good and penalise negative environmental performance, variables are included in the formula according to the environmental correlation sign presented in Table 2 instead. Therefore, coefficients reported in Table 3 are only used to determine the weight each variable has within the corresponding LSI sub-component. For example, the share of artificial surface is positively correlated with fiscal capacity (Table 3). However, the existence of larger shares of artificial surface is an undesired outcome in environmental terms (Table 2). Consequently, this variable will enter the formula to compute the Soil LSI sub-component with negative sign.

We then use the estimated coefficients reported in Table 3 -rescaled to add up to 1 for each category- as the weights to calculate the seven sub-indexes to measure the environmental performance of each municipality in each domain. At this point, the signs of the variables have been modified to reward environmentally desirable outcomes and punish undesired ones, as defined in Table 2. As a result, the larger the sub-index is, the better the environmental performance. As an example of how to interpret these outcomes, forest surface is significantly and negatively correlated with local tax revenue per capita. It determines 26,6% of the value of the soil sub-index. Therefore, an environmentally friendly policy such as increasing forest surface has a potentially negative impact on fiscal capacity of a municipality. As a municipality with larger forest surface will have a larger LSI, through the soil sub-index, then that municipality would be compensated through a larger transfer allocation.

Table 3. OLS Regression results that test the correlation between variables and Local Tax Revenue per capita

Local Tax Revenue per capita	(1) Water	(2) Air	(3) Energy	(4) Transport	(5) Tourism	(6) Soil	(7) Waste	(8) All	(9) Sub-Indexes Weights
iPM10		0.0306 (0.0524)						0.0269 (0.0354)	0.0773113
iNO2		0.122* (0.0648)						-0.118** (0.0541)	0.3078061
iO3		0.243*** (0.0566)						0.0199 (0.0451)	0.6148826
Water demand	0.196*** (0.0188)							-0.172*** (0.0279)	0.8128221
Water quality	0.0452** (0.0188)							0.0546** (0.0232)	0.1871779
Photovoltaic			0.0267** (0.0136)					-0.0100 (0.0253)	.0365105
Wind power			0.132*** (0.0136)					0.171*** (0.0235)	0.1805779
Electric consumption			0.528*** (0.0137)					0.524*** (0.0298)	0.7216687
Efficiency certificate			0.0448*** (0.0135)					0.0582* (0.0324)	0.0612429
Vehicles				0.315*** (0.0146)				0.162*** (0.0335)	0.3434649
Infrastructure				0.384*** (0.0147)				0.151*** (0.0272)	0.4183523
Detour to the capital city				-0.219*** (0.0147)				-0.136*** (0.0255)	0.2381828
Touristic posts					0.00384 (0.0163)			-0.0244 (0.0237)	-

Source: own elaboration.

Table 3. OLS Regression results that test the correlation between variables and Local Tax Revenue per capita (continuation)

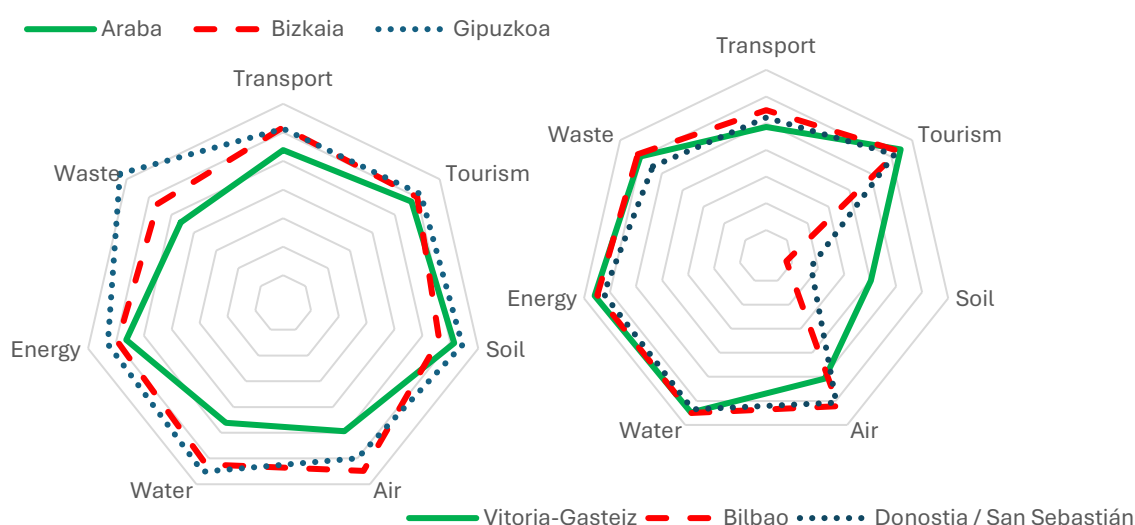
Local Tax Revenue per capita	(1) Water	(2) Air	(3) Energy	(4) Transport	(5) Tourism	(6) Soil	(7) Waste	(8) All	(9) Sub-Indexes Weights
Artificial surface						(0.0226) 0.358***		(0.0318) 0.431***	0.3501549
Non-developable surface						(0.0611) 0.393***		(0.112) 0.420***	0.38359
Waste generation							0.328***	0.146***	0.7219639
Separate collection							(0.0222) 0.126***	(0.0290) 0.0718**	0.2780361
Constant	0.00168 (0.0187)	-0 (0.0360)	0.00123 (0.0135)	-0 (0.0145)	0 (0.0163)	0 (0.0191)	-0.0533** (0.0208)	0.00333 (0.0230)	
Observations	2,750	753	3,755	3,514	3,765	2,510	2,144	736	
R-squared	0.039	0.027	0.315	0.259	0.000	0.081	0.093	0.623	

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Source: own elaboration.

As shown in Figure 4 and in Table A1 (Annex A), and even if there are many differences within provinces, overall, municipalities in Araba show the worst sustainable performance on average, whereas municipalities in Gipuzkoa stand out as the best. In fact, the latter scores the best in every area but air quality, which is led by Bizkaia. The most significant differences are observed in the area of urban waste management, where Gipuzkoa surpasses the other two jurisdictions by a wide margin. This is not surprising since the province is usually presented as an example of good practices in this policy area (Gatto and Montes, 2021; Gainza and Montes, 2023). If we look into the figures for the three capital cities, they record really similar numbers, with Donostia lagging slightly behind. It is soil use the area in which Vitoria-Gasteiz stands out when compared to Donostia and Bilbao, due to the larger extension of the former, which allows for higher shares of natural surface within local borders.

Figure 4. Average subindex values for the three Basque provinces and capitals (2016-2019, unweighted)



Source: own elaboration.

Finally, these sub-indexes are aggregated to construct the LSI by following the same method. First, the seven sub-indexes have been used as regressors to try to explain local tax revenue per capita. Then, the estimated coefficients have been rescaled to sum up 1 so they can be used as weights to aggregate the seven environmental sub-indices into one composite LSI. Touristic pressure area has been excluded due to the lack of significance of the sub-index on tax revenue per capita, which suggests this area would not be relevant. LSI follows a normal distribution and adopts values ranging between -2.89 and 0.58.

Once again, estimates in Table 4 show that higher environmental performance is related to a lower local tax revenue per capita, with the only exception of water. Again, the signs are relevant only regarding the motivation of the use of the subindexes, as only estimated coefficient magnitude are used to compose the LSI. These estimates support the rationale for compensating for the erosion of tax bases arising from environmental protection through green fiscal equalisation. Consistently, while energy and transportation would have the highest weights in the final index, water and soil use would be the ones with the lowest.

Table 4. OLS Results for Sub-Index aggregation

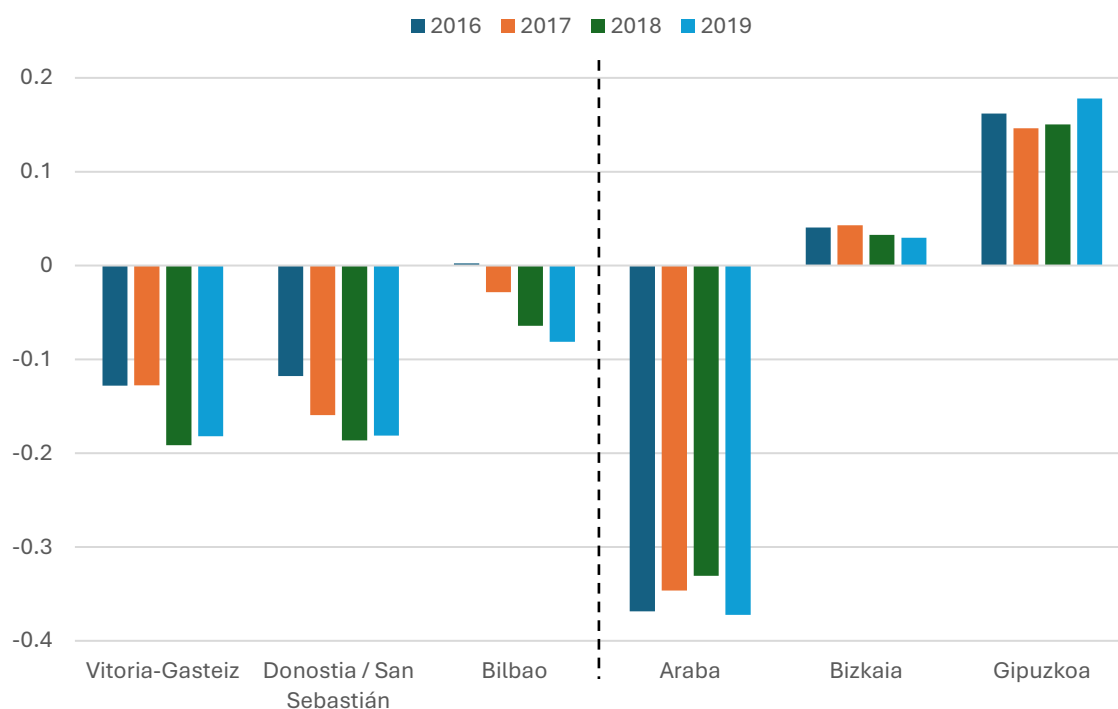
Local Tax Revenue per capita	OLS	Weights
Water	0.142*** (0.0305)	0.0779625
Air Quality	-0.271*** (0.0610)	0.1488469
Energy	-0.615*** (0.0369)	0.3378964
Transport and mobility	-0.556*** (0.0473)	0.3052592
Touristic pressure	0.0310 (0.0229)	
Soil use	-0.0637** (0.0259)	0.0349719
Waste	-0.173*** (0.0299)	0.0950632
Constant	0 (0.0225)	
Observations	1,004	
R-squared	0.492	

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Source: own elaboration.

Once the six sub-indexes are gathered, results are consistent with those commented in Figure 4, as Figure 5 illustrates. Indeed, while municipalities in Araba perform worse than their peers in Bizkaia and Gipuzkoa, it is Bilbao the city that stands out over Vitoria-Gasteiz and Donostia. There are no clear patterns over time. Cities tended to worsen their performance between 2016 and 2019, but this was not the case for the unweighted average for the provinces. However, cross-province comparisons are not as relevant as within-province differences, since municipal funds are allocated according to three different provincial funds.

Figure 5. Local Sustainability Index for three provinces and capitals



Source: own elaboration.

6.2.2 Principal Component Analysis

As an alternative methodological approach, we use Principal Component Analysis (PCA) to build the LSI. PCA is one of the most broadly used techniques to design composite indicators, as it is viewed as a less discretionary methodology when compared to alternative approaches (OECD and EC JRC, 2008). The objective of this methodology is to keep the largest variance of the data as possible in the fewest linear combinations of the original variables as possible. In our case, we use the same 18 variables enumerated in Table 2, after which PCA outcomes suggested some most correlated variables should be dropped in order to attain a more efficient and simpler index, while retaining most of its explicative power/variability. With this aim, we retained 13 out of the 18 variables and the first six principal components. We lowered the usual threshold for eigenvalue equal or higher to one to 0.94 to reach an explicative power of 79%. Together with both, Kaiser-Meyer-Olkin (KMO) measure of 0.7 and a p-value equal to zero in the Bartlett's test of sphericity, they suggest that our specification is correct.

Table 5. Principal Components

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	3.68924	1.33301	0.2838	0.2838
Comp2	2.35623	1.14834	0.1812	0.4650
Comp3	1.20788	.132733	0.0929	0.5579
Comp4	1.07515	.0644805	0.0827	0.6407
Comp5	1.01067	.0741336	0.0777	0.7184
Comp6	.936537	.191177	0.0720	0.7904

Source: own elaboration.

Under this specification, PCA extracted six principal components. Next, Table 6 shows the loadings⁶ of each variable within each of the six components extracted, grouped according to their sign. As it can be observed, PCA suggests dropping certain variables (PM10, photovoltaic energy installed power and touristic pressure) because their correlation with the rest of the variables was so high that it resulted in a great loss of explanatory power. Variables with the greatest explanatory power are those more often used in EFTs and related to soil use, such as artificial surface, and non-developable surface, followed by NO2 air pollution index. Within variables with negative factors, those with the highest explanatory power are O3 air pollution index, car ownership and water demand. In this case, LSI follows a normal distribution and adopts values that range between -3.65 and 2.83.

Table 6. Principal Component Loadings

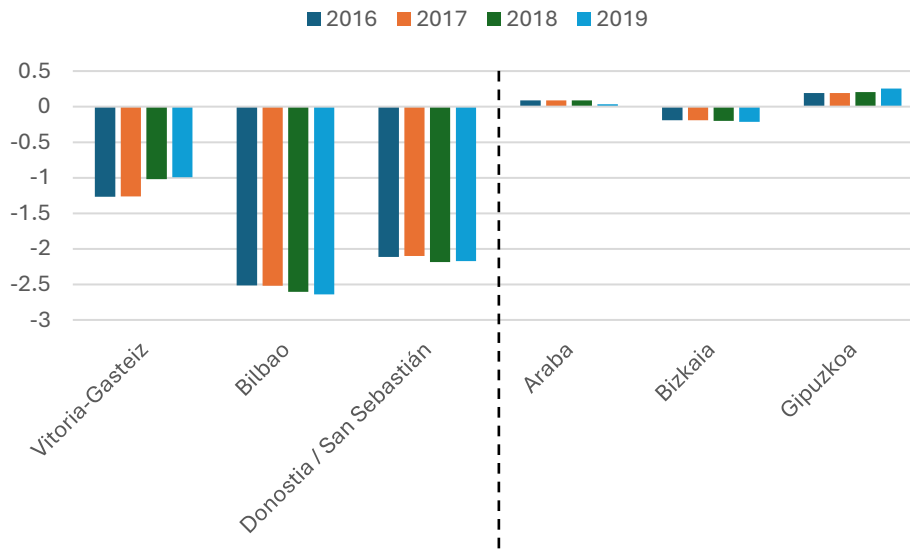
Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6
Artificial surface	.4648	.2024	.09075	-.009403	.00094	-.06881
Non-developable surface	.4639	.2046	.1058	.008776	.006139	-.07935
NO2 $\mu\text{g}/\text{m}^3$.4586	-.04973	.07579	-.264	.02861	.009112
Surface covered by forest	.2147	.4244	.1523	.2723	.01102	-.01271
Urban waste collection separation rate	.09578	.245	-.5592	.3616	-.1163	.0308
Installed wind power capacity	.08991	-.1261	-.06678	.1845	.5767	.7615
O3 $\mu\text{g}/\text{m}^3$	-.4013	.1648	.2144	.3166	-.000187	-.06824
Vehicles	-.3013	.2462	.01365	-.4741	-.01626	.1226
Water demand	-.1727	.4187	-.04127	-.01107	.06296	.1343
Non-developable surface	-.08156	.4524	-.1234	.1913	-.02338	-.004158
Health quality of consumption water	-.05797	.03788	-.1702	-.0473	.7867	-.5836
Detour to reach the capital of the province	-.04914	.09569	.7365	.1959	.1401	.004569
Annual non-industrial electric consumption	-.03066	.4247	-.00441	-.5374	.09786	.1716

Source: own elaboration.

⁶ PCA loadings illustrate the importance of independent variables. As coefficients in regressions, they represent the size of the contribution of independent variables to the components.

In this case, as Figure 6 shows, Bizkaia and Bilbao are the worst performers, with Gipuzkoa still as the best ranked province and Vitoria-Gasteiz as the best capital this time. Results for each municipality can be observed in Table B1 (Annex B). Finally, it should be mentioned that differences in results between Indices built using the two methodologies are reasonable. In fact, not all variables used in econometrically-based Index have been retained in the PCA-based Index and while the rationale for signs and weight of the former came from correlations towards per capita local tax revenue and theory, variability maximisation was the criteria applied in the latter case. Therefore, even though the PCA approach could be technically superior regarding some mathematical properties, we consider that the OLS approach might be more useful for policymakers due to operational management improvements, such as increased transparency, and understandability for local stakeholders of the formula used.

Figure 6. Local Sustainability PCA Index for three provinces and capitals



Source: own elaboration.

6.3 Using LSI for greening local equalisation

Once the LSI has been constructed, we will use it to re-allocate 5% of the equalisation transfers received by municipalities, as in the Portuguese model. So, in a first approach, 5% of the municipal equalisation fund of each province ($0,05*U$) is redistributed according to the unitary value of the index (V) in this province. Unitary value is the amount of funds paid by each unit of population-weighted LSI ($\frac{p_i}{p} * LSI_i$):

$$V = \frac{0,05 * U}{\sum_{i=1}^n \frac{p_i}{p} * LSI_i} \quad (1)$$

The participation of each municipality in the share of funds allocated according to the LSI (U_i) is then calculated as the product of its unitary value, times the value of LSI for this municipality multiplied for its relative population:

$$U_i = V * LSI_i * \frac{p_i}{p} \quad (2)$$

Or, equivalently:

$$U_i = \frac{p_i * LSI_i}{\sum_{i=1}^n p_i * LSI_i} * 0,05 * U \quad (3)$$

In order to interpret the results of the new system, it should be kept in mind that each municipality would stop receiving 5% of its current participation in the *Udalkutxa* of its province that, as explained in Section 5, mostly depends on population:

$$Loss_i \approx \frac{p_i}{p} * 0,05 * U \quad (4)$$

In exchange, that share would be allocated according to each municipality's performance on the LSI relative to the rest. In summary, the municipalities that would gain from the change would be those whose per capita environmental performance is better than the average:

$$\frac{p_i * LSI_i}{\sum_{i=1}^n p_i * LSI_i} > \frac{p_i}{p} \quad (5)$$

So that,

$$LSI_i > \frac{\sum_{i=1}^n p_i * LSI_i}{p} \quad (6)$$

However, the main goal of our proposal lies on setting incentives for local governments to improve their efforts to promote sustainability. Yet this way municipalities in a good starting position would be better-off and receive extra transfers with neither any effort nor improvement. To solve this, we consider a second approach that will allocate 2.5% of the fund based on the baseline index and the other 2.5% according to the year-by-year variation⁷ of the index in order to reward not only relative environmental performance, but also relative improvement. It should be kept in mind that since the transfer allocation formula works as a zero-sum game, transfers are allocated according to scores that are relative to the performance and evolution on the performance of the rest of municipalities within each province.

As local funding models for each of the three provinces differ in terms of the variables used and their associated weights, we will follow an approach that allows for equal treatment to every municipality (horizontal equity). Thus, two municipalities of the same size with the same score in the LSI would participate in the same share in the municipal transfer fund of its province. Thus, heterogeneities in per capita funding levels in this case would come from the amount of local funds provided by each provincial government. Therefore, although up to this point all municipalities have been equally treated in the computations regardless of the province they belong to, this will be relevant in the following steps.

Finally, the implementation of the expenditure needs component caused by climate adaptation is proposed. To do so, we use the Local Climate Change Vulnerability and Risk Index created by the Basque Public Agency for Environmental Management (Ihobe, 2019). It actually comprises four indices that measure the risk of each municipality to suffer effects of heatwaves on human health, of draughts on agriculture, and to suffer effects of floods caused by an increase in sea or

⁷ Year-by-year variation of the LSI is calculated and normalised. Then the formula described above for the baseline case is again applied. First, the unitary value is computed to calculate the participation based on year-by-year change on LSI.

river levels. In particular, we have made use of the risk indices on the worst-case scenario (RCP 8.5) for the 2071-2100 period. In order to synthesise all four variables in just one composite index, we have calculated the average out of the maximum values for heat and water-level related indicators. This way, we are able to concentrate all the adaptation-need information in just one variable ranging from 0 to 2, with higher values indicating a greater need for adaptation. Again, the formula applied to link environmental variables with local funding replicates the one described above. Yet, in this case 2.5% of the local fund would be allocated according to climate mitigation related fiscal capacity equalisation (1.25% according to the base value of LSI and 1.25% according to the year-on-year change of LSI), and another 2.5% according to climate adaptation related expenditure need component described in this paragraph, the combination of both resulting in the LSI+. It should be noted that in the latter case, although desirable to avoid moral hazard issues, evolution cannot be considered due to lack of data availability.

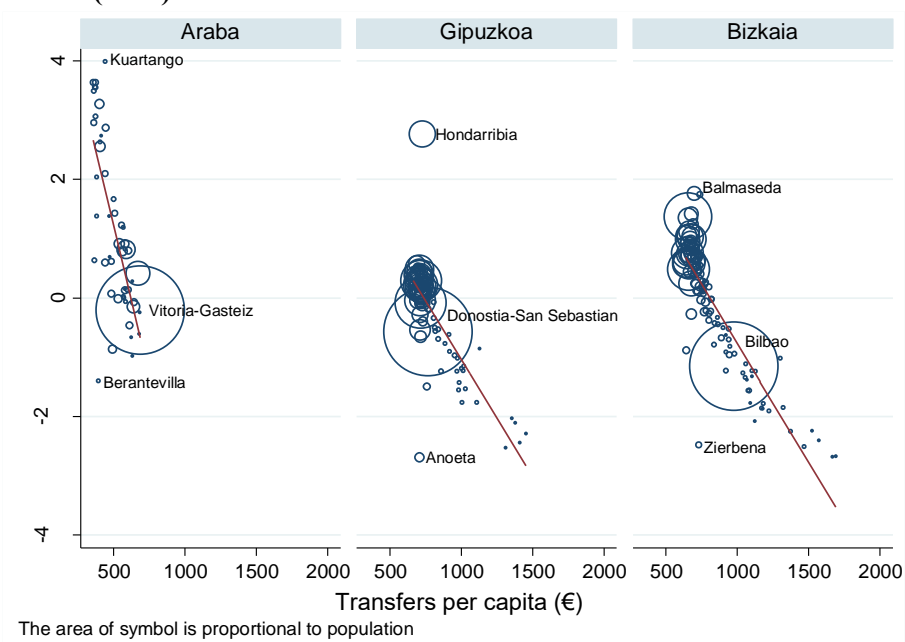
7. Results

We will start by providing the results of the LSI application in the two scenarios explained in the previous section. The first scenario will redistribute 5% of the municipal equalisation fund of each province according to the base value of the index. In contrast, the second scenario will allocate 2.5% of the fund based on the same variable and the other 2.5% according to the year-by-year variation of the index in order to reward not only relative environmental performance, but also relative improvements in it. This section only includes detailed results for the latter scenario, which is the preferred one. Detailed figures of per capita transfers for each municipality under each of the scenarios considered are reported in Table C1 (Annex C).

Figure 7 shows the distributive results the green fiscal equalisation reform based on the LSI would have on local transfers, under the OLS approach, when considering the year-by-year variation. As it can be observed, current local funding systems provide a relatively uniform funding across municipalities. Looking to the data in Table C1 (Annex C)⁸, we could state that Araba's system is the one that provides overall less funding per capita (480€ on average), but also the most evenly distributed (with a standard deviation value of 100€), despite being the one that benefits its capital the most (645€), when compared to Gipuzkoa's (706€ for the capital vs. 750€ provincial average) and Bizkaia's (913€ for the capital) systems. While Bizkaia's system is the most generous (803€), it is also the least evenly distributed among municipalities, since it records the largest standard deviation in per capita funding (with a value of 235€).

⁸ Data also represented in maps at Annex D: Figures D5, D6, and D7.

Figure 7. Change in per capita transfers (%). Current system vs. 2.5% base + 2.5% change OLS-based Index (2019)



Source: own elaboration.

Environmental fiscal equalisation reform would improve the equity of Basque local funding systems, as currently neglected fiscal capacity and expenditure needs would then be considered within the equalisation formula. To the extent that equalisation is aimed at facilitating the provision of similar levels of services at equal tax effort, a reform of the instrument that improves the construction of tax capacity and expenditure needs would enhance the equity of the funding system.

Furthermore, environmental performance of small municipalities measured by the LSI is systematically better than for large cities, and this is also reflected in the change in per capita transfers the green reform would have. Distribution of gains and losses depending on municipality size would differ in each province. While small municipalities in Araba would be, overall, better-off after a reform, the opposite would be true in Bizkaia and Gipuzkoa, where it is medium-sized municipalities the ones that would register the largest wins. This can be explained because it is smallest municipalities those that receive the largest per capita allocations under the current local funding system, since it includes a fix amount paid equally to every municipality to support fixed costs (in 2019: 21,035.42€ in Araba; 84,141.69€ for smallest municipalities in Gipuzkoa; 81,137€ in Bizkaia). Also, the outcome in Araba differs because there is a lack of intermediate cities, with a large population difference between the capital city and the rest of municipalities.

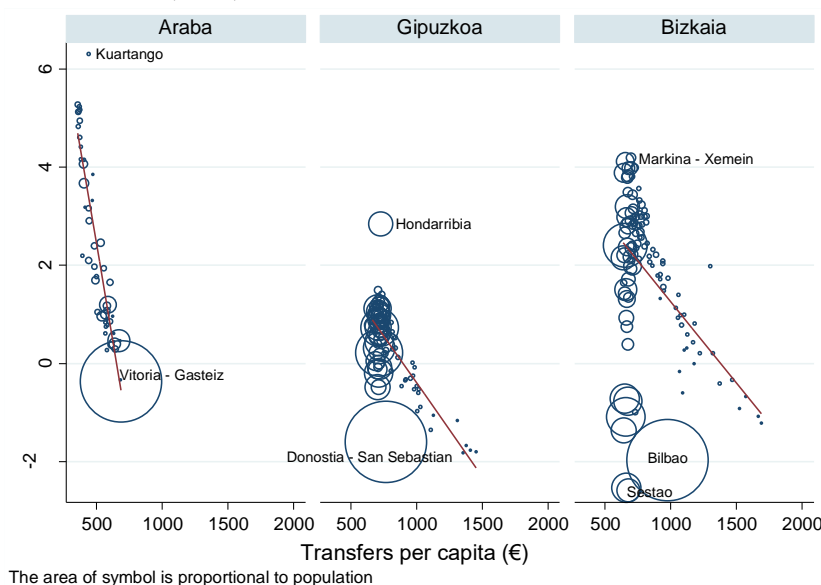
Results are very similar when compared with the baseline reform scenario (Figure D1, Annex D), that neglects the year-by-year change in LSI. However, the scenario illustrated by Figure 7 shows more even results for Araba and Bizkaia as winners and losers do not record as extreme values, while the opposite is true for Gipuzkoa. Indeed, under the baseline scenario (Figure D1, Annex D), the transfer loss recorded by worst-off municipalities in Araba and Bizkaia would almost double. This can be explained because these municipalities, Berantevilla (-3.5% in baseline vs. -1.4% in base+change) and Zierbena (-4% in baseline vs. -2.7% in base+change), are bad environmental performers, but show a good positive trend. In contrast, Kuartango (4.3% in

baseline vs. 4% in base+change), in Araba, is not only a good performer, but records a positive trend. Finally, in Gipuzkoa, Hondarribia (-0.3% in baseline vs. 2.8% in base + change) does not stand out for the highest value of LSI, however it does show a very good year-to-year improvement. This case represents a good example of the rationale for considering year-by-year variation within the formula.

In contrast, if the environmental fiscal equalisation reform would apply the LSI designed through PCA instead (Figure 8), wins and losses would be less evenly distributed, with slightly higher maximum and minimum values. In this case, larger losses would be faced by large municipalities, and particularly by capitals (In 2019: Vitoria Gasteiz -0.37%; Donostia/San Sebastián -1.6%; Bilbao -2%). This is particularly the case in Araba, where transfer losses of Vitoria – Gasteiz would fund almost all gains of the rest of municipalities in this province. These changes in the funding distribution among municipalities brought about by the green fiscal equalisation reform makes sense if we consider that it is usually larger cities that incur in more severe environmental problems, such as worse air quality or lower shares of natural surface, to cite just few examples.

Comparing reported PCA-based methodology that considers year-by-year changes in LSI (Figure 8) with baseline (Figure D2, Annex D), we observe, again, that results are quite similar. As seen for results of the OLS-approach, in Araba and Bizkaia wins and losses for municipalities in the extremes of the distribution tails are larger under the baseline scenario. With highest wins for Kuartango (11.3% in 2019) in Araba, and Markina-Xemein (4.2% in 2019) in Bizkaia, being the highest losses recorded in Sestao and Portugalete (-2.5% in 2019).

Figure 8. Change in per capita transfers (%). Current system vs. the 2.5% base + 2.5% change PCA-based Index (2019)



Source: own elaboration.

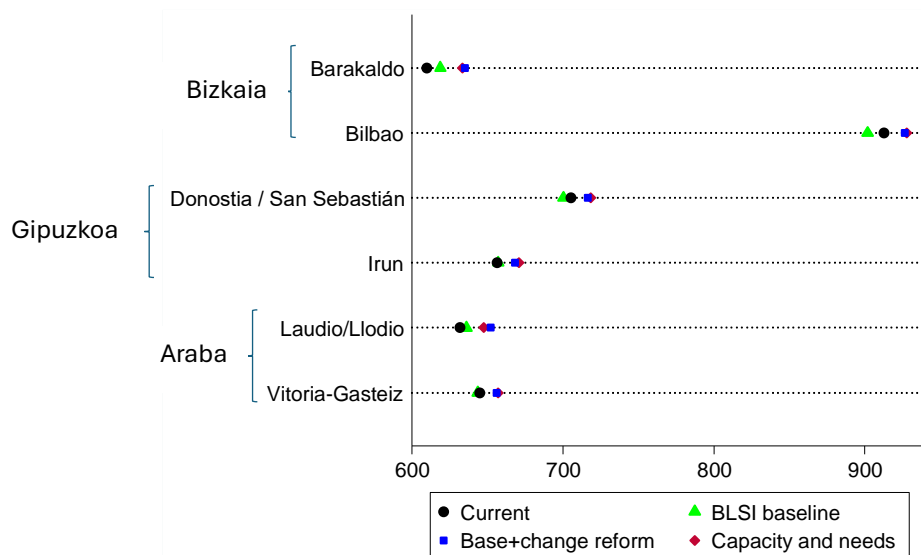
Finally, when considering both the LSI index and expenditure needs for climate adaptation (LSI+), both OLS and PCA-based approaches reach similar outcomes (Figure D3 and Figure D4, Annex D). Navaridas (-1.9% OLS and -1.7% PCA), Orexa (-3% and -2.7%) and Nabarniz (-3.3% and -2.6%) are the most negatively impacted municipalities in each province as they record a non-existent risk of suffering floodings neither due to the rise of the sea level nor due to a river overflow, and thus low adaptation needs. Oppositely, Barrundia, Valdegovía-Gaubea (3.7% OLS and 4.5% PCA) in Araba; and Valle de Trápaga-Trapagaran (1.3% and 2%) in Bizkaia would be

compensated for the high risk of suffering both floodings and droughts; being the risk in Hondarribia (1.5% and 1.5%) (Gipuzkoa) limited to very serious flood risk as a coastal municipality (with 2019 data).

Figure 9 and 10 show the results for the two most populated cities in each province for the current system and the three reform scenarios suggested for each of the two Index-building methodologies: allocating the 5% of equalisation transfers received by municipalities according to the base value of the LSI; allocating the 2.5% of the transfers according to the base value and the other 2.5% according to the year by year variation of the LSI; and allocating 2.5% of the local fund according to the LSI (1.25% according to the base value and 1.25% according to the year-on-year change), and another 2.5% according to climate adaptation related expenditure need component.

Both figures show that, overall, large cities would be better-off in case increased expenditure needs for climate adaptation would be considered within the fiscal equalisation formula, when compared to current situation. Yet, the formula that considers both base values of environmental variables and their evolution in time, is the one that benefits the largest cities the most, as even if they record negative results in LSI, they show overall a positive trend within the 2016-2019 period. It is also true, that large municipalities have policy tools and resources (legal, financial and human) that allow them to implement more ambitious environmental policies than smaller municipalities. Therefore, the incentives established by this reform could have a more profound impact on them. Both methodologies show similar results, with PCA-based Index showing larger variability than the OLS-based approach.

Figure 9. Transfer per capita (€) in OLS-Index Scenario (2016-2019)

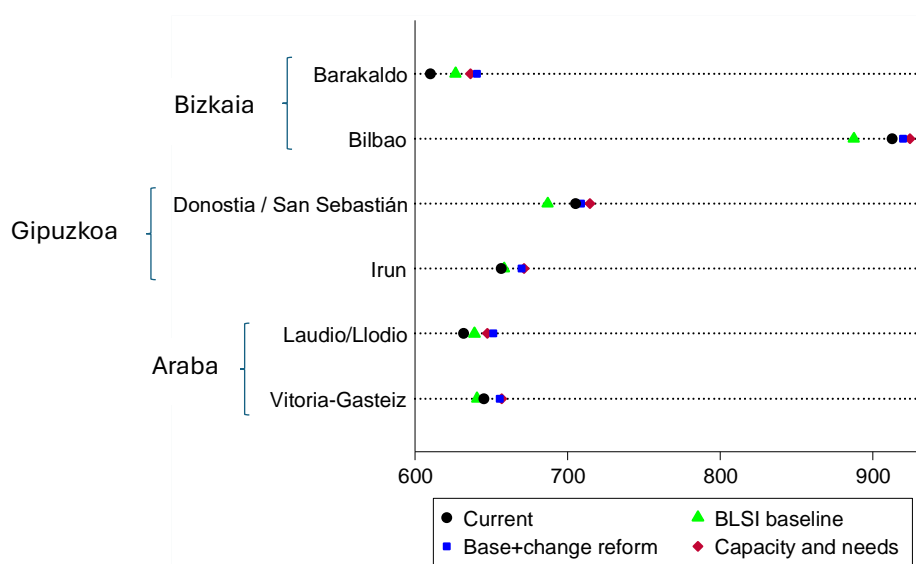


Source: own elaboration.

The exception is Donostia/San Sebastian, whose public budgets would be worst-off in every reform scenario (but the baseline) when compared to the current system due to the relatively worse environmental performance it shows when compared to the rest of municipalities in Gipuzkoa. First, because this capital shows very negative records of soil use and second, because the rest of municipalities of the province outstand among the most sustainable towns in Spain in waste management. However, biggest losses would be faced by the largest city in the Basque Country,

Bilbao, under the LSI baseline scenario, this is the one considering only level values and not yearly changes in variables. In fact, in this reform scenario, and under the PCA approach, the loss would have reached up to the 2.8% of per capita transfers received in 2019. On the opposite side, Barakaldo, the fourth largest city in the Basque Country, would have increased its transfers up to a 3% in the same scenario also in 2019.

Figure 10. Transfer per capita (€) in PCA Index-Scenario (2016-2019)



Source: own elaboration.

In sum, we find that, overall, less sustainable cities could lose up to 5% of their per capita transfers, while small and most sustainable municipalities could win up to 13% of their per capita allocations. More rural towns, and those that could be considered as intermediate cities, would be among the top winners, whereas more industrial and car-intensive cities would be worse-off. In fact, in line with the argument suggested by Loft et al. (2014), these results evidence that environmental fiscal equalisation could serve to compensate rural areas for the ecological services they provide cities with. This is particularly relevant in the current context, first, due to the difficulties of ecological transition’s political economy faces to gather support to pass and make politically feasible implementation of the measures necessary to reach environmental objectives set at the EU within the Green European Deal, and at the international level within the SGD agenda; and second, because of the abandonment feeling rural inhabitants are increasingly voicing through their support to local party platforms, and as explained by the literature of “places that don’t matter” or “territories of despair” (Rodríguez-Pose, 2018).

At this point is relevant to recall that fiscal equalisation’s aim is to allow all jurisdictions to provide its citizens with a standard level of services for an equivalent fiscal effort. Well, then environmental fiscal equalisation would not only set a strong incentive for local entities to cooperate to the international, national and regional green agendas, but would also contribute to close the rural-urban divide regarding the quality and access to basic public services (Alloza et al., 2021). Precisely, this catching-up process to equalise public service standards has also been recently set as objective by the British Levelling-Up agenda (HM Government, 2022).

8. Conclusions and policy recommendations

Academia, policymakers and public opinion are increasingly concerned by sustainability issues and their consequences for the environment, public health and the well-being of citizens. On the search for new tools to promote and attain UN's Sustainable Development Goals and internationally committed climate objectives, fiscal instruments occupy a central position, with examples that range from carbon taxes or subsidies for green investment, to massive public investment plans, such as the European Green Deal. In a context of increased decentralisation of public finances, engagement of all levels of government is crucial to achieve sustainability goals. Although, in general, regions and cities seem committed to it (Smoke and Cook, 2022), this is not always the case, as local political agendas may differ from central government's (Oates, 2005). This, combined with lack of subnational institutional capacity can compromise achievement of results.

Following the literature of Environmental Federalism and previous experiences of Ecological Fiscal Transfers (EFTs), we propose a new fiscal equalisation framework to set financial incentives to municipalities to foster more ambitious environmental policies. The main idea behind this tool would be to compensate municipalities for local tax revenue losses caused by environmental protection policies, that also serves as an incentive to adopt effective environmental policies. The main difference between EFTs and our proposal is that we do not defend an ad hoc low-scale arrangement, but a more ambitious one that gets incorporated within the comprehensive and large-scale general fiscal equalisation system instead. Therefore, these will be unconditional grants, rather than earmarked ones. Whereas, Mato Grosso (2009) and May et al. (2012) discuss a positive environmental effect of earmarking transfers to green expenditure, this colludes with the intrinsic unconditional nature of fiscal equalisation transfers. Thus, we combine ETFs approach with Snoddon and Tombe's (2019) proposal for Canadian carbon pricing revenue equalisation.

We contribute to the environmental federalism discussion by designing a new policy tool and simulating its results on the Basque local funding system. With this aim, we build a Local Sustainability Index measuring local performance in environmental protection and climate change mitigation in seven fields: water, air quality, energy, transport and mobility, touristic pressure, soil use and waste; and thus, the potential tax base loss. We do so for the period 2016-2019 for all Basque municipalities. We apply both an OLS approach and Principal Component Analysis to construct this composite index that would alter the 5% of currently paid transfers to Basque municipalities. Results range from up to 5% loses in per capita received transfers in less sustainable municipalities, to up to 13% wins in per capita allocations in most sustainable and small municipalities. We complement this LSI baseline component with a climate adaptation expenditure need component based on the Basque Local Climate Change Vulnerability and Risk Index, to complete a comprehensive tool (LSI+) that covers both mitigation and adaptation policy areas and fiscal capacity and needs components of fiscal equalisation.

Creating a link between local sustainability results and the volume of transfers municipalities receive would improve incentives towards sustainability and environmental goals achievement. Furthermore, we found that the distribution of budgetary resources among municipalities resulting from this new fiscal equalisation scheme with an environmental component can improve, reducing the relative differences in per capita funding. These changes in resource distribution among municipalities were also seen in Portugal, where Santos et al. (2012) found that the introduction of ecological indicators in the fiscal transfer scheme greatly affected the funding

differences among municipalities. And were found in Brazil too, where it benefited low-income and native communities, since they were the ones living in protected land areas and that way could spend more money coming from EFTs in education, subsistence, healthcare or infrastructure (Nascimento et al. 2011, May et al. 2013).

Redistributing equalisation transfers in this zero-sum game, from large and urban to small and rural local governments would help addressing the gap in access and quality of local public services (Alloza et al., 2021). As in the rest of Europe, Basque rural towns and even intermediate-level cities are experiencing population decline and aging, while economic activity is increasingly concentrating in cities that serve as capital cities. As first suggested by Rodriguez-Pose (2018), the abandonment feeling of these territories is already having political consequences, with the raise of provincial parties in Spain as paradigmatic example.

Finally, this paper is only a start point in the research field on the incorporation of environmental goals into local fiscal equalisation, since it applies the idea of greening intergovernmental fiscal relations introduced by literature on EFTs and illustrates the proposal with an example to stimulate the debate. Furthermore, a logical extension of this research involves adapting the proposed approach, with its relevant specifics, to the realm of regional equalisation, as regional governments grapple with opportunity costs and, consequently, incentive issues regarding the implementation of their environmental policies, in addition to the corresponding expenditure needs, analogous to those considered in the study for local governments.

Further research should extend the analysis for a larger set of jurisdictions and for a more extensive timeframe, as reported simulations outcomes are limited to the Basque country for the 2016-2019 period due to data availability issues. In addition, if equalisation schemes start applying this approach in the future, there will be data available on the behavioural change caused by this policy, paving the way to calculate elasticities and carry out not only static, but also dynamic simulations.

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ANNEX A. Table A1. Local Sustainability Index local average values (2016-2019) for the seven sub-indexes (OLS approach)

Municipality	Water	Air	Energy	Transport	Tourism	Soil use	Waste	TOTAL
Abadiño	0.25125886	.09160712	-.11874254	-.01039099	.20524965	.13414476	-.04510801	-0.00966723
Abaltzisketa	.39960016	-.23804589	.37027609	-.18709869	.30456362	.46967555	.89679639	.16540056
Abanto y Ciérvana-Abanto Zierbena	.24411688	.14506192	.12780655	.0132403	.3157993	-1.0467719	-.0320668	.04819512
Aduna	.39452653	.28066676	-2.1160146	-1.0810916	-.25447161	.14357801	1.2422844	-.84935546
Agurain/Salvatierra	.01899979	-.77177262	-.53953978	-.13204744	.3065617	-.42645483	-.03797035	-.35453541
Aia	.40316942	.18316976	-.14139739	.4954192	-2.0941312	.40806773	-1.0064387	.08074557
Aizarnazabal	-.13364972	.40529313	.20282693	.20825999	-.00895174	.02716897	1.0568133	.28342888
Ajangiz	.30872326	.37275111	-.06315247	.4358634	.06324471	.40596569	-.0083231	.20467015
Albiztur	-.05575246	-.28752303	.3976921	-.71186049	.09322408	.62046582	1.3054786	.01573507
Alegia	.39505762	.20689147	.37373368	.04059687	.32540418	.45245091	1.0858128	.31931453
Alegria Dulantzi	.49880606	-.595581	-.0861284	-.16081697	.29806186	-.29468257	-.06655054	-.14458763
Alkiza	-.33451699	-.18934025	.39431948	.03316134	.03069812	.69919745	.91747415	.2007697
Alonsotegi	.12286079	.16861897	-.83215193	.72824714	.29827305	.23629244	-.07417006	-.02298731
Altzaga	.28291519	-.06661797	.50870311	.3352779	.02558551	.52713548	.74647117	.37577334
Altzo	.42027521	.05559736	.47400672	-.39982954	.32540418	.62057873	1.1771541	.21276153
Amezketza	.23877403	-.09187648	.2196892	-.49920657	.24292485	.56258483	1.2339041	.06375819
Amorebieta-Etxano	.36844102	.38795361	-.11138837	.17829562	.27737058	.17875655	-.10686151	.09935177
Amoroto	.07146325	.48221951	-.23986791	.57491429	.1693809	.81274699	-.06276945	.19425191
Amurrio	.14092283	.15670673	.13935516	.05079026	.27810246	.34210548	.00926402	.10974854
Andoain	.33306649	.23012876	.24790261	.34403972	.31709536	-.07501038	.54344684	.29804585
Anoeta	.41525106	.28593987	.21121962	-.62936642	.30253181	-.04327478	1.0926029	.05653865
Antzuola	.38256975	-.15748849	.50178393	.55488558	.2889415	.73589864	.8968886	.45631616
Arakaldo	.20787089	.41836796	.27683478	-.12782488	-.1382441	.36652277	.20884433	.16567205
Arama	.44594969	-.03698881	.15311461	-1.2905478	.32540418	-.04447806	1.3268438	-.18837449
Aramaio	.31433956	-.34354176	.94133685	-.23484406	.21531691	.78047589	.39244629	.2843595
Arantzazu	.2926266	.48246422	.28116338	.33157722	.20401269	.30750083	-.17490152	.28497546
Areatza	.24245044	.07168363	.31354863	.41600395	-.3386125	.81176911	-.17298371	.27445261
Aretxabaleta	.40132676	-.22578085	.41519058	.46696451	.30042336	.29027933	.72927864	.35999743
Armiñón	.04627687	-.28931357	-.07200864	-.76340787	.21581975	-.42398778	-.43187202	-.35270705

ANNEX A. Table A1. Local Sustainability Index local average values (2016-2019) for the seven sub-indexes (OLS approach) (continuation)

Municipality	Water	Air	Energy	Transport	Tourism	Soil use	Waste	TOTAL
Arraia-Maeztu	-.72885914	-1.1656712	.0240958	-.56054196	-.06430395	.58857992	-1.0310506	-.4707301
Arrankudiaga	.08734549	.27852252	-.31421179	.00418545	.26437446	.57063714	-.19143164	-.05486834
Arrasate/Mondragón	.36987483	-.04525495	.1462478	.48908061	.2814061	-.03445128	.52618722	.26962946
Arratzu	.30135955	.46358357	.2066033	.37693287	.32540418	.67559962	-.36557567	.26624464
Arratzua-Ubarrundia	.34278072	-.3412722	-2.5877198	-.69060945	.32540418	-.39840139	-1.2894887	-1.245785
Arrieta	-.15651011	.34508439	.12801833	.083388	.26621663	.59577069	-.06838657	.12220887
Arrigorriaga	.10801696	.27212918	.26491547	.41316392	.23471708	-.50051452	.15984001	.26225387
Artea	.24211546	.3860368	-.11176323	-.00094095	.10813223	.56228603	-.18683817	.04018745
Artzentales	-2.3839236	-.01449701	.08946625	.03000581	-.23316566	.5261715	-.12248256	-.14186702
Artziniega	.20988316	.27641389	.39047026	-.09671219	.28793452	.37145223	.05856332	.17848017
Asparrena	-2.2729738	-.89467344	-.55048755	.04885944	.15769034	.35023307	-.26256285	-.4941808
Asteasu	.40344019	.12062594	.17791724	-.06762681	.11109322	.2626578	1.0452524	.19743255
Astigarraga	.29841604	.186371	-.07905046	.2841126	.21952085	-.59391565	.07770655	.0976398
Ataun	.22227616	-.41483573	.34165305	.08349229	.17925394	.86500397	1.0505424	.22663104
Atxondo	.24777995	.05187424	-.25147944	-.20831695	.07561803	.52819491	-.07775848	-.11044578
Aulesti	.24386661	.28368906	.36245259	-.08119939	.32540418	.79716503	-.06694	.18043807
Ayala/Aiara	-.39297164	.00126289	.25672867	-.34743984	.06172161	.44844569	-.16194242	-.04947236
Azkoitia	.39533759	-.07369827	.28382706	.62612899	.30123261	.50398377	.38931649	.36152244
Azpeitia	.4006453	.07359374	.18053542	.506254	.25523983	.36685942	.31853197	.30084088
Añana	-.13216605	-.54982635	-.14023655	-.41797385	-.39662909	.38370972	-.50035747	-.30126623
Bakio	.26483437	.4324843	-.01719574	.26168834	.05570389	.01987404	-.99337988	.06535466
Baliarrain	.36557239	-.09723186	-.13000725	-.21522694	.32540418	.29809394	1.6007158	.06699334
Balmaseda	.25456448	-.01584182	.40259322	.43739067	.29174978	.5519495	-.03834721	.30269809
Barakaldo	.25336535	.26882408	.27629455	.6749623	.26812855	-1.2576746	.11497876	.32611099
Barrika	.25429725	.28868571	.19944203	.11215406	.14196775	-.40701588	-.6510725	.08829528
Barrundia	-.93354183	-.63742751	.76809702	-.5924272	.07655431	.22959258	-.60686736	-.13862845
Basauri	.24492696	-.17522017	.33324052	-.02611077	.31623936	-3.4021538	-.00132044	-.02146089
Baños de Ebro/Mañueta	-.7920493	-.30292464	.23309822	-.35310494	.20826653	-.2317021	-.9057104	-.23006779
Beasain	.39080074	-.13360433	.39290269	.07196671	.26073223	.32788093	.70169514	.2434821
Bedia	.26530023	.34187567	-.03434788	-.45103438	.27474442	.72480171	-.11141372	-.06296147

ANNEX A. Table A1. Local Sustainability Index local average values (2016-2019) for the seven sub-indexes (OLS approach) (continuation)

Municipality	Water	Air	Energy	Transport	Tourism	Soil use	Waste	TOTAL
Beizama	.33306627	-.18056677	.33170928	-.30227826	-.32137475	.73377365	1.2970215	.16786046
Belauntza	.39451036	.02625332	-.04885295	-.90632335	.32540418	.12321276	1.148142	-.145051
Berango	.26637816	.22891591	.43430251	.18587111	.32540418	-.8065222	-.09860172	.22075004
Berantevilla	-8.1688055	-.34363467	-3.4268119	-1.1323372	.32540418	-.16964336	-1.3482854	-2.3256783
Berastegi	.3951595	-.29326714	.23169131	.21242433	.19542236	.75731831	1.4805847	.29752179
Bergara	.46309936	.09135988	.19635164	.36437183	.27894109	.40977706	.58775119	.29748154
Bermeo	.29044181	.22431313	.34327046	.54366616	.26688993	.24897198	-.03175647	.34366896
Bernedo	-1.9872266	-1.116324	-2.0728582	-.31360999	-.28149171	.28140081	-1.3394492	-1.2347253
Berriatua	.26816414	.36990449	-.01676649	.03847164	.14996551	.58982995	.12091962	.11416683
Berriz	.38326409	.13787922	.4489178	-.04640657	.30605481	.37104384	.08145049	.20864383
Berrobi	.41705156	.2213525	.56893822	.39488296	.2291062	.27218702	1.5128963	.53158545
Bidania-Goiatz	-.01556773	-.43004881	.21816641	.17206562	-.1637715	.52892739	1.0800797	.18219052
Bilbao	.25119362	.11233274	.24494232	-.25448996	.17231779	-2.6135672	.07446399	-.04293879
Busturia	.28884122	.30436352	.2321113	.74586949	.09008851	.5035363	-3.6943676	.3564252
Campezo/Kanpezu	-.13808406	-.93567409	-.09094548	-.34474056	.13778051	.5666311	-1.0628798	-.36722748
Deba	.39363373	.27523845	-.09665773	.24204396	-.61567957	.32950612	-.21456092	.10400951
Derio	.29305907	.39881581	-1.082122	.04180203	-.17902701	-2.5916707	-.71693187	-.42946398
Dima	.24396259	.06463819	.22629435	.00932206	.26505177	.6544494	-.13799914	.11771951
Donostia / San Sebastián	.17576188	.03804183	.12275315	-.39368331	.07270999	-2.138375	-.2850659	-.16121462
Durango	.2637527	.26695161	.4322307	.14878805	.27697157	-1.2315958	.2041468	.22810146
Ea	.28266703	.53869515	.05554137	.28719131	-.12701455	.62229377	-.1687835	.21437322
Eibar	.39616409	.0012637	.30314564	.38231842	.28726878	-.16632816	.24391041	.26758215
Elantxobe	.2544388	.34917593	.29998688	.54390745	-.31076676	.43952302	-.23116136	.33260367
Elburgo/Burgelu	-.00673148	-.47730804	.04603088	-.62660515	-.79536731	-.28275219	-.5279207	-.30736811
Elciego	-.60152693	-.36382331	.18132117	-.01785842	-.67869972	-.31957998	-1.0104306	-.15246524
Elduain	.39485166	-.24189257	-.97430452	.42848616	.32540418	.94431057	1.4805847	-.02986256
Elgeta	.40687604	-.0241047	.32025474	.10412803	.11762237	.73622287	.57234517	.24828817
Elgoibar	.39359309	.186177	.16149165	.31040723	.29699937	.4034055	-.03723124	.218288
Elorrio	.25311001	.15189884	.12699964	-.32124324	.24417946	.30944779	-.06714354	-.00836787
Elvillar/Bilar	-.77000836	-.50018989	.30413171	.14793263	.32540418	-.19192926	-1.0334445	-.09151534

ANNEX A. Table A1. Local Sustainability Index local average values (2016-2019) for the seven sub-indexes (OLS approach) (continuation)

Municipality	Water	Air	Energy	Transport	Tourism	Soil use	Waste	TOTAL
Erandio	.09438143	.19340878	-.23642187	.41809013	.31458985	-1.2775649	-.22366115	.01794547
Ereño	.06302004	.26637366	.29959033	-.01170675	.01310355	.81755632	-.43870095	.12910616
Ermua	.23795708	-.02041806	.40162968	.23145949	.29041822	-.61858017	.31475997	.23016609
Errenteria	.36664435	.19250832	.44632503	.5546458	.31368527	-.20329307	.35329315	.40383674
Errezil	.7555998	-.2072741	.32042712	.31303277	-.04880481	.57562441	1.2897919	.37462603
Erriberagoitia/Ribera Alta	-.20717667	-.60399542	.33930692	-.93720385	-4.2556296	.40090165	-.65765829	-.32599313
Errigoiti	-.26119215	.362066	.41753827	.38631519	-.10711161	.65321893	.39604802	.353034
Eskoriatza	.13411894	-.39187117	.33079338	.28635818	.20952886	.50469989	.658444	.23155888
Etxebarri	.27155698	.10946783	.48790912	.48782287	.32540418	-1.9227547	.17792093	.30091172
Etxebarria	.24335747	.24464531	.19953706	-.06856061	.05986721	.59714682	.08315852	.13067021
Ezkio-Itsaso	.37736845	-.08460883	-.71635408	-.42586272	.11600395	.57199706	.58557591	-.2795546
Forua	-.01110402	.35232487	.2479884	.4052555	.32540418	.43516054	-.24295502	.25120141
Fruiz	.25276201	.52982356	-.17270453	.48405966	.32540418	.19963825	-.03874055	.19127488
Gabiria	.39865093	-.09086101	.06040403	-.4317179	-.0488485	.54177252	1.1023488	.02991948
Gaintza	.27951957	-.06647918	.38046096	.06410366	.32540418	.65886814	.43312426	.22423747
Galdakao	.24945345	.34620146	.21699305	.2276438	.3148087	-.4301075	.11920379	.21008077
Galdames	.09552175	.10081511	.1349191	.52850043	.32540418	.51727754	-.14113706	.23404464
Gamiz-Fika	.25314423	.46996516	.37562139	.40879955	.23537036	.17448996	.0128624	.34872451
Garai	-.32503424	.23001455	-1.0250757	-.07021972	-.03491077	.63534395	-.12974809	-.34902322
Gatika	.25558532	.49015585	.38647278	.12315579	.2310269	.22669487	.00144362	.26913161
Gautegiz Arteaga	.2870908	.48919453	-.15655075	.02987673	-.18452732	.27219627	-.31992272	.03052596
Gaztelu	-.74712881	-.10894388	.41702379	.28100687	-.05249198	.79701823	1.5112386	.32376312
Gernika-Lumo	.29969916	.21799928	.27036017	.50488127	.27025883	-.7524655	-.03334326	.27180232
Getaria	.39452664	.26949458	-.86615868	.23802223	-.44253965	-.17391338	-.62699428	-.21482785
Getxo	.24606618	.0142554	.47677687	.08214146	.30494021	-3.6202598	.12985687	.09321873
Gizaburuaga	.25553057	.47796965	-.18356961	-.0600201	-.06081748	.69264465	-.2051623	.01543661
Gordexola	.24568471	.38199738	.05420416	-.22392072	-.0765885	.78445218	-.14668562	.03946421
Gorliz	.25562032	.37405667	.15953272	.48010919	-.12961301	-.79437451	-.66219727	.18533788
Güeñes	.25425215	.23584395	.27814268	.46901455	.30085307	.32837182	-.11023302	.29308585
Harana/Valle de Arana	-.47774791	-1.2664412	.40798438	-.54300732	-.1108232	.51040439	-.78146422	-.31009243

ANNEX A. Table A1. Local Sustainability Index local average values (2016-2019) for the seven sub-indexes (OLS approach) (continuation)

Municipality	Water	Air	Energy	Transport	Tourism	Soil use	Waste	TOTAL
Hernani	.29968439	.19382432	-.08545907	.75048403	.28366666	.134868	.72025243	.32561619
Hernalde	.14169497	-.12707671	.22069983	-.30238658	.32540418	.39274973	.63604964	.04859942
Hondarribia	.2254721	.26479783	.07848021	-.25745854	-.16283688	-1.2868371	-5.1120937	-.52605568
Ibarra	.38657044	-.07609779	.49572743	.19255118	.32540418	-.21868214	1.0468682	.3369645
Ibarrangelu	.12930391	.3991089	-.2112591	.27042988	-.64940331	.61745002	-.41166719	.06311348
Idiazabal	.39537977	-.21507567	.15966371	-.25792395	.19627106	.50560241	.92339027	.07948988
Igorre	.26200076	.39730337	.29895779	.26350616	.28515125	.218727	-.15173978	.25424246
Ikaztegieta	.39557323	.31774734	.02956893	-.0376975	.32540418	-.1587885	1.1375046	.17920098
Irun	.23070043	.17818105	.1801186	-.03961567	.23290853	-.71466858	.80601102	.14490472
Irura	.41640343	.07075873	.55569794	.00746752	.32540418	-.16705726	.77259822	.30064726
Iruraiz-Gauna	.21255615	-.77610608	.36074657	-.75874297	.32540418	.15702641	-.23202832	-.22523368
Iruña Oka/Iruña de Oca	-.61174919	-.53023539	-.296117	-.53790858	.30947464	.04058279	-1.1129338	-.49525554
Ispaster	.25022241	.41759091	.26322162	.22469324	-.17621692	.73585253	.19967076	.28391186
Itsasondo	.59308096	-.07547998	.29427231	-.10746254	-.1225775	.70854929	1.3907229	.25861859
Iurreta	.23478342	.39532427	-1.1830214	-.29191335	.32540418	-.02855836	-.05551802	-.41797724
Izurtza	.27583419	.22370819	-2.5906216	-.60597104	.32540418	.30978915	-.15780971	-1.0097049
Karrantza Harana/Valle de Carranza	-4.0183512	-.16120442	.20275197	.13652282	-.09803687	.3248874	-.12559593	-.22766916
Kortezubi	.28643752	.51708522	.10746895	.25056608	.17759996	.65782442	-.41210534	.19592818
Kripan	-.13796019	-.80634164	.25348865	.31971058	.32540418	.06801154	-.98037623	-.03834885
Kuartango	-.67185899	-.67729995	2.3301518	-.47854726	.18623511	.45524951	-.71443936	.43607918
Labastida/Bastida	-.73748008	-.45676952	.06336582	.13650202	-.30087002	-.02124608	-.94008967	-.15251587
Lagrán	-.92974487	-1.3773998	-.10445639	-.34332682	.17383644	.65150236	-.84746816	-.47538474
Laguardia	-1.9483612	-.66775681	-.83581165	-.38834786	-1.2865442	-.15827461	-1.1843679	-.77038206
Lanciego/Lantziego	-.73727811	-.33597914	.29550048	.32105729	.25040717	-.24225944	-.86258734	-.00010783
Lanestosa	-2.0468754	.03640156	.10647104	.41856994	.32540418	-.97767429	-.14456633	-.03834684
Lantarón	-.54753255	-.40715605	.19578491	-.52237407	-.00729945	-.02855196	-.54194933	-.24911332
Lapuebla de Labarca	-.71444109	-.22174786	.35250271	-.00861342	.17113002	-.64537198	-.85828956	-.07638764
Larrabetzu	.24276391	.53159254	-.17543442	.32747094	.19988832	.38892266	-.76441711	.07967066
Larraul	.10660121	-.04687745	.418037	.11334594	.32540418	.58243873	1.4122734	.33181058

ANNEX A. Table A1. Local Sustainability Index local average values (2016-2019) for the seven sub-indexes (OLS approach) (continuation)

Municipality	Water	Air	Energy	Transport	Tourism	Soil use	Waste	TOTAL
Lasarte-Oria	.3731262	.09533129	.44874835	.544964	.26266867	-1.3637989	.14018366	.32689702
Laudio/Llodio	.35105947	.31989047	.44046007	.24902585	.30959289	.17742411	.15839898	.32109423
Laukiz	.2569136	.38582597	.30609614	.09086419	.21141788	-.52375114	.00890552	.19115455
Lazkao	.37009493	.00532403	.54660465	.15252044	.26203442	.15921002	.72732567	.33560976
Leaburu	.15746197	.20089706	.18242059	-.22566811	.29046364	.26676635	.64282459	.10536929
Legazpi	.38761391	-.60499662	.4278633	.41801703	.28250307	.62510004	.98138485	.32749898
Legorreta	.22723663	.16291876	-.27206322	-.00893479	.26964481	.40739392	.82473583	.03995862
Legutio	-2.3311042	-.28144841	-2.473325	-.72785761	.16900465	-.39155918	-.27983745	-1.32184
Leintz-Gatzaga	.76569262	-.62260766	.27782064	-.07347271	-1.5402715	.87276582	1.0172686	.16569554
Leioa	.26492628	-.00759336	.12918055	.16671753	.27970985	-3.4024108	.1257553	.00703176
Lekeitio	-.05462673	.27023585	.32853369	.6074856	.16901959	-2.7776562	.04386578	.23944598
Lemoa	.2474095	.32421449	.11838103	-.10315394	.32540418	.10007873	-.11791271	.0683496
Lemoiz	.0889232	.43954472	.2824634	.47247095	.22132104	.25885031	-.52198397	.27145802
Leza	-.80806776	-.69405291	-.52678291	-.0943107	.00629987	-.01040271	-1.0583192	-.47406482
Lezama	.25465057	.42040044	.12338591	.27633133	.20095011	.02340475	-.71517823	.14130421
Lezo	.23588531	.07681177	-.12882475	-.45915167	.26779592	-.5275284	.12817783	-.16012994
Lizartza	.30091463	.03033989	.51637754	.02463919	-.01180469	.6814181	1.6633997	.39193803
Loiu	.26310434	.32292183	-2.1105402	-3.1066542	.20227643	-1.5440773	-.84213155	-1.7269554
Mallabia	-1.2233579	.05851807	-2.6661072	-.44498387	.04183912	.48616842	-2.4983182	-1.3438651
Markina-Xemein	.25082986	.32467461	.17170368	.33292272	.25957512	.71659773	.12802067	.26475872
Maruri-Jatabe	.26967127	.45370041	.23567886	.22139454	.24440788	.59731313	-.05393276	.25153603
Mañaria	.24450761	-.05285697	.24714083	-.06200435	.32540418	.65083435	-.05323917	.09347525
Mendaro	.38657721	.1775297	-.12716869	.56414218	.27735052	.74551907	-.52290746	.16216597
Mendata	.11489465	.4985847	.4172141	.20881613	.29027965	.89734176	-.33749767	.28718655
Mendexa	.07598876	.3559944	.05459935	.29691421	-13.891365	.38921311	-.21538157	.1611343
Meñaka	.00102704	.30991068	.21504198	.09537993	.03925022	.43460981	.01154978	.16428389
Moreda de lava/Moreda Araba	-.74223706	-.23335296	.36853502	-.20172038	.32540418	-.22458539	-.87617868	-.12079738
Morga	.25419081	.44361274	.18228982	.11268486	.05931339	.66221886	-.35382426	.17136426
Mundaka	.28545938	.13085579	.22912037	.38712441	-1.4896716	-.22909728	-.87806835	.1458409

ANNEX A. Table A1. Local Sustainability Index local average values (2016-2019) for the seven sub-indexes (OLS approach) (continuation)

Municipality	Water	Air	Energy	Transport	Tourism	Soil use	Waste	TOTAL
Mungia	.26009353	.37608874	.1733065	.41651383	.2524307	-.43951839	.12313251	.25829607
Munitibar-Arbatzegi Gerrikaitz	.255342	.19849358	.62001698	.0795704	.0103812	.79766166	-.03161655	.3081335
Murueta	.1225718	.49338213	-1.5300473	.48048293	-.51041537	.09924229	-.69063074	-.3495141
Muskiz	.24631075	.31135492	.36131523	.1532867	.23791463	-.5593261	-.35601519	.18102187
Mutiloa	.37855828	-.09368834	-.52943803	-.30597879	-.37745745	.5288858	.06977555	-.23160067
Mutriku	.39766302	.27950908	.26079598	.36817476	-.42449136	.50856928	.00432081	.29131398
Muxika	.15922318	.44577984	.3257479	.27786079	.01930771	.69564017	-.29253832	.27017319
Nabarniz	.44428861	.17550938	.27018552	.33624785	.32540418	.76893414	.12785455	.29374466
Navaridas	-.98788591	-.48262434	.43283921	-.33669793	-.30548563	-.15995373	-.94665232	-.20096618
Oiartzun	-.00920413	.12281925	-.67777717	-.41682778	-.12303862	.26037783	-.36542257	-.3643276
Okondo	-.43912356	.25531695	.41499372	-.14995818	.32540418	.72520921	-.08424613	.11556994
Olaberria	-2.7803996	.04714002	-1.7219683	-1.375114	-.24304459	-.27157638	.34362892	-1.1881944
Ondarroa	.24301724	.15855733	.32560891	.21330033	.29018067	-.46538752	.11937323	.21275347
Ordizia	.41424496	-.14900904	.22111536	.12311384	.32540418	-.87895044	.91716771	.17886208
Orendain	.44079674	.15071766	.10161631	.03059346	.32540418	.50209235	1.8411018	.29305429
Orexa	.38721162	.02511152	.23299241	.36325567	.32540418	.75900614	1.6633997	.40821211
Orio	.23958715	.37033903	.30203317	.46748608	-.73745555	-.29735432	-.03687387	.30465857
Ormaiztegi	.38496	.08021198	.38913221	-.10635985	.19994897	.2177404	.94267444	.23819921
Orozko	.02528426	-.0323805	.25856938	-.00193704	.17354237	.65148053	.00729229	.10740657
Ortuella	.25004931	.13029118	.2150688	-.09280705	.29590569	-1.8874828	.01092609	.01825852
Otxandio	-.14020808	-.20340018	.28650786	.24176788	.20932598	.31783652	-.1242138	.12871256
Oyón-Oion	-.71275744	-.47256199	.25192117	.24918888	.29280527	-.33969327	-.9383555	-.06580006
Oñati	.39577578	-.47050013	.92768514	.56774958	.14034723	.61449438	.55187808	.52154873
Pasaia	.44826075	.22294739	.4811582	.5396896	.31979661	-.98681037	.42374033	.40123086
Peñacerrada-Urizaharra	-.59810534	-1.2079227	.05610541	-.75102634	-.45887786	.58003208	-1.8348417	-.59086623
Plentzia	.25934805	.26377655	.30456311	.53607334	.23707195	-.85967042	-.12726817	.28387101
Portugalete	.24156094	-.18023986	.4469192	.51464718	.28451475	-4.4050267	.18797607	.16393524
Ribera Baja/Erriberabestia	.96128114	-.29328526	-2.3819199	-.15731315	-.54508922	-.89142228	-.60604825	-.91036169
Samaniego	-.93184354	-.59917677	-.3092303	.03857536	-.42129519	-.08502062	-1.1113377	-.36316739

ANNEX A. Table A1. Local Sustainability Index local average values (2016-2019) for the seven sub-indexes (OLS approach) (continuation)

Municipality	Water	Air	Energy	Transport	Tourism	Soil use	Waste	TOTAL
San Millán/Donemiliaga	-1.0858966	-.79232193	-1.3800907	-.75829899	-.86741761	.22409949	-.86066012	-.97437913
Santurtzi	.24542711	.09694792	.29353389	-2.1702315	.28494008	-3.1097306	.13642204	-.62551896
Segura	.38484154	-.12729403	.33951965	.00583515	.20543796	.48904192	.97729796	.23756735
Sestao	.23976591	-.20401399	-.31944221	.53141881	.2880039	-4.5977793	.17647467	-.10140874
Sondika	-.32463771	.09645646	-.22622871	-1.98835	.25985082	-1.8323055	-.73408054	-.82821947
Sopela	.26442337	.19911296	.34430456	-1.13456291	.00308957	-1.5177087	.03640746	.07589903
Sopuerta	.06625375	.19430863	.27393698	.38725394	.15526291	.56743617	-.11821747	.25346886
Soraluze-Placencia de las Armas	.38574287	.01118158	.43858	.53248013	.32540418	.41090483	.27892176	.38336217
Sukarrieta	.26298084	.2749563	-.56513386	.42969286	.28691866	-.17146188	-.71963608	-.0727672
Tolosa	.40644157	.08424687	.78919267	.21287	.26841204	.27221523	.52151418	.43496963
Trucios-Turtzioz	.24543339	-.16985559	.19836173	.34665131	.25917255	.5482044	-.15582184	.17105516
Ubide	.2152978	-.28654674	.2488324	.04590121	.10288754	.35087181	-.2594761	.05982893
Ugao-Miraballes	.1149135	.38867474	.5126165	.25002343	.32540418	-.17659188	.07646008	.31743796
Urduliz	.28349843	.37288358	.22312519	.48390081	.23141517	-.60768611	-.33609562	.24751092
Urduña/Orduña	.25280339	-.05139768	.31701922	.27871893	.19049524	-.04441474	.07084561	.2094415
Urkabustaiz	-.40868891	-.36544643	-.0084408	-.30426986	.20944158	.40229398	-.42277764	-.20811286
Urneta	-2.2328023	.11611393	.26734187	.38604368	.02967486	.12455721	-.05679078	.05034283
Urretxu	.2698503	-.24659863	.34536978	.52658712	.28882434	-.00010599	.81439113	.33919242
Usurbil	-.08653739	.32224493	-.59420823	.17188942	.16282035	.07496046	.4240558	-.06415791
Valdegovía/Gaubea	-1.9448641	-.87280558	-.09425665	-.55253347	-1.8841414	.56614291	-1.4864104	-.60355958
Valle de Trápaga-Trapagaran	.2451698	.07529093	-.03971392	-.1919799	.28551263	-1.336838	-.09996893	-.09795705
Villabona	.39274722	.17893148	.41062637	.21672245	.28998821	.32244252	1.0237896	.37075975
Villabuena de Álava/Eskuernaga	-.69743155	-.33939805	-.36101092	-.53230855	-1.1082351	-.19535286	-1.0064359	-.49187506
Vitoria-Gasteiz	.24093235	-.46250073	.29599659	-.56995969	.22571812	-.98671447	.0121217	-.15738228
Yécora/Iekora	-1.0055485	-.59274746	.36913482	.19906709	.32540418	-.11015378	-1.1631191	-.0955494
Zaldibar	.24216301	.06245785	.40515276	-.0457667	.32540418	.29164681	-.0405152	.15745317
Zaldibia	.50092667	-.00540065	.12300818	-.05264305	.16542717	.46148225	1.1409656	.1883466
Zalduondo	-.31539024	-.92294971	.42103866	-.01143491	-.33109231	.27097899	-.72776324	-.0828968

ANNEX A. Table A1. Local Sustainability Index local average values (2016-2019) for the seven sub-indexes (OLS approach) (continuation)

Municipality	Water	Air	Energy	Transport	Tourism	Soil use	Waste	TOTAL
Zalla	.24717415	.1311244	-.03313622	.46255325	.27982517	.27163424	-.13460797	.16549309
Zambrana	.11775856	-.61303377	-.33744212	-.34081439	.32540418	.269169	-.45248597	-.333726
Zamudio	.24243812	.38690284	-3.326052	-.39525706	.15127933	-.75779789	-.87379886	-1.2775941
Zaratamo	.25496937	.39964321	-.89579223	-.87356043	.27771184	.24618387	-.11846107	-.49263537
Zarautz	.3974897	.25627439	.1855953	.30546478	-.32615195	-.79342052	-.03757922	.19377303
Zeanuri	.24465509	-.20030572	.06929118	.17413665	-.66369059	.69111128	-.15936851	.07484848
Zeberio	.23615667	.39311381	.34703115	.06292453	.07496506	.90496589	.13728191	.2580928
Zegama	.40033608	-.73438589	.07638992	-.17019661	.18622387	.79885962	.9209746	.01124636
Zerain	.38884859	-.31696821	.14790502	-.2114488	-1.1051077	.66398608	.78473054	.06638559
Zestoa	.17685643	.30216743	.03552158	.32192594	-.27597864	.36771599	.42951577	.22272916
Zierbena	.25147187	.28131765	-4.2231672	-3.0398539	.12374292	-2.2407505	-2.1421363	-2.5754591
Zigoitia	-.44626914	-.49360684	-1.5105392	-.44291673	.13366534	.34725337	-1.0226766	-.83894901
Ziortza-Bolibar	.22750599	.15596963	.24975099	.79017425	-.48102249	.71549819	-.86509225	.30933433
Zizurkil	.39163016	.21532429	.38017856	.26155899	.28422735	.33997416	.88394617	.36680733
Zuia	-.56748813	-.52682018	-1.7388644	-.27683783	-.07068049	.56271071	-.68898513	-.31173928
Zumaia	.40778412	.36309467	.2013737	.06760259	-.0297655	-.93565241	-.02749783	.13918158
Zumarraga	.41842609	-.18160375	.29706817	.54902498	.24433054	.18090369	.69790368	.34623506

ANNEX B. Table B1. Local Sustainability Index local average values (2016-2019) (PCA approach)

Municipality	PCA Index Value	Municipality	PCA Index Value	Municipality	PCA Index Value
Abadiño	-.20971252	Arrankudiaga	.48671012	Belauntza	.32518961
Abaltzisketa	.50545571	Arrasate/Mondragón	-.13017858	Berango	-.95867632
Abanto y Ciérvana-Abanto Zierbena	-.90224584	Arratzu	.57287626	Berantevilla	-.63266403
Aduna	.34222777	Arratzua-Ubarrundia	-.46728492	Berastegi	1.0565115
Agurain/Salvatierra	-.5268426	Arrieta	.62563044	Bergara	.39145657
Aia	.38035852	Arrigorriaga	-.45075601	Bermeo	.07087301
Aizarnazabal	.02061272	Artea	.4445953	Bernedo	.20648272
Ajangiz	.14622452	Artzetales	.60319023	Berriatua	.50733195
Albiztur	.86954743	Artziniega	.18819552	Berriz	.0822188
Alegia	.23484672	Asparrena	.18325404	Berrobi	.46321527
Alegría Dulantzi	-.38959375	Asteasu	.42894172	Bidania-Goiatz	.69734034
Alkiza	.74579482	Astigarraga	-.3489772	Bilbao	-2.5704107
Alonsotegi	.07350184	Ataun	.76935364	Busturia	.53622615
Altzaga	.27679029	Atxondo	.18121927	Campezo/Kanpezu	.38748061
Altzo	.63338677	Aulesti	.80086853	Deba	.11274344
Amezketza	.61544704	Ayala/Aiara	.28723377	Derio	-1.7623724
Amorebieta-Etxano	-.20153852	Azkoitia	.44502423	Dima	.45540024
Amoroto	.83660123	Azpeitia	.36581901	Donostia / San Sebastián	-2.1428196
Amurrio	.06657412	Añana	.25867085	Durango	-1.1651363
Andoain	-.14783656	Bakio	-.06067205	Ea	.60251336
Anoeta	-.11994212	Baliarrain	.30735184	Eibar	-.36916783
Antzuola	.78253868	Balmaseda	.33805687	Elantxobe	.4458544
Arakaldo	.27223056	Barakaldo	-1.1789345	Elburgo/Burgelu	-.26338695
Arama	.06836945	Barrika	-.67133245	Elciego	-.35046898
Aramaio	.69372595	Barrundia	.58478981	Elduain	1.2253761
Arantzazu	.14685623	Basauri	-2.5693226	Elgeta	.68880548
Areatza	.56782372	Baños de Ebro/Mañueta	-.11677192	Elgoibar	.06106673
Aretxabaleta	.26114954	Beasain	.14645521	Elorrio	-.05862417
Armiñón	-.34204909	Bedia	.4187875	Elvillar/Bilar	-.02408931
Arraia-Maeztu	.50201483	Beizama	1.0073478	Erandio	-1.1649588

ANNEX B. Table B1. Local Sustainability Index local average values (2016-2019) (PCA approach) (continuation)

Municipality	PCA Index Value	Municipality	PCA Index Value	Municipality	PCA Index Value
Ereño	.83638473	Hernalde	.36550885	Laukiz	-.36536434
Ermua	-.83820975	Hondarribia	-1.555079	Lazkao	.06297556
Errenteria	-.16567397	Ibarra	-.35903468	Leaburu	.20393201
Errezil	1.0337677	Ibarrangelu	.58300485	Legazpi	.72803377
Erriberagoitia/Ribera Alta	.50122509	Idiazabal	.475685	Legorreta	.20894184
Errigoiti	.79454052	Igorre	-.02145572	Legutio	-.67110773
Eskoriatza	.51341992	Ikaztegieta	-.23855134	Leintz-Gatzaga	.98012606
Etxebarri	-1.5343851	Irun	-.56700532	Leioa	-2.8033795
Etxebarria	.47667582	Irura	-.31359141	Lekeitio	-2.0206449
Ezkio-Itsaso	.62074807	Iruraiz-Gauna	.21414595	Lemoa	-.16352611
Forua	.3039881	Iruña Oka/Iruña de Oca	-.04452669	Lemoiz	.23431071
Fruiz	.17261276	Ispaster	.70107964	Leza	-.10953646
Gabiria	.62539673	Itsasondo	.61487723	Lezama	-.08126925
Gaintza	.59881299	Iurreta	-.38223917	Lezo	-.59709017
Galdakao	-.53724585	Izurtza	-.10547617	Lizartza	.81474429
Galdames	.92197416	Karrantza Harana/Valle de Carranza	.25837786	Loiu	-1.295837
Gamiz-Fika	.27522799	Kortezubi	.52898524	Mallabia	.04616376
Garai	.20304973	Kripan	.26490665	Markina-Xemein	.51540357
Gatika	.12011312	Kuartango	2.7857553	Maruri-Jatabe	.47143675
Gautegiz Arteaga	.35484625	Labastida/Bastida	-.03073192	Mañaria	.44455217
Gaztelu	.93063895	Lagrán	.82517353	Mendaro	.43594351
Gernika-Lumo	-.69697045	Laguardia	-.12569046	Mendata	.84262346
Getaria	-.57713628	Lanciego/Lantziego	-.12673083	Mendexa	.24523006
Getxo	-2.9113213	Lanestosa	-.53715559	Meñaka	.34365907
Gizaburuaga	.66590002	Lantarón	.04535043	Moreda de lava/Moreda Araba	-.16568206
Gordexola	.65145356	Lapuebla de Labarca	-.58681352	Morga	.69988772
Gorliz	-.68254469	Larrabetzu	.21402706	Mundaka	-.31278486
Güeñes	.21842201	Larraul	.75353151	Mungia	-.43156239
Harana/Valle de Arana	.72659291	Lasarte-Oria	-1.2307971	Munitibar-Arbatzegi Gerrikaitz	.95937395
Hernani	.31257508	Laudio/Llodio	-.13494068	Murueta	.02650853

ANNEX B. Table B1. Local Sustainability Index local average values (2016-2019) (PCA approach) (continuation)

Municipality	PCA Index Value	Municipality	PCA Index Value	Municipality	PCA Index Value
Muskiz	-.53147062	Sondika	-1.2618402	Zeberio	.70164935
Mutiloa	.35096714	Sopela	-1.4290622	Zegama	.74968324
Mutriku	.25114177	Sopuerta	.6217954	Zerain	.60821126
Muxika	.69630954	Soraluze-Placencia de las Armas	.25623574	Zestoa	.31207403
Nabarniz	.76818772	Sukarrieta	-.10088699	Zierbena	-2.1129944
Navaridas	-.12027664	Tolosa	.03708481	Zigoitia	-.01333456
Oiartzun	.08285323	Trucios-Turtzioz	.72957429	Ziortza-Bolibar	.38647816
Okondo	.48496725	Ubide	.27749348	Zizurkil	.3144349
Olaberria	-.20105835	Ugao-Miraballes	-.30005299	Zuia	.31299618
Ondarroa	-.61777788	Urduliz	-.57513812	Zumaia	-.92248991
Ordizia	-.85683101	Urduña/Orduña	-.14459176	Zumarraga	.14927204
Orendain	.55409671	Urkabustaiz	.29837001		
Orexa	.9341395	Urnietia	.01216309		
Orio	-.27227302	Urretxu	.13693716		
Ormaiztegi	.25254256	Usurbil	-.02565536		
Orozko	.52561555	Valdegovía/Gaubea	.40946307		
Ortuella	-1.6399788	Valle de Trápaga-Trapagaran	-1.3256586		
Otxandio	.12027811	Villabona	.14617715		
Oyón-Oion	-.3129325	Villabuena de Álava/Eskuernaga	-.07660402		
Oñati	.77787226	Vitoria-Gasteiz	-1.1373658		
Pasaia	-.61163317	Yécora/Iekora	-.05281282		
Peñacerrada-Urizaharra	.42805267	Zaldibar	-.16628793		
Plentzia	-.65109088	Zaldibia	.38266106		
Portugalete	-3.3818573	Zalduondo	.31182519		
Ribera Baja/Erriberabeitia	-.87910204	Zalla	.18306327		
Samaniego	-.09568118	Zambrana	.12456977		
San Millán/Donemiliaga	.50827378	Zamudio	-.75020733		
Santurtzi	-2.4340041	Zaratamo	.30916381		
Segura	.36569071	Zarautz	-.92571013		
Sestao	-3.417837	Zeanuri	.53483235		

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Araba	480.12303 (100.3309)	484.63492 (97.62045)	497.28814 (94.0392)	498.75577 (97.45668)	502.40072 (95.54589)	495.09656 (95.26035)	496.91904 (94.3181)
Bizkaia	803.27798 (234.7061)	798.97153 (223.799)	828.83581 (233.641)	820.17195 (226.0549)	836.69862 (231.2372)	819.21389 (224.8647)	827.47723 (227.4185)
Gipuzkoa	749.70926 (178.8401)	746.1329 (170.6184)	755.8285 (173.4733)	762.10591 (172.5338)	766.45773 (173.7943)	760.35303 (171.2002)	762.52894 (171.8243)
Abadiño	652.40737 (51.34663)	655.06813 (50.95455)	685.43705 (56.54241)	675.65106 (36.34254)	695.45893 (40.77964)	675.47587 (36.54659)	685.37981 (38.71484)
Abaltzisketa	869.29259 (65.42793)	859.80782 (65.30645)	872.74141 (65.8069)	873.87118 (71.98237)	878.77424 (72.74754)	866.34677 (71.58948)	868.7983 (71.97195)
Abanto y Ciérvana-Abanto Zierbena	637.85078 (41.26497)	641.97027 (41.84846)	658.25115 (43.24945)	658.64057 (31.71346)	666.57714 (31.6664)	659.06617 (31.6673)	663.03445 (31.63652)
Aduna	791.30547 (75.48389)	774.46697 (74.32749)	796.85204 (75.9155)	798.81061 (80.9597)	808.87272 (82.97916)	801.07783 (81.03748)	806.10888 (82.04749)
Agurain/Salvatierra	580.60699 (68.57514)	580.08158 (66.53531)	586.11189 (65.5858)	604.8317 (56.65631)	606.43667 (56.25317)	602.96696 (57.05439)	603.76944 (56.83969)
Aia	655.97887 (65.47092)	656.21774 (65.2537)	668.69142 (65.81876)	671.42365 (69.695)	676.82335 (69.8917)	671.98124 (70.5399)	674.68109 (70.6428)
Aizarnazabal	706.2102 (61.04018)	706.21492 (61.69478)	712.31031 (60.70441)	721.29706 (66.31119)	721.44684 (65.39896)	720.01372 (65.57114)	720.08861 (65.1195)
Ajangiz	859.24052 (50.071)	854.17527 (49.64277)	888.45414 (52.64009)	869.78907 (42.03114)	887.90209 (45.6703)	871.86823 (42.63163)	880.92474 (44.37408)
Albiztur	896.28895 (101.6361)	883.76806 (99.32001)	902.52377 (101.0569)	910.84394 (103.4822)	921.90919 (102.2386)	903.85689 (102.0282)	909.38951 (101.4004)
Alegia	659.62509 (62.5596)	662.34016 (62.91477)	670.53653 (63.42909)	676.24053 (68.16716)	679.90989 (69.2506)	674.96404 (68.14101)	676.79872 (68.68252)
Alegría-Dulantzi	530.21814 (37.61264)	534.5918 (37.68512)	539.75305 (35.39253)	548.94072 (30.81145)	547.99605 (28.73084)	547.5912 (31.12035)	547.11887 (30.03373)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Alkiza	844.63641 (59.49522)	836.77367 (59.55806)	852.07535 (60.73277)	842.86431 (71.6736)	849.99556 (71.3064)	834.21387 (70.77573)	837.77949 (70.57831)
Alonsotegi	678.8219 (53.37923)	679.98994 (52.73468)	716.01529 (60.27598)	700.21161 (42.41375)	724.8227 (46.68193)	699.82054 (41.78194)	712.12608 (43.68343)
Altzaga	1,107.0374 (42.90453)	1,088.0739 (44.61123)	1,095.9737 (43.08546)	1,103.6775 (44.71306)	1,102.4274 (39.75454)	1,094.1083 (42.45312)	1,093.4833 (39.9583)
Altzo	776.20008 (64.19948)	771.89862 (64.17918)	785.798 (65.48067)	778.27815 (77.46393)	785.77291 (78.88342)	779.51758 (77.18847)	783.26495 (77.8989)
Amezketza	694.2291 (59.82909)	692.38143 (60.15725)	707.65502 (60.40095)	705.47562 (67.63974)	710.57727 (68.9199)	704.56615 (67.55338)	707.11697 (68.18844)
Amorebieta-Etxano	601.77653 (43.27208)	608.32326 (43.73605)	637.51301 (49.1657)	625.68827 (31.80044)	644.68914 (36.30275)	625.90557 (31.63979)	635.40601 (33.81978)
Amoroto	1,108.0913 (78.24609)	1,090.4821 (77.00034)	1,138.1 (81.94837)	1,120.3754 (55.85676)	1,146.4028 (57.57591)	1,120.1811 (55.50916)	1,133.1947 (56.364)
Amurrio	555.64473 (37.73339)	561.58905 (37.59275)	568.95079 (36.88381)	575.75419 (24.52789)	578.27733 (23.73685)	573.87916 (24.8502)	575.14073 (24.45386)
Andoain	656.12194 (60.25937)	658.79389 (60.97855)	662.92915 (61.50776)	674.0404 (64.63363)	676.42596 (64.67606)	672.00688 (64.30672)	673.19966 (64.32642)
Anoeta	630.92454 (75.18813)	632.0047 (72.44173)	639.19096 (73.72274)	648.24165 (66.49058)	655.22883 (71.49405)	649.54246 (69.6913)	653.03605 (72.34953)
Antzuola	662.55946 (60.24841)	666.62698 (60.53107)	679.49723 (61.62722)	680.84351 (62.479)	687.36707 (63.6552)	678.24092 (62.26691)	681.5027 (62.85546)
Arakaldo	1,458.8017 (78.48232)	1,423.3084 (77.16093)	1,460.618 (82.17876)	1,451.7033 (64.51579)	1,473.5522 (63.74459)	1,450.7255 (63.28278)	1,461.65 (62.90045)
Arama	1,025.0729 (95.91274)	1,003.8452 (93.73071)	1,015.7071 (92.9082)	1,021.8077 (109.2162)	1,024.3933 (106.2898)	1,023.0388 (108.4768)	1,024.3316 (106.9902)
Aramaio	558.03462 (41.58734)	565.82531 (41.44861)	578.14831 (41.05775)	578.40689 (34.00182)	583.85644 (33.96481)	575.38551 (34.27334)	578.11028 (34.25495)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Arantzazu	874.52051 (59.55397)	869.70379 (58.819)	903.15842 (63.38025)	879.09799 (66.17242)	898.5855 (70.60368)	876.95645 (66.49309)	886.7002 (68.70203)
Areatza	769.43913 (49.02932)	769.70893 (48.5979)	811.40934 (55.5694)	787.92016 (29.62683)	814.50512 (35.48315)	785.17831 (29.96433)	798.47079 (32.82949)
Aretxabaleta	651.32233 (56.61764)	654.89169 (57.12459)	662.96036 (58.03771)	667.38973 (61.0062)	671.77799 (62.40431)	665.67758 (61.05853)	667.87172 (61.75568)
Armiñón	406.59645 (32.28772)	414.81199 (31.97404)	422.83944 (30.75381)	426.04951 (31.12083)	427.24666 (29.67701)	426.33223 (31.49511)	426.9308 (30.77429)
Arraia-Maeztu	348.30115 (24.48791)	358.1161 (25.28373)	376.78004 (23.35158)	371.47598 (18.64914)	377.05075 (13.01853)	363.94034 (17.77915)	366.72773 (14.91984)
Arrankudiaga	821.82925 (55.01563)	815.49191 (54.71236)	859.68994 (61.59895)	840.89448 (34.3961)	867.36549 (40.12479)	841.09111 (33.27411)	854.32661 (36.10691)
Arrasate/Mondragón	656.9578 (58.266)	659.23888 (58.57896)	663.87891 (58.89407)	673.37622 (60.81878)	675.15046 (62.39089)	671.19169 (61.27219)	672.07881 (62.05664)
Arratzu	994.64165 (48.51381)	983.59031 (48.70982)	1,025.261 (52.23801)	1,004.6796 (21.72324)	1,026.1399 (24.7392)	1,004.0363 (21.91913)	1,014.7664 (23.43236)
Arratzua-Ubarrundia	451.69022 (29.64373)	447.61309 (29.6155)	464.30141 (29.49051)	466.14658 (24.14419)	472.76563 (22.80961)	469.18023 (24.02658)	472.48976 (23.36322)
Arrieta	878.1904 (39.56993)	871.20361 (40.18538)	915.63106 (43.91003)	888.44325 (24.98079)	910.28616 (27.07267)	878.69847 (24.82)	889.61992 (25.87775)
Arrigorriaga	634.08385 (43.21008)	640.99394 (43.48137)	663.52103 (49.48655)	656.74379 (32.32296)	673.80304 (37.06283)	655.82684 (31.88512)	664.35646 (34.0293)
Artea	869.46816 (56.1382)	861.86377 (55.13823)	904.03624 (61.37761)	883.67805 (34.20485)	909.81334 (39.82352)	883.94897 (35.14775)	897.01662 (37.93085)
Artzentales	991.20566 (83.17259)	975.35659 (82.04135)	1,022.5736 (85.63789)	1,008.8207 (65.05939)	1,032.2559 (62.76379)	999.51612 (64.22868)	1,011.2337 (63.07538)
Artziniega	540.21734 (39.35424)	547.72429 (39.64694)	555.63056 (37.6585)	563.10492 (25.31374)	563.62263 (23.96578)	559.60394 (25.5589)	559.86279 (24.87032)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Asparrena	535.90734 (38.93311)	536.09757 (39.50245)	551.48641 (37.55322)	555.76297 (25.97211)	559.00974 (26.03823)	554.63555 (27.51022)	556.25893 (27.52929)
Asteasu	655.84292 (43.05329)	657.42032 (44.66769)	669.0681 (44.00808)	670.18306 (45.86388)	672.76065 (44.08265)	669.66894 (46.11743)	670.95774 (45.20705)
Astigarraga	611.44231 (54.87336)	614.07884 (55.06478)	618.12405 (54.71669)	627.1655 (58.7382)	628.05661 (58.59602)	625.50216 (58.89101)	625.94771 (58.81173)
Ataun	649.85152 (63.44374)	652.03065 (63.75267)	667.27317 (64.60861)	667.07195 (70.51386)	674.28793 (69.31313)	666.75887 (69.30211)	670.36686 (68.70313)
Atxondo	729.79821 (54.13714)	727.35129 (53.43208)	766.45351 (60.76107)	748.27138 (41.5216)	773.82866 (48.26849)	749.1275 (42.01384)	761.90613 (45.31558)
Aulesti	999.89193 (65.61992)	987.52628 (64.99871)	1,034.6499 (70.13411)	1,011.6672 (52.29362)	1,036.9854 (55.01386)	1,012.8238 (51.97503)	1,025.4829 (53.33786)
Ayala/Aiara	372.94624 (27.99849)	386.25386 (28.70049)	397.81646 (27.0167)	398.0614 (18.66273)	400.44033 (18.67431)	396.30978 (19.49045)	397.49924 (19.49043)
Azkoitia	655.38729 (58.78662)	658.77427 (59.25882)	668.89675 (60.26199)	673.65685 (60.89828)	678.76457 (62.67583)	673.68431 (61.05009)	676.23817 (61.93464)
Azpeitia	652.51716 (56.12562)	655.39789 (57.02417)	665.28175 (57.75554)	670.14005 (59.97491)	674.66859 (60.66245)	669.74865 (59.60714)	672.01292 (59.94765)
Añana	654.19258 (44.56408)	650.58767 (43.82542)	664.69121 (42.56646)	669.77466 (28.42599)	674.93552 (24.87717)	661.38771 (28.46961)	663.96814 (26.68798)
Bakio	704.41114 (40.80486)	705.41948 (41.52984)	737.4948 (44.29136)	720.97688 (32.88893)	737.11792 (34.73923)	719.3606 (33.30177)	727.43112 (34.23272)
Baliarrain	1,254.3717 (132.7368)	1,224.5308 (128.9637)	1,236.3145 (129.1013)	1,271.3942 (110.6161)	1,275.1662 (111.2648)	1,262.9315 (110.4277)	1,264.8174 (110.7607)
Balmaseda	659.42165 (39.42486)	665.56404 (39.92619)	702.4069 (44.57379)	680.78675 (30.11709)	700.41234 (33.30551)	678.89227 (29.32836)	688.70506 (31.14883)
Barakaldo	609.88041 (44.21852)	618.80722 (44.95549)	626.49871 (46.73169)	635.07339 (34.62887)	640.44881 (36.78104)	633.54772 (34.25528)	636.23543 (35.33267)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Barrika	657.60304 (35.87541)	661.20992 (36.44518)	681.33608 (37.51608)	675.04335 (25.88296)	684.56946 (26.27215)	675.36343 (26.47993)	680.12649 (26.64045)
Barrundia	336.9978 (22.74431)	351.08358 (23.31048)	366.95022 (22.0394)	360.46348 (17.98744)	366.07655 (13.12525)	359.97183 (16.61746)	362.77837 (14.2789)
Basauri	624.46693 (45.5233)	628.30846 (44.06863)	613.71966 (42.94466)	643.46297 (36.24636)	636.97854 (33.46346)	645.19877 (35.5462)	641.95656 (34.29668)
Baños de Ebro/Mañueta	524.9807 (48.52194)	528.65126 (48.0048)	537.78711 (46.01984)	546.09744 (41.09846)	547.43222 (38.98262)	537.64031 (41.23552)	538.3077 (40.20892)
Beasain	652.68559 (59.21951)	654.90775 (59.72098)	662.98466 (60.79333)	671.38931 (61.07504)	676.19348 (61.67045)	670.26935 (60.75569)	672.67143 (61.04826)
Bedia	727.60471 (33.52227)	725.87904 (34.41024)	768.88486 (41.53854)	739.22353 (29.56879)	765.28926 (39.15315)	738.74632 (29.56581)	751.77919 (34.28888)
Beizama	1238.4586 (165.1719)	1210.4727 (159.1788)	1229.1755 (162.117)	1250.551 (165.3888)	1262.7625 (168.2442)	1251.0493 (165.9671)	1257.155 (167.3915)
Belauntza	970.99537 (66.09672)	952.96748 (65.46744)	967.31214 (66.0241)	962.60623 (77.36522)	968.1082 (78.10811)	962.24888 (77.7332)	964.99986 (78.10236)
Berango	612.81301 (40.12607)	620.28369 (40.62321)	633.43933 (42.70859)	634.68912 (30.01251)	643.12978 (33.29218)	636.36969 (30.47192)	640.59003 (32.11084)
Berantevilla	384.76502 (17.06704)	371.82482 (16.02148)	398.84988 (14.5083)	387.82589 (22.73982)	397.1167 (16.67661)	395.28313 (18.13455)	399.92853 (15.20212)
Berastegi	665.8221 (67.13522)	667.97971 (67.17003)	685.68009 (68.32004)	684.00684 (71.01904)	692.53928 (71.40641)	683.42954 (71.11353)	687.69576 (71.30733)
Bergara	659.23115 (59.53336)	661.70876 (59.82321)	671.95243 (61.06889)	675.71233 (63.15387)	681.41373 (65.30292)	674.73432 (63.23432)	677.58502 (64.30231)
Bermeo	607.08662 (45.51863)	616.37994 (46.4223)	647.64356 (50.45508)	633.67661 (34.50388)	650.9705 (37.51686)	631.21394 (34.29203)	639.86089 (35.78431)
Bernedo	355.64537 (20.3301)	356.52832 (21.23835)	380.49997 (19.73349)	371.60152 (16.81063)	379.4496 (17.47984)	365.08125 (18.34301)	369.00529 (18.58761)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Berriatua	761.88851 (46.40307)	760.63515 (47.19471)	802.99035 (51.82096)	777.0442 (43.70034)	799.67018 (45.78629)	776.43367 (42.83271)	787.74666 (43.87718)
Berriz	665.83034 (44.04491)	670.48895 (44.08596)	703.69814 (49.4814)	686.91102 (31.42683)	707.53518 (35.20282)	686.55426 (31.28884)	696.86634 (33.15934)
Berrobi	734.2141 (48.25745)	735.58399 (49.89948)	743.95391 (49.75748)	746.92925 (53.0512)	749.68871 (52.41972)	743.52702 (52.23757)	744.90675 (51.92645)
Bidania-Goiatz	778.72645 (53.61732)	773.9387 (53.90429)	788.84614 (54.4129)	788.0567 (54.81567)	794.27034 (54.26991)	779.80637 (54.51807)	782.91319 (54.24164)
Bilbao	912.6795 (63.95481)	901.91004 (62.73843)	887.58051 (61.56448)	926.65759 (46.42912)	919.85245 (45.74985)	927.80955 (46.62461)	924.40698 (46.28903)
Busturia	711.87379 (55.26819)	716.06772 (55.35941)	755.94504 (59.1444)	734.34844 (46.33837)	754.66337 (48.60408)	732.17904 (46.27697)	742.3365 (47.40478)
Campezo/Kanpezu	415.33498 (29.0187)	423.02842 (31.19345)	439.20287 (28.26956)	440.99009 (18.14991)	442.76964 (15.35586)	437.62512 (19.20992)	438.51489 (17.88517)
Deba	662.38139 (65.29802)	662.55562 (65.16688)	671.75349 (65.50714)	679.25704 (68.04237)	682.99981 (68.09308)	678.46169 (68.61704)	680.33308 (68.64246)
Derio	614.69128 (44.76086)	614.08967 (44.20336)	619.93183 (45.64453)	632.77473 (36.9124)	637.0112 (38.47338)	632.73768 (37.43107)	634.85592 (38.25317)
Dima	815.81898 (72.72013)	811.8624 (71.20152)	853.29463 (77.52782)	838.8956 (52.2616)	863.94874 (58.50184)	841.13694 (53.11917)	853.6635 (56.22733)
Donostia / San Sebastián	705.19981 (62.9668)	700.26226 (62.37974)	686.95732 (60.73357)	716.41482 (67.22803)	708.69328 (65.06979)	718.49222 (67.42292)	714.63145 (66.34086)
Durango	593.60893 (42.54742)	602.11372 (42.5901)	611.40594 (46.57135)	616.12128 (31.58062)	625.94104 (36.66681)	615.36156 (32.47886)	620.27144 (34.9015)
Ea	817.85043 (48.54064)	815.04983 (49.57614)	857.86184 (52.45829)	833.55238 (38.896)	853.1041 (42.15431)	832.34962 (40.56194)	842.12548 (42.17831)
Eibar	657.40229 (59.79203)	659.64209 (60.0869)	661.64575 (60.79108)	673.42678 (64.65216)	675.18039 (66.05451)	672.00562 (64.36137)	672.88243 (65.04982)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation).

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Elantxobe	885.35727 (58.87616)	880.57006 (58.36639)	918.96284 (61.24663)	902.41734 (40.3371)	921.14422 (40.00071)	897.54942 (40.24097)	906.91286 (40.07427)
Elburgo/Burgelu	348.90355 (22.75083)	360.51933 (23.75085)	368.90028 (23.11223)	371.3441 (20.13607)	373.87906 (19.08324)	370.57865 (18.62307)	371.84613 (18.2516)
Elciego	566.23877 (31.26901)	568.72404 (31.5832)	574.40463 (29.65667)	577.13605 (32.69884)	576.85292 (32.95583)	568.21257 (32.65868)	568.071 (32.76365)
Elduain	940.61039 (63.08841)	925.36903 (62.4331)	948.6647 (64.75251)	943.79877 (62.68201)	956.4923 (65.32072)	944.78874 (63.2033)	951.13551 (64.52404)
Elgeta	651.72812 (57.52411)	654.02989 (57.77492)	668.18723 (59.53832)	665.41379 (63.7693)	673.48776 (66.36107)	655.92913 (63.20838)	659.96611 (64.49636)
Elgoibar	656.29837 (59.80132)	658.05167 (60.13034)	665.42861 (60.82915)	674.01482 (61.70168)	677.64906 (62.71276)	672.85577 (61.6764)	674.67289 (62.17463)
Elorrio	628.01024 (47.3563)	631.90026 (47.01352)	665.18247 (53.66995)	651.14576 (32.59657)	673.43768 (38.76791)	653.21366 (33.04726)	664.35962 (36.09921)
Elvillar/Bilar	527.31846 (46.80819)	532.41758 (46.19179)	541.03125 (44.55962)	549.15257 (35.68102)	550.91008 (35.04123)	540.55932 (36.1254)	541.43807 (35.835)
Erandio	621.3099 (42.75856)	625.86047 (42.75185)	637.48276 (43.41509)	643.42092 (27.67592)	648.89583 (28.05334)	645.52366 (28.20664)	648.26112 (28.40152)
Ereño	1574.9894 (119.715)	1533.2344 (116.2304)	1581.5516 (119.8348)	1581.1309 (77.60384)	1604.9611 (79.32904)	1571.3346 (77.50164)	1583.2496 (78.3553)
Ermua	669.02951 (43.71577)	673.80541 (43.98711)	689.07762 (45.48276)	689.30982 (33.58797)	697.01867 (37.4975)	689.16572 (34.3382)	693.02015 (36.30236)
Errenteria	657.74134 (61.22761)	661.50161 (61.90665)	664.31547 (63.21485)	675.90919 (66.11288)	679.35084 (68.07806)	673.93421 (65.54292)	675.65504 (66.50889)
Errezil	760.37845 (62.53)	758.66473 (62.82122)	775.22084 (63.36897)	776.28837 (61.7017)	783.73357 (59.5374)	768.76573 (60.54573)	772.48832 (59.46614)
Erriberagoitia/Ribera Alta	353.96696 (12.41024)	365.11556 (13.58247)	382.14838 (12.0745)	371.3107 (12.03821)	376.00388 (13.11561)	371.12487 (12.02179)	373.47146 (12.50249)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Errigoiti	1,014.6209 (88.61998)	1,003.638 (87.07901)	1,048.4971 (91.67683)	1,036.1264 (65.90152)	1,059.5079 (68.53171)	1,025.9087 (65.68153)	1,037.5994 (66.99964)
Eskoriatza	658.00731 (60.89262)	659.81331 (61.01702)	672.14778 (62.15215)	675.04549 (61.28799)	680.60345 (65.967)	674.03292 (63.03099)	676.81189 (65.36483)
Etxebarri	619.76301 (45.37877)	627.85141 (45.37649)	628.95951 (44.89915)	642.97369 (34.26839)	643.32377 (32.87566)	641.29424 (34.08005)	641.46928 (33.37498)
Etxebarria	868.9474 (43.65606)	862.57795 (44.79865)	904.16829 (48.68657)	886.46723 (10.72468)	907.68528 (16.29616)	884.99122 (12.06822)	895.60025 (14.85166)
Ezkio-Itsaso	871.41987 (141.0642)	856.92019 (136.6981)	876.09604 (137.5)	918.89365 (90.88297)	926.61933 (91.23342)	918.77945 (89.66077)	922.64229 (89.83927)
Forua	704.97205 (50.65615)	708.24241 (51.15344)	744.90021 (53.29594)	726.45325 (40.69975)	742.33919 (45.35787)	725.7788 (41.9206)	733.72177 (44.2452)
Fruiz	809.07642 (44.31726)	806.39722 (44.94004)	841.33476 (47.63861)	822.79943 (35.5328)	839.27866 (39.7238)	812.14239 (36.02578)	820.38201 (38.13403)
Gabiria	769.59612 (63.14159)	763.57272 (62.85539)	779.37749 (63.71987)	775.53372 (72.14588)	782.66562 (72.85209)	776.86292 (71.9581)	780.42887 (72.3101)
Gaintza	1300.9811 (80.15469)	1270.5748 (79.33919)	1283.8387 (79.05518)	1276.8783 (96.40384)	1279.6513 (97.3577)	1266.9057 (95.18249)	1268.2922 (95.63982)
Galdakao	620.60762 (47.97563)	627.57363 (48.40905)	649.06773 (53.78949)	645.56 (38.62363)	661.61306 (42.10043)	643.86957 (37.45575)	651.8961 (39.08178)
Galdames	930.22107 (49.32257)	922.00257 (49.70833)	970.76525 (54.88524)	942.05153 (32.35268)	968.10132 (32.96708)	942.70079 (32.48606)	955.72568 (32.79244)
Gamiz-Fika	653.56135 (52.64924)	660.58285 (52.97961)	695.58841 (56.26367)	680.13349 (38.30291)	697.93698 (41.82502)	678.69296 (38.95986)	687.5947 (40.71373)
Garai	1,087.6407 (31.01436)	1,064.4507 (32.51465)	1,106.7002 (36.16587)	1,085.4545 (5.555457)	1,105.8135 (17.24317)	1,076.2397 (7.463268)	1,086.4192 (13.53002)
Gatika	699.46145 (62.52228)	703.20944 (62.21443)	736.22181 (65.0387)	725.13176 (51.44377)	741.60464 (52.82394)	724.48338 (51.23606)	732.71983 (51.926)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Gautegiz Arteaga	792.78145 (51.22784)	788.91807 (50.90932)	829.29541 (54.10875)	809.68377 (34.80495)	829.84563 (35.70684)	808.5976 (34.80408)	818.67854 (35.25375)
Gaztelu	1,210.4054 (114.8325)	1,185.5841 (111.9841)	1,201.611 (113.3272)	1,200.3146 (131.3713)	1,211.5392 (129.1119)	1,200.0865 (130.6062)	1,205.6988 (129.4728)
Gernika-Lumo	616.72389 (48.79612)	624.62363 (48.86723)	642.07429 (50.59593)	641.71012 (37.80186)	650.88256 (38.45363)	640.77712 (38.03247)	645.36334 (38.36066)
Getaria	650.87227 (66.62017)	648.11877 (66.69534)	653.03893 (66.15437)	670.67035 (64.9879)	671.28409 (64.71732)	668.8303 (65.32084)	669.13717 (65.22375)
Getxo	610.46222 (44.91244)	616.47104 (44.73315)	593.96694 (42.57035)	632.53485 (33.18161)	621.43397 (32.86869)	634.83193 (33.90245)	629.28149 (33.74181)
Gizaburuaga	1,491.2976 (67.46029)	1,452.3447 (66.72621)	1,498.9613 (72.22155)	1,478.9814 (52.66223)	1,504.8831 (54.52551)	1,476.9619 (51.73162)	1,489.9127 (52.66223)
Gordexola	735.76516 (39.33456)	734.89599 (40.19381)	780.92068 (45.09827)	753.95301 (19.18674)	778.49616 (23.18517)	753.94113 (19.93286)	766.21271 (21.91832)
Gorliz	664.23949 (44.94062)	668.71393 (45.29754)	687.55182 (47.83421)	686.27785 (31.15594)	696.92743 (32.77516)	683.44101 (31.62798)	688.7658 (32.42845)
Güeñes	632.11314 (47.37548)	639.5299 (48.01706)	674.18539 (51.8736)	658.46071 (31.27944)	676.77244 (35.13887)	658.27018 (32.17664)	667.42605 (34.10226)
Harana/Valle de Arana	435.27915 (29.63202)	442.55687 (30.48979)	461.88934 (28.37128)	456.94608 (20.4403)	462.60611 (19.35822)	448.26392 (20.86547)	451.09394 (20.25014)
Hernani	644.29291 (56.51262)	647.84418 (57.18008)	656.88423 (58.32316)	659.49469 (63.73378)	665.05297 (63.97734)	659.96152 (63.20227)	662.74066 (63.32045)
Hernialde	912.92273 (65.52641)	899.94635 (65.16457)	912.70326 (67.25169)	911.40896 (74.61364)	920.22038 (77.12148)	911.2052 (74.70243)	915.61091 (75.95121)
Hondarribia	656.55341 (64.40942)	650.16507 (66.2282)	647.86398 (71.15486)	677.3867 (77.50826)	684.59019 (82.84995)	675.61122 (72.84939)	679.21296 (75.68106)
Ibarra	665.17734 (57.76171)	667.78191 (57.95507)	669.02936 (56.9341)	681.79457 (60.55955)	680.65222 (57.77988)	680.33454 (59.84813)	679.76336 (58.44582)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Ibarrangelu	1,101.2908 (115.896)	1,082.4043 (112.4086)	1,126.7265 (116.0916)	1,129.5104 (73.23409)	1,152.4449 (72.76261)	1,128.0088 (72.50479)	1,139.4761 (72.25465)
Idiazabal	650.95569 (56.22083)	651.44522 (56.76477)	664.99201 (57.20013)	666.2162 (60.85548)	671.43047 (61.87555)	666.01957 (60.60782)	668.62671 (61.1212)
Igorre	670.49755 (43.10176)	675.50631 (43.7104)	706.14308 (48.24107)	690.83376 (35.51492)	708.90218 (38.11029)	690.56819 (35.20436)	699.6024 (36.47783)
Ikaztegieta	764.72332 (59.98433)	760.64407 (60.47052)	764.99728 (59.65193)	782.17925 (53.63483)	781.81555 (52.91633)	781.38231 (53.71797)	781.20046 (53.3553)
Irun	656.35034 (58.90617)	657.16096 (57.44632)	658.28168 (57.61091)	668.22689 (60.58957)	669.71142 (61.0296)	670.73276 (61.6557)	671.47503 (61.86933)
Irura	624.69816 (73.53329)	628.92293 (72.9017)	631.09197 (72.07382)	645.17422 (77.71453)	644.29209 (77.68309)	643.1048 (77.82211)	642.66373 (77.79563)
Iruraiz-Gauna	337.18783 (27.46968)	350.29459 (27.85224)	363.03976 (26.34355)	360.44906 (25.85844)	364.44381 (21.77231)	359.82157 (24.90619)	361.81894 (22.89518)
Iruña Oka/Iruña de Oca	381.90534 (27.97771)	389.73675 (28.01777)	402.66714 (27.64486)	404.78501 (13.32779)	409.6428 (12.65783)	405.20913 (13.20751)	407.63803 (12.87469)
Ispaster	909.23731 (47.23848)	902.69541 (47.93097)	946.6222 (51.92549)	923.89496 (24.04579)	946.68296 (25.82264)	922.46532 (23.72858)	933.85932 (24.61179)
Itsasondo	717.78215 (51.39439)	716.92908 (52.22231)	730.10233 (53.42675)	732.86456 (53.40155)	739.66022 (53.01951)	731.60363 (51.61837)	735.00145 (51.42629)
Iurreta	665.68324 (47.56968)	662.69239 (47.30539)	694.73519 (52.1702)	685.3954 (33.1734)	704.8343 (36.2957)	687.28115 (32.93708)	697.0006 (34.48332)
Izurtza	1189.1666 (31.92198)	1152.8022 (29.63101)	1197.3625 (28.85516)	1168.5406 (30.66912)	1193.1084 (27.76831)	1172.4891 (31.4701)	1184.773 (30.00591)
Karrantza Harana/Valle de Carranza	733.62559 (44.72166)	729.6325 (45.92123)	771.39538 (49.64201)	752.73415 (27.01515)	772.95991 (30.81205)	752.13628 (29.43015)	762.24916 (31.32847)
Kortezubi	992.28874 (60.15112)	980.48183 (59.62492)	1,022.1784 (63.43586)	1,004.2275 (38.68877)	1,025.7767 (41.24238)	1,007.4898 (39.49781)	1,018.2644 (40.77325)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Kripan	594.29839 (41.29282)	596.61756 (40.34504)	607.85305 (38.68134)	612.45251 (22.4402)	615.5879 (20.93944)	604.2261 (23.67042)	605.7938 (22.91613)
Kuartango	414.03566 (23.47985)	430.76052 (25.00553)	464.44237 (22.8801)	438.39415 (19.77734)	450.89753 (16.44795)	435.83142 (19.10751)	442.08311 (17.38292)
Labastida/Bastida	604.99261 (41.91031)	605.54008 (41.88103)	614.75204 (40.41434)	623.29507 (29.26304)	625.06186 (26.781)	615.16543 (28.97338)	616.04882 (27.74367)
Lagrán	446.72672 (35.21816)	451.53789 (34.99644)	473.86403 (34.03687)	467.87048 (22.22615)	478.20686 (18.28213)	467.64533 (22.77051)	472.81352 (20.75795)
Laguardia	571.37923 (33.72381)	566.6808 (34.13227)	581.76535 (32.01677)	584.73271 (25.81859)	587.41848 (24.98186)	578.06984 (25.95121)	579.41273 (25.57458)
Lanciego/Lantziego	479.85143 (30.53577)	488.37789 (31.21044)	494.80633 (29.24349)	502.10907 (19.42898)	501.63927 (14.95402)	493.08599 (18.46989)	492.8511 (16.23697)
Lanestosa	990.24688 (75.76026)	975.73647 (75.30709)	999.92891 (76.02787)	1,006.9969 (55.1114)	1,015.3457 (62.47799)	1,004.7618 (58.15134)	1,008.9362 (61.85023)
Lantarón	354.04795 (27.61824)	366.04903 (27.87405)	377.19539 (26.38628)	377.57359 (20.3301)	380.31551 (21.41707)	377.03806 (21.6412)	378.40902 (22.15928)
Lapuebla de Labarca	482.08509 (29.23722)	489.67623 (30.7906)	491.84492 (27.46509)	503.08868 (24.14977)	498.21944 (21.02576)	492.88019 (23.71405)	490.44557 (22.18036)
Larrabetzu	714.1736 (51.11936)	714.84132 (50.78907)	752.06575 (55.48413)	735.78843 (32.02792)	756.88627 (34.78795)	734.49945 (32.6468)	745.04837 (34.03656)
Larraul	945.41812 (58.3364)	933.9953 (58.78767)	947.85666 (59.06455)	938.30785 (70.80884)	943.59293 (70.50637)	933.52093 (70.32523)	936.16347 (70.17123)
Lasarte-Oria	646.76255 (59.89981)	650.19669 (60.28527)	641.70621 (58.27255)	662.82792 (65.89817)	656.25463 (62.9119)	661.62413 (65.58392)	658.33748 (64.08112)
Laudio/Llodio	631.66405 (41.7508)	636.20925 (42.11987)	638.94571 (40.65761)	652.14579 (28.07837)	651.34999 (26.13205)	647.67381 (27.44516)	647.27591 (26.4582)
Laukiz	696.18303 (59.78339)	699.13789 (59.54295)	723.89179 (61.93834)	721.11743 (46.99558)	733.78694 (48.89823)	720.17273 (47.20822)	726.50748 (48.16035)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Lazkao	637.19071 (54.47513)	641.2244 (55.48445)	647.25933 (55.15542)	654.05053 (60.5037)	655.37376 (59.65332)	652.60491 (59.73027)	653.26652 (59.30857)
Leaburu	838.92711 (46.70469)	830.29736 (47.61943)	840.47655 (47.5136)	839.8985 (54.71994)	842.99404 (53.30526)	838.8861 (54.14545)	840.43387 (53.43778)
Legazpi	663.35599 (60.20779)	665.95482 (60.40852)	679.66169 (61.91561)	679.27133 (64.73603)	686.55508 (67.38835)	679.05997 (64.76598)	682.70184 (66.08521)
Legorreta	657.93138 (60.41421)	657.64533 (60.89635)	668.62481 (61.19562)	673.30017 (66.89705)	677.40815 (66.79152)	672.56549 (66.28038)	674.61947 (66.22838)
Legutio	455.00037 (32.08615)	449.80607 (29.80966)	465.19784 (31.78174)	464.62954 (23.41602)	475.63482 (24.91404)	468.34034 (24.85343)	473.84298 (25.59929)
Leintz-Gatzaga	970.96151 (58.65787)	956.36895 (58.50896)	974.71595 (60.40511)	969.11928 (64.16724)	978.64351 (65.78617)	959.72066 (63.23504)	964.48277 (64.04805)
Leioa	604.06107 (40.90288)	609.32636 (40.72414)	589.81811 (37.31941)	624.72397 (28.77811)	612.75342 (25.96779)	625.12599 (29.31678)	619.14072 (27.88605)
Lekeitio	641.50694 (34.78021)	647.76001 (35.30223)	640.42115 (34.7286)	659.67926 (25.69012)	656.34819 (26.2917)	658.30373 (26.36055)	656.63819 (26.65597)
Lemoa	679.40001 (54.15639)	681.65833 (53.55416)	711.94649 (59.17366)	700.84654 (43.96257)	721.04316 (46.98643)	700.59781 (43.37527)	710.69612 (44.83805)
Lemoiz	742.51055 (57.93927)	744.11403 (57.5007)	779.3363 (61.56176)	763.76346 (44.40384)	783.85729 (48.93641)	760.44502 (45.0784)	770.49193 (47.32143)
Leza	665.17513 (43.25338)	659.11658 (42.94802)	671.04889 (41.00326)	681.61133 (25.39322)	682.31736 (20.12344)	673.1401 (24.53042)	673.49311 (21.88691)
Lezama	676.71827 (36.96588)	680.01494 (37.43651)	710.85747 (41.48936)	693.40099 (27.01056)	711.44042 (30.32873)	692.81008 (27.78885)	701.82979 (29.44503)
Lezo	659.4548 (53.70008)	656.80313 (53.38179)	660.92349 (53.10234)	669.11166 (58.86257)	669.78767 (57.33455)	669.01669 (59.12835)	669.3547 (58.36295)
Lizartza	734.73702 (57.40496)	734.52222 (58.2703)	748.45976 (59.32143)	745.16132 (66.61722)	752.11881 (66.95537)	744.50505 (65.88532)	747.98379 (66.0545)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Loiu	614.32607 (30.88689)	597.74478 (28.27684)	628.42036 (32.67773)	618.21966 (16.75588)	638.10047 (19.37607)	626.01886 (16.86867)	635.95926 (18.95856)
Mallabia	801.72393 (44.37992)	780.53075 (42.39308)	832.11979 (49.64061)	807.18487 (26.07293)	837.8464 (31.45052)	811.80566 (25.9264)	827.13642 (28.96899)
Markina-Xemein	648.87602 (50.31092)	655.10326 (50.70004)	695.80388 (55.84678)	673.68692 (39.62547)	696.21389 (43.45786)	672.13947 (39.60751)	683.40296 (41.51654)
Maruri-Jatabe	724.94875 (40.19104)	727.20807 (41.05223)	767.11581 (44.45588)	742.87207 (28.62721)	762.79318 (30.84982)	741.88448 (28.85576)	751.84503 (29.96651)
Mañaria	1,003.6771 (73.01927)	990.03369 (71.52773)	1,031.7368 (80.34065)	1,017.6482 (50.59171)	1,046.3962 (59.91973)	1,017.2456 (51.78143)	1,031.6196 (56.29519)
Mendaro	656.74366 (64.27314)	657.82897 (64.01328)	670.05998 (65.09428)	675.77949 (62.73996)	681.9939 (63.76223)	676.89189 (63.75258)	679.99909 (64.25973)
Mendata	1,364.2721 (110.7497)	1,334.9661 (107.3884)	1,381.6076 (113.1207)	1,371.247 (88.58418)	1,397.9666 (94.96435)	1,370.9207 (89.64308)	1,384.2805 (92.83334)
Mendexa	1,037.1839 (105.5321)	1,022.6954 (102.286)	1,059.5312 (107.2215)	1,056.3153 (92.05972)	1,077.5463 (95.41227)	1,056.0646 (92.54835)	1,066.68 (94.24568)
Meñaka	781.28135 (37.86418)	779.66057 (38.80173)	818.22174 (42.30807)	793.16416 (33.56995)	812.26943 (36.42167)	791.47316 (33.72969)	801.0258 (35.16257)
Moreda de Álava/Moreda Araba	538.98919 (35.17429)	543.18328 (35.27487)	550.55838 (33.67485)	555.70349 (28.79226)	556.89289 (28.39496)	546.1937 (29.12881)	546.7884 (28.93526)
Morga	1,078.9693 (75.41294)	1,062.5172 (73.74277)	1,107.7929 (78.38902)	1,086.1319 (63.95751)	1,110.1835 (68.12838)	1,076.2833 (64.79028)	1,088.3091 (66.87761)
Mundaka	699.91998 (49.26035)	702.11997 (49.17633)	728.45993 (52.01775)	722.40723 (31.37332)	736.80579 (33.39484)	722.116 (31.65186)	729.31528 (32.66167)
Mungia	619.53323 (45.73053)	627.14379 (46.26919)	649.80351 (48.28835)	645.06361 (32.17889)	656.42961 (33.17187)	643.79862 (32.25317)	649.48162 (32.74818)
Munitibar-Arbatzegi Gerrickaitz	1,253.4941 (72.06304)	1,229.996 (70.84831)	1,278.6476 (77.39716)	1,253.2165 (61.09974)	1,281.0861 (65.46104)	1,250.8479 (61.07513)	1,264.7827 (63.26101)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Murueta	1,052.4641 (61.99809)	1,030.9844 (61.27039)	1,069.7967 (64.51305)	1,056.2151 (48.91483)	1,076.3319 (52.17633)	1,056.7419 (49.48597)	1,066.8003 (51.12319)
Muskiz	656.45716 (45.97754)	661.28506 (46.63459)	683.01613 (48.85292)	679.76679 (33.48912)	690.92463 (34.55661)	679.91855 (33.71675)	685.49747 (34.24978)
Mutiloa	954.15321 (60.64741)	935.98164 (60.01527)	951.57904 (60.45269)	956.35652 (56.5)	962.5104 (57.44831)	957.13345 (57.05329)	960.21039 (57.52709)
Mutriku	659.4948 (64.32652)	661.91226 (64.65631)	670.58716 (64.97128)	677.36163 (68.41289)	681.19239 (68.28046)	675.87768 (68.57786)	677.79306 (68.51213)
Muxika	773.58507 (38.66431)	773.63313 (39.31231)	817.75601 (44.97336)	790.92013 (16.70406)	816.26859 (20.70751)	790.43796 (16.44608)	803.11219 (18.39402)
Nabarniz	1,575.0895 (105.9351)	1,535.3201 (102.8051)	1,580.4393 (108.061)	1,571.4918 (82.76064)	1,596.6214 (84.30132)	1,561.4785 (82.2411)	1,574.0433 (83.00874)
Navaridas	603.08118 (56.43252)	603.14747 (55.19745)	611.94861 (53.60595)	621.99027 (49.9577)	625.36538 (43.32684)	613.74034 (48.18147)	615.42789 (44.92497)
Oiartzun	651.91355 (60.69545)	647.4057 (60.33235)	661.50838 (61.70475)	666.97974 (61.32829)	674.54695 (62.87251)	669.22415 (61.74899)	673.00776 (62.52605)
Okondo	529.56044 (34.57547)	536.89563 (34.95695)	548.79287 (33.78097)	551.72882 (20.92394)	555.59879 (14.94525)	547.84346 (19.36185)	549.77845 (16.36742)
Olaberria	698.27937 (64.16518)	682.23691 (62.02089)	702.30815 (63.97893)	700.46973 (70.2893)	712.07102 (70.07531)	705.55612 (71.09816)	711.35676 (70.98576)
Ondarroa	640.72212 (49.46195)	646.69436 (49.37958)	666.37831 (51.35852)	665.10095 (36.00962)	675.46844 (36.06448)	663.89837 (35.95506)	669.08212 (35.98777)
Ordizia	638.55204 (50.14742)	640.74902 (50.84541)	638.14825 (49.74141)	652.07636 (55.79935)	648.78833 (55.08704)	650.83409 (55.49998)	649.19008 (55.14085)
Orendain	996.27342 (51.43022)	981.87994 (51.86777)	993.90269 (51.74409)	981.99473 (64.6809)	985.7838 (62.66261)	980.2007 (63.70628)	982.09524 (62.67812)
Orexa	1,335.348 (123.2349)	1,305.2378 (120.2762)	1,320.3622 (121.7107)	1,330.1235 (132.4862)	1,338.2462 (133.1089)	1,321.5892 (131.381)	1,325.6506 (131.6934)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Orio	640.75842 (58.3121)	644.256 (58.90076)	646.8795 (58.70522)	658.25095 (62.97329)	659.58571 (59.50513)	657.43654 (61.9816)	658.10393 (60.27963)
Ormaiztegi	658.45821 (72.02672)	660.31643 (71.64336)	669.49156 (70.18229)	677.88607 (76.62427)	678.50205 (74.10218)	676.57952 (75.79816)	676.88751 (74.49763)
Orozko	719.49218 (51.78684)	720.22631 (51.2595)	763.11068 (57.61714)	737.27829 (43.54626)	763.02302 (47.41003)	737.66049 (44.23813)	750.53286 (46.16885)
Ortuella	617.88697 (40.0057)	622.61977 (40.24734)	625.24617 (40.6045)	638.98839 (27.69094)	640.75568 (29.53249)	638.48541 (28.09115)	639.36906 (29.00825)
Otxandio	748.2274 (59.81988)	747.79364 (59.04115)	782.72089 (64.88185)	768.90092 (45.71404)	790.51377 (52.19221)	768.43691 (47.16817)	779.24334 (50.38877)
Oyón-Oion	506.33111 (32.5845)	512.79249 (33.22427)	517.90605 (31.49723)	526.88455 (22.29154)	526.21264 (19.86161)	518.87025 (21.9599)	518.53429 (20.78401)
Oñati	655.18571 (63.41055)	660.3459 (63.57537)	672.46112 (64.97832)	673.83858 (66.18978)	680.33461 (68.91888)	672.6356 (66.79187)	675.88361 (68.14731)
Pasaia	656.65442 (64.11809)	660.39681 (64.01358)	658.20882 (64.80846)	676.09137 (65.29424)	676.88875 (66.01574)	673.13046 (64.75529)	673.52915 (65.09022)
Peñacerrada-Urizaharra	388.74239 (23.67615)	395.16494 (23.86575)	414.37174 (22.44965)	408.13662 (21.56377)	414.42004 (13.12371)	400.90431 (17.69403)	404.04602 (13.46899)
Plentzia	659.39804 (49.18081)	665.32243 (49.33078)	683.40839 (49.89366)	680.55409 (42.95356)	688.27809 (45.0812)	678.23366 (43.69529)	682.09566 (44.68938)
Portugalete	614.925 (45.6721)	621.54128 (44.83053)	589.05474 (39.70665)	636.18914 (33.62216)	617.14414 (29.3979)	637.01332 (34.22511)	627.49082 (32.02223)
Ribera Baja/Erriberabeitia	411.78634 (25.80561)	413.39774 (24.53365)	421.8343 (24.54556)	424.8545 (20.85281)	429.48252 (19.80376)	427.82646 (20.35735)	430.14047 (19.82226)
Samaniego	540.89051 (35.15969)	542.28551 (35.55671)	553.12614 (32.96632)	558.945 (26.39346)	558.76534 (22.59707)	550.89266 (26.00227)	550.80284 (24.10147)
San Millán/Donemiliaga	346.9623 (20.6795)	351.13134 (20.52273)	375.56892 (19.81954)	364.43245 (7.431909)	374.74245 (6.980951)	367.63933 (7.594981)	372.79433 (7.767011)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Santurtzi	607.31614 (43.73642)	605.21871 (53.63825)	599.99656 (41.4511)	646.38329 (53.30986)	621.73056 (29.27235)	635.788 (40.39304)	623.46163 (30.37978)
Segura	657.65472 (59.12864)	659.56423 (59.61077)	670.08033 (59.23497)	675.39632 (62.41644)	677.97555 (61.75916)	673.43362 (61.89423)	674.72324 (61.559)
Sestao	625.29715 (49.3287)	628.11158 (47.46908)	598.24316 (43.35498)	644.2987 (37.07248)	628.10319 (33.61183)	648.75008 (37.71291)	640.65232 (35.97454)
Sondika	644.41833 (40.9454)	637.29193 (37.40354)	657.65728 (42.47164)	653.66074 (23.30286)	670.94737 (24.85949)	660.12831 (24.59026)	668.77162 (26.03621)
Sopela	623.40716 (46.00047)	628.56291 (45.8816)	634.44973 (46.00703)	646.61975 (31.25015)	649.40902 (31.50497)	645.5642 (31.57888)	646.95884 (31.68985)
Sopuerta	670.17789 (52.22424)	675.18626 (52.20861)	717.98723 (56.77482)	694.31628 (36.23135)	717.44097 (41.27111)	694.28846 (37.62397)	705.85081 (40.14214)
Soraluze-Placencia de las Armas	665.21211 (59.05203)	668.35777 (59.62521)	676.15512 (61.26837)	681.73866 (63.50762)	688.22732 (62.85749)	679.36567 (63.31853)	682.61 (62.98437)
Sukarrieta	987.12972 (77.96684)	972.25271 (75.453)	1,005.3058 (78.69975)	993.96065 (73.62209)	1,012.1856 (71.56468)	992.05258 (74.03683)	1,001.1651 (72.96783)
Tolosa	646.67397 (58.44106)	651.31089 (58.97233)	656.01571 (59.53362)	663.88061 (63.63198)	666.50537 (64.09062)	662.23385 (63.15298)	663.54623 (63.37736)
Trucios-Turtzioz	1,241.7532 (123.2758)	1,217.1884 (119.9058)	1,263.0064 (123.9976)	1,259.0986 (102.1429)	1,282.5179 (103.015)	1,257.4793 (102.7873)	1,269.1889 (103.224)
Ubide	1,424.1028 (125.224)	1,389.011 (120.4901)	1,427.7533 (126.11)	1,427.0421 (109.9419)	1,451.099 (114.1535)	1,423.9741 (110.8951)	1,436.0025 (112.9922)
Ugao-Miraballes	647.27855 (46.70954)	654.20483 (46.81347)	678.77386 (50.97833)	671.22761 (34.9704)	686.31547 (37.1524)	668.61327 (34.25418)	676.1572 (35.34621)
Urduliz	625.88185 (45.35069)	633.01857 (45.43779)	653.11541 (47.75412)	650.62982 (28.07502)	661.96374 (30.99772)	648.53189 (28.37397)	654.19885 (29.83888)
Urduña/Orduña	642.53729 (38.03568)	648.38632 (38.6637)	677.24872 (43.19177)	664.07977 (22.05821)	681.42952 (28.49684)	662.46266 (23.21436)	671.13754 (26.4488)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Urkabustaiz	424.65194 (29.7886)	433.61006 (30.57973)	447.06559 (29.57059)	449.66103 (13.93673)	453.00783 (12.2674)	447.26507 (14.20207)	448.93847 (13.35996)
Urnietia	666.01803 (66.51848)	665.42555 (66.45882)	674.15167 (67.89848)	684.372 (67.68958)	689.97989 (69.03867)	682.18687 (68.25986)	684.99082 (68.93141)
Urretxu	656.41391 (57.49543)	659.53059 (58.40858)	666.41054 (59.0112)	674.64584 (58.67657)	677.6423 (62.36482)	673.28185 (59.80553)	674.78007 (61.65291)
Usurbil	656.38417 (61.3348)	655.01564 (61.6294)	664.53449 (62.27401)	673.35082 (64.46619)	677.71195 (64.56181)	673.84432 (64.2155)	676.02488 (64.26489)
Valdegovía/Gaubea	369.77196 (17.62854)	376.97168 (16.40758)	396.1428 (17.62244)	380.37437 (19.33961)	387.11682 (21.40521)	382.22754 (19.35589)	385.59876 (20.37995)
Valle de Trápaga-Trapagaran	608.29982 (42.77536)	612.08882 (42.82671)	622.13159 (43.99372)	630.5701 (27.89739)	636.60023 (30.85372)	633.88871 (28.63607)	636.90378 (30.09251)
Villabona	658.2551 (61.24826)	661.60195 (61.60728)	668.26414 (62.57846)	675.6374 (65.26372)	679.79148 (66.59647)	674.98175 (65.32509)	677.05879 (65.98834)
Villabuena de Álava/Eskuernaga	535.37105 (32.06852)	535.59146 (32.4054)	548.0973 (29.89313)	547.25969 (32.82462)	548.92246 (30.25485)	539.17042 (32.50731)	540.0018 (31.25529)
Vitoria-Gasteiz	645.07167 (32.84454)	643.53734 (32.80111)	640.61892 (33.16832)	656.19558 (25.4838)	655.43171 (25.46042)	657.12345 (25.37722)	656.74152 (25.36382)
Yécora/Iekora	537.47202 (32.95252)	542.04062 (33.41649)	550.35561 (31.80505)	556.64042 (24.22214)	556.89297 (20.15823)	546.95526 (22.67977)	547.08154 (20.63939)
Zaldibar	665.80871 (55.40153)	669.85338 (55.06047)	698.9433 (59.78969)	690.62127 (41.15827)	708.5085 (45.04612)	689.66977 (41.30307)	698.61338 (43.22295)
Zaldibia	639.0869 (54.42289)	641.39906 (55.44589)	652.66128 (55.29308)	656.64208 (59.22274)	660.01951 (58.49401)	655.1284 (58.12768)	656.81712 (57.7672)
Zalduondo	579.57226 (36.76428)	582.15258 (36.43596)	594.37522 (34.5039)	592.47178 (31.92966)	595.18636 (35.46432)	582.48236 (33.39178)	583.83965 (35.17519)
Zalla	641.53512 (43.47613)	646.97681 (45.25291)	682.51225 (48.69929)	668.79851 (24.99302)	685.29671 (32.18999)	666.46043 (27.08351)	674.70953 (30.72177)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

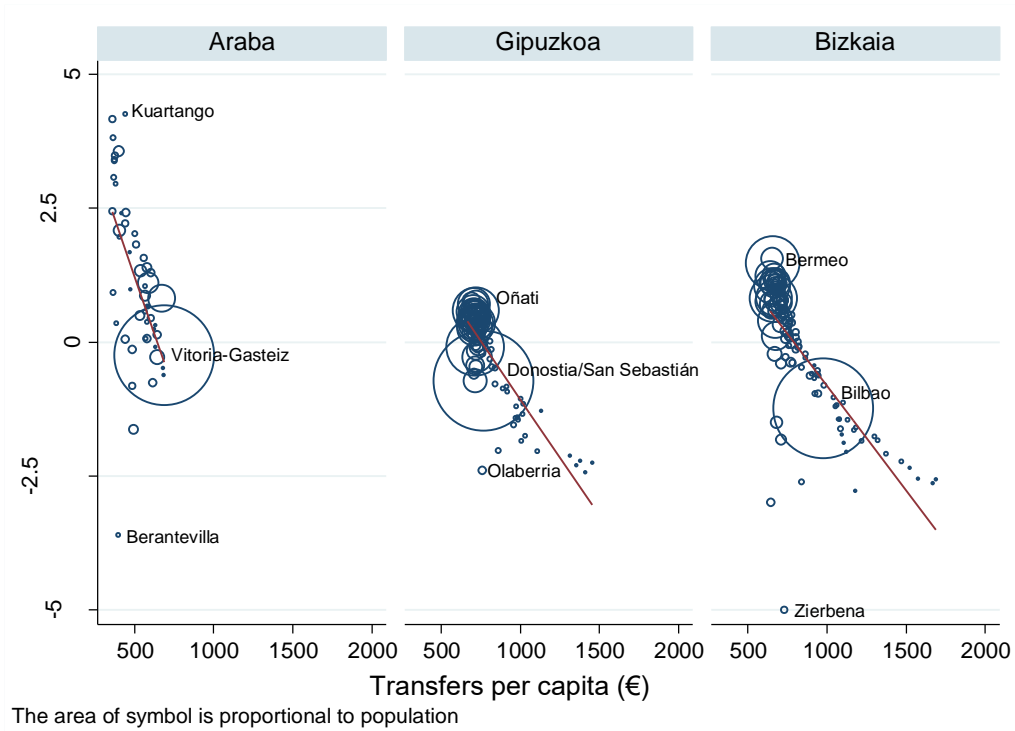
Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Zambrana	373.04419 (17.4246)	383.14781 (18.05508)	396.11862 (17.63404)	393.41048 (6.378029)	397.90764 (2.653301)	393.16514 (3.291447)	395.41372 (1.165602)
Zamudio	674.70772 (42.94338)	660.74871 (42.32599)	696.30776 (46.89082)	688.62095 (30.09076)	708.6605 (31.92137)	692.1848 (28.16834)	702.20458 (29.12412)
Zaratamo	697.6019 (36.15873)	692.1796 (38.04324)	738.21489 (42.71158)	713.8018 (37.14572)	735.03326 (33.68129)	712.92271 (33.53255)	723.53844 (31.47537)
Zarautz	650.27361 (61.01015)	652.06359 (61.36207)	648.54551 (60.6193)	667.71156 (64.64487)	665.14156 (63.78646)	667.83086 (64.36431)	666.54586 (63.94827)
Zeanuri	891.67452 (55.08151)	883.38911 (54.20307)	926.8403 (60.51839)	904.06114 (38.01184)	929.84624 (43.24025)	904.08443 (38.83764)	916.97698 (41.42279)
Zeberio	881.58442 (66.46081)	876.06735 (65.48222)	920.45713 (71.91873)	901.01882 (47.5008)	927.23699 (51.9868)	899.42235 (47.1631)	912.53143 (49.41147)
Zegama	654.38709 (61.55151)	653.92167 (61.4017)	671.34968 (62.61293)	667.98524 (67.73859)	675.77687 (69.18705)	667.47614 (67.95099)	671.37196 (68.67989)
Zerain	944.68749 (56.84231)	930.37164 (57.3691)	945.55299 (57.90671)	945.35518 (62.59723)	950.94378 (63.84223)	936.01575 (61.87076)	938.81005 (62.48473)
Zestoa	654.32892 (64.71339)	656.24402 (65.01056)	666.32742 (64.7299)	674.89892 (65.51689)	677.75032 (64.40724)	673.8863 (65.47612)	675.312 (64.91528)
Zierbena	690.51872 (53.94521)	659.62899 (47.37189)	685.111 (51.39056)	688.26332 (33.1792)	707.17336 (34.30769)	700.67636 (35.42495)	710.13138 (36.26203)
Zigoitia	453.95552 (31.3052)	454.30113 (30.57123)	471.46267 (30.78066)	467.95044 (25.30793)	476.24206 (27.31182)	468.74453 (26.67982)	472.89034 (27.69197)
Ziortza-Bolibar	1194.52 (98.20025)	1173.9305 (94.60901)	1211.6158 (99.9744)	1204.4774 (87.50756)	1228.09 (97.44254)	1201.7437 (85.73826)	1213.55 (90.2078)
Zizurkil	656.84644 (57.38307)	660.24677 (58.31347)	668.79838 (58.63007)	676.01807 (59.506)	679.35563 (59.67711)	674.82002 (59.25926)	676.4888 (59.34567)
Zuia	498.88435 (33.47986)	502.88465 (32.52686)	517.75499 (33.15776)	515.59025 (19.19164)	524.77871 (21.51641)	515.19938 (20.71723)	519.79361 (21.85548)

ANNEX C. Table C1. Transfers per capita in each of the reform scenarios (€) (2016-2019 unweighted mean & s.d.) (continuation)

Municipality	Current system	Local Sustainability OLS Index	Local Sustainability PCA Index	LSI OLS base + change	LSI PCA base + change	OLS Capacity + Needs	PCA Capacity + Needs
Zumaia	645.0962 (56.80483)	646.51777 (57.02964)	643.59988 (55.60886)	659.54587 (62.25452)	656.19738 (59.58649)	660.14348 (62.08288)	658.46924 (60.72598)
Zumarraga	656.75476 (61.54745)	659.93148 (62.24495)	666.8657 (62.74541)	675.93393 (63.20121)	679.17927 (64.55544)	673.45398 (63.83739)	675.07665 (64.52002)

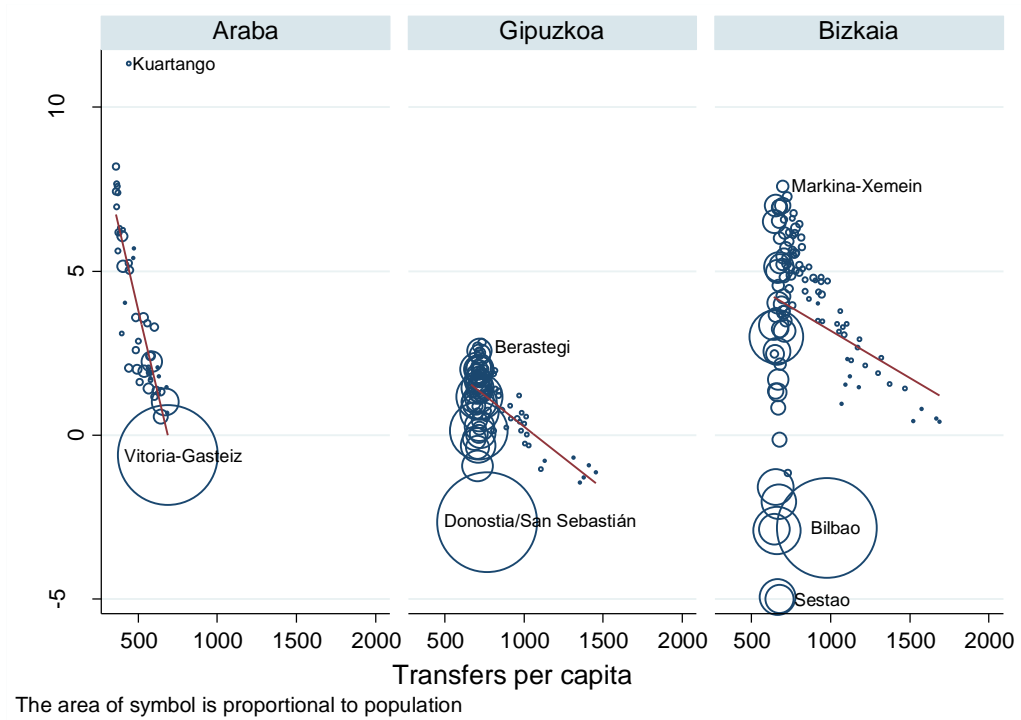
ANNEX D. Figures of baseline results and expenditure need reforms

Figure D1. Change in per capita transfers (%). Current system vs. 5% base OLS-based Index (2019)



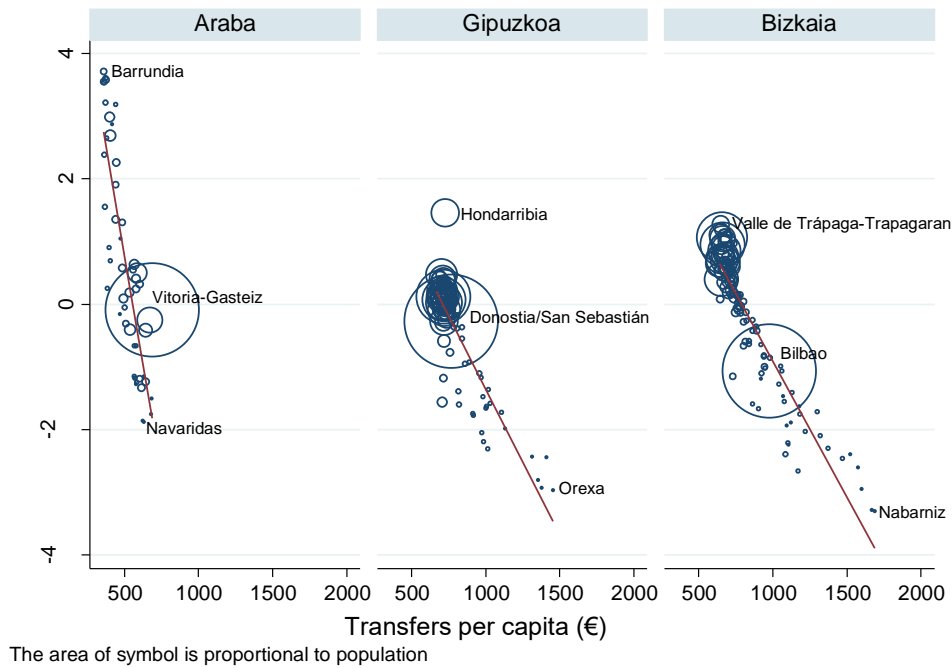
Source: own elaboration.

Figure D2. Change in per capita transfers (%). Current system vs. 5% base PCA-based Index (2019)



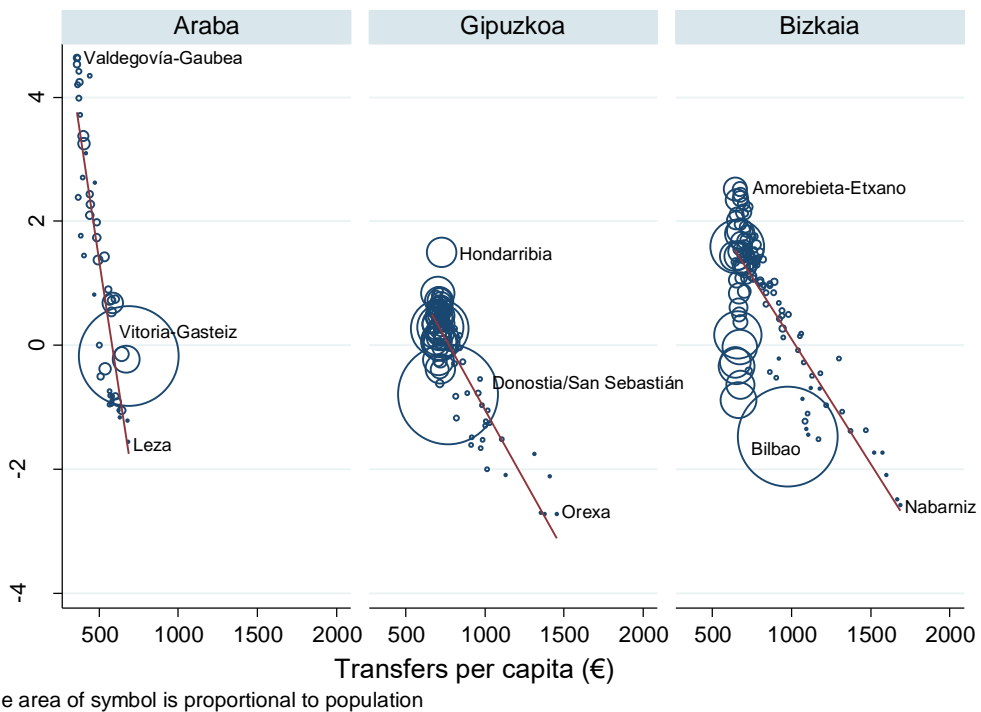
Source: own elaboration.

Figure D3. Change in per capita transfers (%). Current system vs. 2.5% fiscal capacity + 2.5% expenditure needs OLS-based Index (2019)



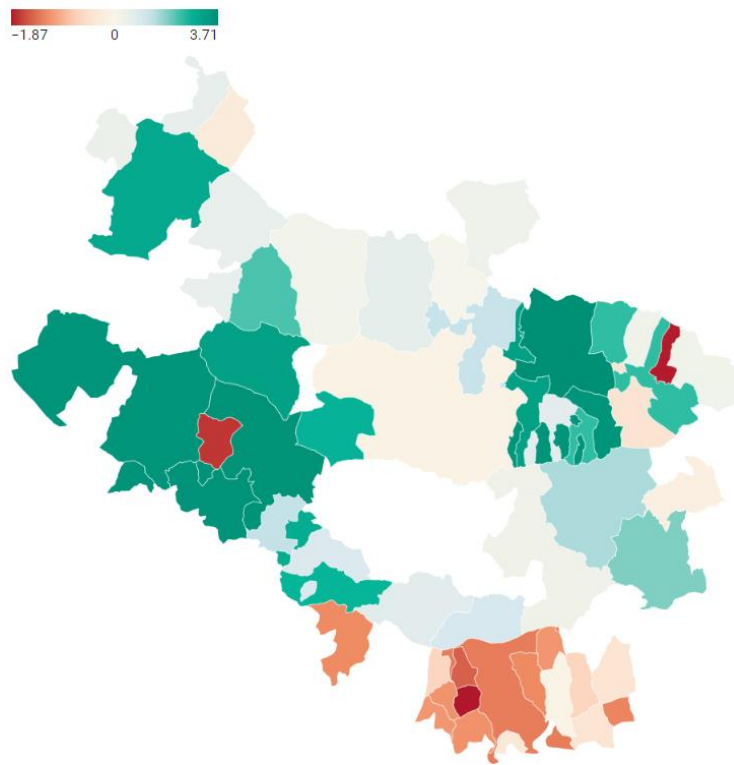
Source: own elaboration.

Figure D4. Change in per capita transfers (%). Current system vs. 2.5% fiscal capacity + 2.5% expenditure needs PCA-based Index (2019)



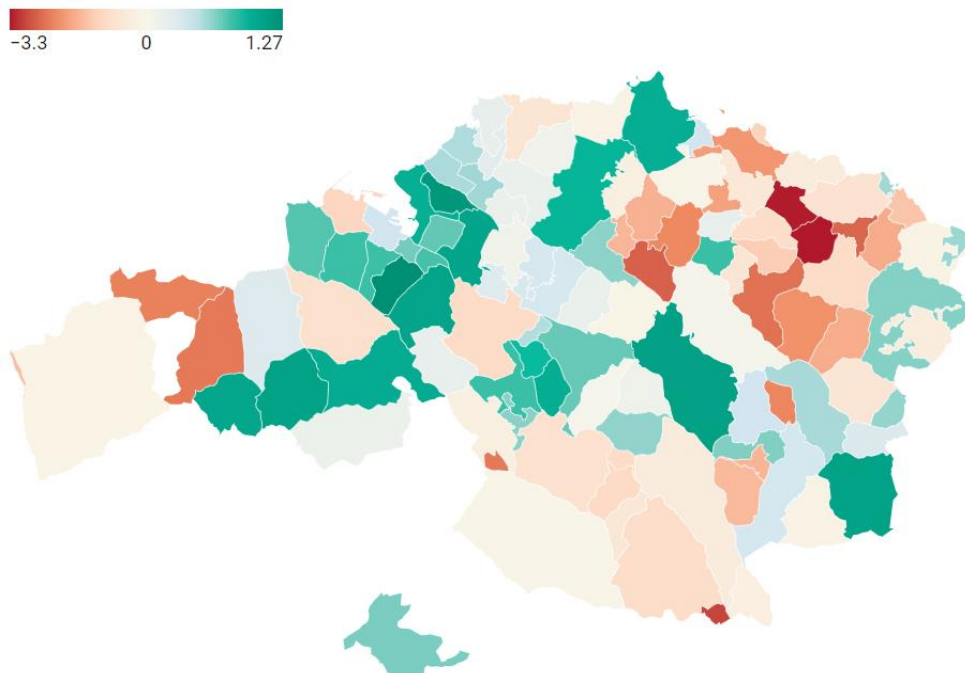
Source: own elaboration.

Figure D5. Change in per capita transfers (%). Current system vs. 2.5% fiscal capacity + 2.5% expenditure needs OLS-based Index (2019). Araba



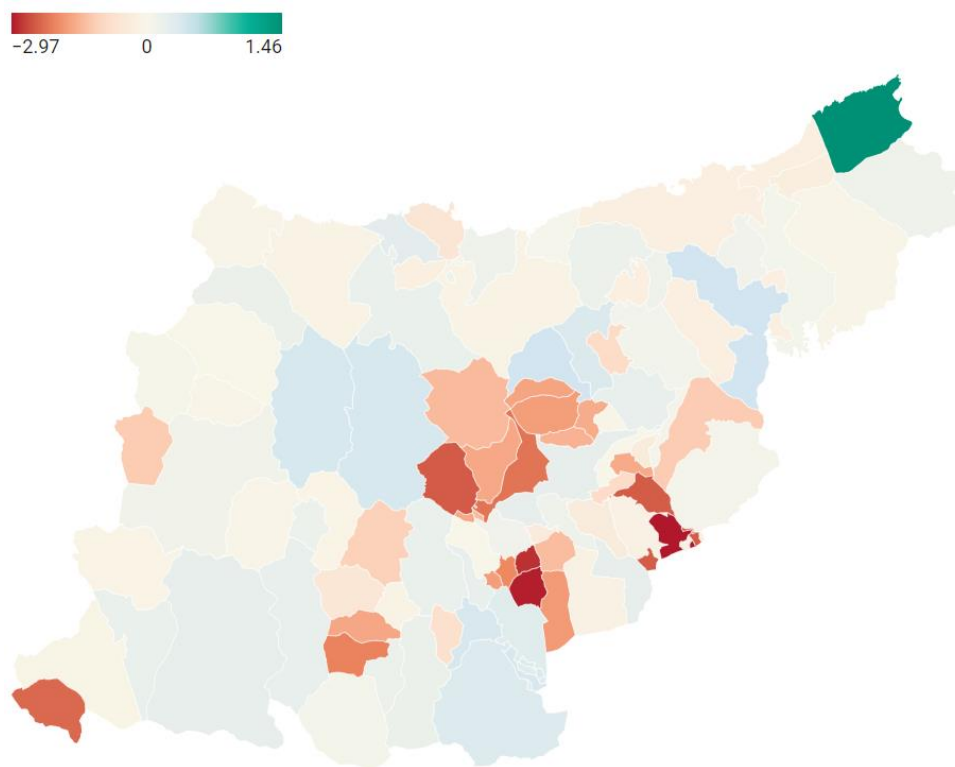
Source: own elaboration.

Figure D6. Change in per capita transfers (%). Current system vs. 2.5% fiscal capacity + 2.5% expenditure needs OLS-based Index (2019). Bizkaia



Source: own elaboration.

Figure D7. Change in per capita transfers (%). Current system vs. 2.5% fiscal capacity + 2.5% expenditure needs OLS-based Index (2019). Gipuzkoa



Source: own elaboration.

CHAPTER 3

COALITIONS AND BLOCKADES IN THE NEGOTIATION OF THE SPANISH REGIONAL FUNDING SYSTEM REFORM: NARRATIVE EVIDENCE FROM GAME THEORY

1. Introduction

During the last decade, since the global financial crisis first, and the European debt crisis later, detonated, Spain has undergone a long list of structural reforms. This intense reformer momentum affected virtually all policy areas, from education (Bromley et al., 2021) and healthcare (Gallo and Gené-Badia, 2013), to pensions (Alonso-García and Rosado-Cebrián, 2021) and taxes (García-Urbe, 2023). However, even though in Spain fundamental pillars of the Welfare State, such as education, health, or social assistance, fall under the responsibility of regional governments, the regional funding system (RFS) remain among the few central policy areas that have remained unchanged, at least in its core.

At first glance, the fact that the RFS has not been reformed since 2009 can be surprising. In particular, when realising that it suffered profound reforms in five occasions in just a twenty-two-year period (1987-2009). However, a logic explanation emerges from the examination of two groups of drivers, endogenous and exogenous. On the one hand, the end of the decentralisation process, of asymmetric information and non-rationality across regions, and, potentially, of the *status quo* clause are identified among the endogenous determinants of blockade. On the other hand, political fragmentation, the Catalan conflict, fiscal rules and macroeconomic cycle, represent the key exogenous causes of the current situation.

The importance of the RFS is such, that it represents more than 150.000 million euro in 2024⁹, a number that equates to more than the 10% of Spanish GDP. However, it is not only important in economic terms, but it is crucial for citizen's welfare, as it is the tool that funds most fundamental public services. Furthermore, the RFS is on the centre of the quasi-federal intergovernmental fiscal relations framework. This is the combination of rules that guide interactions between institutions, and particularly of vertical ones. Therefore, understanding its political economy is crucial to assess and orientate negotiations on future reforms.

This paper applies two methodological instruments, narrative approach and game theory, to investigate why after more than ten years since the RFS agreed in 2009 should have been revised, the model remains frozen, and even represents a taboo for the central government (CG). First, narrative approach (Friedman and Schwartz, 1963; Romer and Romer, 1989, 2004) will help us to gather evidence from the law and mass media on the drivers of past reforms and the current context. Second, game theory (Von Neumann and Morgenstern, 1944; Kreps and Wilson, 1982; Selten, 1978; McCain, 2010) will allow to model these scenarios to observe them in a systematic way.

This evidence is used to explore region's positions around the following negotiation axis: the end of the *status quo*, the redistribution degree, the weight of cost of provision variables (other than population) in the expenditures needs formula, the level of tax harmonisation, the concession of bailouts. All these axes are crossed by political alignment. This exercise contributes to forecast which the outcomes of future negotiations could be and, based on that, we offer possible solutions for the "sudoku" the negotiation of the RFS constitutes. Therefore, on the one hand, three regional coalitions are identified: the aged rural coalition, the Mediterranean coalition, and a third coalition of "Castillas". And, on the other hand, as going back to the pre-2009 context of asymmetric information plus non-rational scenario is neither possible nor desirable, five possible exitways for

⁹ It includes advanced payments from CG to regions in 2024, plus the settlement of 2022 that will also be paid in 2024. That is, resources concerned with intergovernmental fiscal relations, excluding the remaining non-financial regional revenues, such as own taxes or fees, and non-tax revenues.

the game are identified: 1) Fiscal and Financial Policy Council (FFPC) rules could be modified to help building accords, 2) some axis could be excluded from the negotiation by externalising them to an independent scientific body, 3) reform should be comprehensive to alleviate/compensate losses and wins from isolated changes, 4) the CG-Cataluña coalition should be rebuilt, which emerges as a closer reality in the view of recent agreement on regional debt relief, and 5) the repetition of the game could be limited.

This paper is structured as follows. Section 2 provides a chronology of the RFS reforms recorded in the last forty years. It does so by applying a narrative approach. Section 3 makes use of the chain store game theory model in order to explain the past instability that defined the Spanish RFS until 2009. Section 4 develops on the determinants that explain the current situation of coalition formation and blockade, and analyses each of the main five axes along which regions align. Finally, Section 5 proposes some alternatives to try to contribute to overcome blockade and Section 6 concludes by summarising key findings.

2. Narrative record of legislated regional funding reforms in Spain (1980-2009)

The narrative approach collects data from legislation and mass media to help identify motivation behind policy reforms that do have an impact on their outcomes. This methodology was pioneered by Friedman and Schwartz (1963). However, it was Romer and Romer's (1989, 2004) application to estimate the impact of monetary policy on the output which made this approach popular. The narrative approach became trendy in a context of disaffection of part of the academia with cumulative empirical results that ignored the historical context at which shocks emerge and policies are deployed.

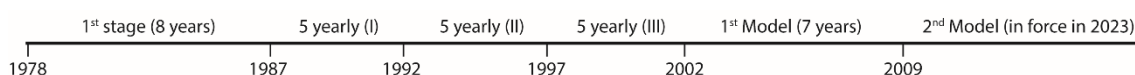
Consequently, it has mostly been used to address identification issues generated by the difficulty to establish the causal directionality of the effect of fiscal reforms on economic growth, as they might be passed in response to macroeconomic shocks (Romer and Romer, 2010; Cloyne, 2013; Hayo and Uhl, 2013; Pereira and Wemans 2015; Gechert et al., 2016b; Akitoby et al., 2020; García-Uribe, 2023). In addition to revenue-side fiscal policy, some authors have used the narrative approach to support their research on the effect of public spending (Ramey and Shapiro 1998; Ramey 2011), of taxes (Favero and Giavazzi, 2012; Gil et al., 2019), and on the complete tax-spending mix (Devries et al., 2011; Guajardo et al., 2011, 2014; Alesina et al., 2015a, 2015b; Kataryniuk and Valles, 2015). Furthermore, more focused papers have been published covering only particular fiscal elements, such as Social Security (Gechert et al., 2016a).

However, as far as we know, the narrative approach has not been yet applied to support research on the RFS reform. Despite most literature uses narrative approach to estimate effect of policy in output, it has also been used to retrospectively measure economic sentiment of institutions based on their outlook reports (Diaz-Sobrinó et al., 2020). In our case, we will take advantage of the narrative approach in order to support our game theory view of the negotiations of consecutive RFS reforms. The complete list of references employed as input can be found in Annex A. Moreover, a Latent Dirichlet Allocation (LDA) Topic Analysis of the CG-regions agreements at the FFPC has been carried out, results of which are included in Annex B. Topics and keywords identified through this approach are consistent with the key elements of reform defined in the following section.

2.1 Overview of regional funding reforms in Spain

This section provides an overview of RFS reforms in Spain (Figure 1)¹⁰. The main elements of each model that will be examined are the following: objectives pursued by the reform, expenditure needs formula, responsibility and tax attribution to regions, equalisation objectives, and type of transfers used to reach them. The process can be separated in three main stages: 1st (until 1986) effective cost stage, 2nd (1987-1996) spending autonomy stage, and 3rd (since 1997) the tax autonomy stage (CFFP, 2001). This story starts in 1978, when the Spanish democratic Constitution entered into force. After four decades of centralism during the dictatorship, political consensus led to a rapid and deep decentralisation process that had provision of basic public services transferred to regional governments. In order to fund newly decentralised spending responsibilities (Figure 4), and considering the initial small degree of tax autonomy of regions (Table 1), CG begin transferring financial resources to regions according to a temporary agreement that functioned until 1986.

Figure 1. Chronological axis of the regional funding systems in Spain



Source: Own elaboration.

The main objective of the temporary framework was not related to equity or efficiency reasons, but it was focused on ensuring regions received sufficient funding so as to provide new regional public services maintaining access and quality standards, while avoiding duplication and increases in spending (FFPC, 1982; Onrubia and Ruiz-Huerta, 2020; Utrilla, 2020). Therefore, transfer allocation was based on the so-called effective cost formula. According to it, regions would receive the same amount the CG used to spend in that territory in each specific decentralised policy area. Although well intentioned, as it was initially thought it would ensure equal access to public services across regions¹¹, it would later be interpreted as the “original sin” of the system as it consolidated already existing inequalities in the provision of public services (Monasterio, 2018; López Laborda, 2019). Funding would proceed from “assigned/ceded” taxes and from a tax sharing system. While effective cost methodology set the basic level of funding, the 1982 agreement at the CFFP reached by CG and regions reminded that regions could increase their service supply through own taxes, surcharges, debt, and solidarity mechanisms such as the Interterritorial Compensation Fund (ICF) and other budgetary allocations aiming fiscal equalisation.

Despite modifications introduced in each reform, it can be said that RFS’s basic structure has remained unchanged. Intergovernmental fiscal transfers paid by CG equate to the difference between expenditure needs and fiscal capacity (actual revenue first, and potential later) from ceded taxes, of which until 1997 no legislative power was recognised to regions. Also, revenues that complement received transfers are maintained: own regional taxes, and surcharges.

¹⁰ For a historical review of RFS reforms, please refer to: Autonomous Regions Report Series published by the Barcelona Public Law Institute, Giménez-Montero (1995), Monasterio and Suarez-Pandiello (1998), Bandrés and Cuenca (2016), Monasterio (2018), Hinojosa (2020), Onrubia and Ruiz-Huerta (2020), and Utrilla (2020).

¹¹ FFPC Agreements in 1982, 1986, 1992, 1993, 1995, 2001, and 2009 introduced the status quo clause explicitly as a pacific and basic starting point for agreeing new funding levels. The 1997 Agreement did not, and therefore opened the possibility to create “loser” regions for the first time.

The rapid (and asymmetric) increase of responsibilities decentralised during the period and the expiration of the temporary arrangement evidenced the need for an updated funding system. In 1987, the first “definitive” funding model entered into force, which allocated transfers based not on the effective cost but on objective variables (relative wealth, fiscal effort, surface area, insularity, number of separate local entities within each municipality) and relative census population. Despite the use of unconditional transfers, decentralised policies were funded according to two different spending needs formulas, one for common responsibilities and another for education. The main difficulty in defining transfer allocations through the variables-based needs formula lied in the fact that regions had different responsibilities due to the asymmetric decentralisation path set by the Constitution (FFPC, 1986). Wealth, Inheritance and gifts, and property transfer tax and stamp duty taxes were ceded, together with Gambling fees (see Table 1). Already in this first model, there was a *status quo* clause, meaning that every region should be better off in terms of received funding, which was sensible considering the sharp increase in responsibilities regions had faced in those years. In addition, this helped CG to gather consensus among regions. The model had a 5-years expiration date and within the period, transfers were updated according to revenue evolution, with a GDP growth-based cap introduced to limit large funding increases.

In 1992, a new model replaced the previous one in order to introduce fiscal co-responsibility and reinforce autonomy, sufficiency and the tax sharing mechanism (FFPC, 1992). Indeed, there were two main drivers that made desirable a move in this sense. On the one hand, regions called for participating in a share of the Personal Income Tax (PIT) and Value Added Tax (VAT) revenue collected within their jurisdiction (Bandrés and Cuenca, 2016). On the other hand, this would introduce incentives for regions to spend in a more efficient pattern, which was among the objectives of the newly signed Treaty of Maastricht. Due to this context of awareness for the financial sustainability of the public sector, accounting homogenisation, budgetary coordination, and a debt issue authorisation procedure were agreed too. The formula differentiation across policy blocks was maintained, population dispersion was introduced, and the variables of the formula became different for regions managing healthcare in order to address the insufficient funding of healthcare provision among “fast track” regions¹². Additionally, this reform incorporated within unconditional funding transfers linked to free-of-charge schooling, and introduced a temporary compensation for the reform of the ICF. Finally, within this 5-year period, two additional agreements were reached at the FFPC, the first one in 1993 related to a new tax sharing on the 15% of PIT revenue (Table 1), and the second one in 1995 related to a new methodology to calculate the cost of decentralised services (FFPC, 1993, 1995).

In 1992, the two main national political parties signed the Second Regional Agreements, which set that “slow track” regions would end up assuming the same responsibilities “fast track” regions had already received a decade before, such as education and healthcare. The 1997 reform of the RFS focused on advancing on fiscal co-responsibility. It increased tax autonomy as regions could now change rates and deductions of PIT and other ceded taxes (Table 1), and participate in the direction of the State Tax Agency. This reform became an outlier for various reasons. First, it is the only reform at which CG did not introduce additional funding to the model. And second, it is the only FFPC agreement that did not explicitly recognise the status quo clause, which was

¹² Spanish 1978 Constitution set two main ways to access to regional autonomy: fast and slow tracks. While regions following the former path would assume main expenditure responsibilities (e.g. healthcare and education) very early in the decentralisation process, regions following the latter path would wait until the nineties.

substituted for a complex guarantee scheme (FFPC, 1996; Utrilla, 2020), opening the risk of creating “loser” regions (Ruiz Huerta and López Laborda, 1999). As a result, and for the first time, three regions made use of their unilateral veto power¹³ and did not signed the agreement with the CG. Therefore, the new 1997 model was applied to all regions but three (Andalucía, Castilla-La Mancha, and Extremadura) (López Laborda and Ruiz Huerta, 2000; Utrilla, 2020; Onrubia and Ruiz-Huerta, 2020).

In 2002, the model was again reformed with the aim of being the last time. This was born as the first permanent model, as it did not have a 5-year expiration date anymore. As the decentralisation of essential public services (healthcare, all education levels, and social services) had already ended in 2001, CG thought it could become a stable model. Consistently, it was also the first comprehensive model, as it gathered the before separated three funding models for common responsibilities (including education), healthcare and social assistance. Variables-based needs formulas were newly estimated -after being frozen in the previous reform-, one per each of the three policy blocks. Tax autonomy was increased again by increasing the PIT ceded share up to the 30%, and introducing the 35% of VAT, 40% of fabrication excises, and the 100% of electricity, fuel consumption and car registration taxes in the tax sharing scheme (Table 1) (FFPC, 2001).

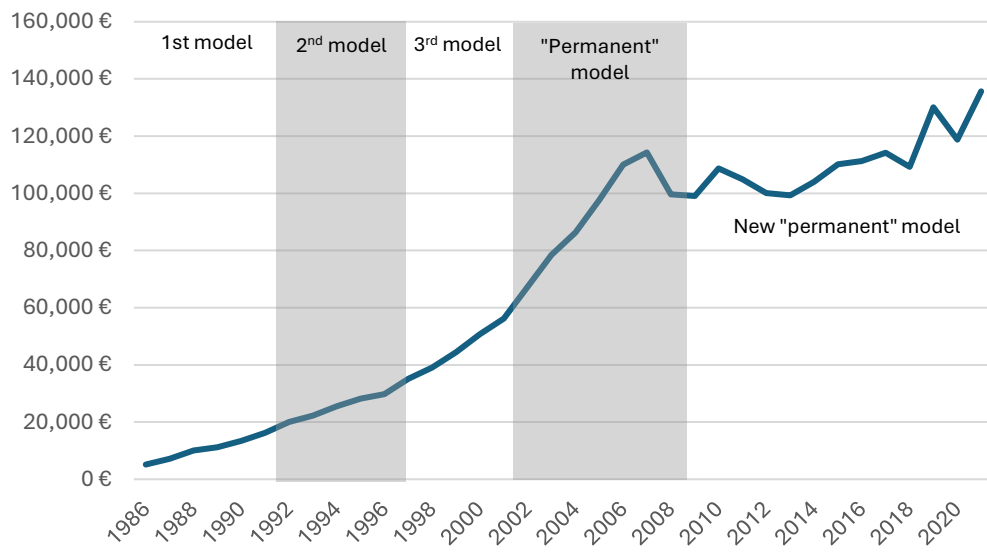
However, the model could not become permanent due to the increasing demand for welfare spending caused by the asymmetric and sharp increases of population Mediterranean regions experimented during the economic *boom* of the first decade of the XXI century (Onrubia and Ruiz-Huerta, 2020; Utrilla, 2020). In 2009, the current RFS entered into force to respond to it, and also to the Autonomy Statutes passed during the period. The expenditure needs formula was modified. It only considers public services considered “fundamental”, this is healthcare, education, and social assistance, and the 75% of regional fiscal capacity for ceded taxes. With this regard, fiscal equalisation degree is total and based in information updated every year. However, for the rest of decentralised services (e.g. justice administration, environment, housing, transport infrastructures) status quo is guaranteed, but no equalisation is applied. In addition, explicit regional convergence mechanisms within the fiscal equalisation system were introduced, the so-called Convergence and Competitiveness Funds. While Convergence Fund allocates transfers for low income and scarcely populated regions, Competitiveness Fund is aimed to improve the treatment provided by the RFS to regions receiving less funding per adjusted population. Regarding tax autonomy, regional participation in PIT and VAT were increased up to the 50%, and in fabrication excises up to the 58%. And computation of normative revenue was modified to get it close to figures of actual revenue.

Despite the different nature, objectives and drivers of the RFS reforms until 2009 all shared some common outcomes: all reforms increased the amount of funding -globally (Figure 2) and for each region-¹⁴ and every reform made some progress towards higher fiscal co-responsibility and tax autonomy (Table 1).

¹³ Although Constitution defines regional funding as CG’s exclusive responsibility, it is formally forced to negotiate with regions at the FFPC, but not to reach an agreement. However, politically it seems irrational for CG to pass a reform without broad (if not unanimous) consensus.

¹⁴ This is true even for the 1997 reform, which is the only reform that did not entail an extra boost of CG’s funding (Utrilla, 2020).

Figure 2. Evolution of global regional funding provided by each model (M€)



Source: Own elaboration based on data from BADESPE (until 2001) and Spanish Ministry of Finance.

Table 1. Evolution of the tax revenue decentralisation process

1981-90	1994	1997	2002	2008	2009	2011	2013	2018
Wealth tax	→	Legislative power	→	Suppressed		Recovered	→	→
Inheritance and gifts tax	→	Legislative power	→	→	→	→	→	→
Property transfer tax and Stamp duty	→	Legislative power	→	→	→	→	→	→
Gambling fees	→	Legislative power	→	→	→	→	→	→
Own regional taxes	→	→	→	→	→	→	→	→
Surcharges	→	→	→	→	→	→	→	→
Fees affected to transferred services	→	→	→	→	→	→	→	→
	PIT(15%)	Legislative power	PIT (30%)	→	PIT (50%)	→	→	→
			VAT (35%)	→	VAT (50%)	→	→	→
			Fabrication tax (40%)	→	Fabrication tax (58%)	→	Legislative power	No legislative power
			Electricity tax	→	→	→	→	→
			Fuel consumption tax	→	→	→	Suppressed	→
			Car registration tax	→	→	→	→	→
						Gambling activity tax	→	→
							Bank deposit tax	→

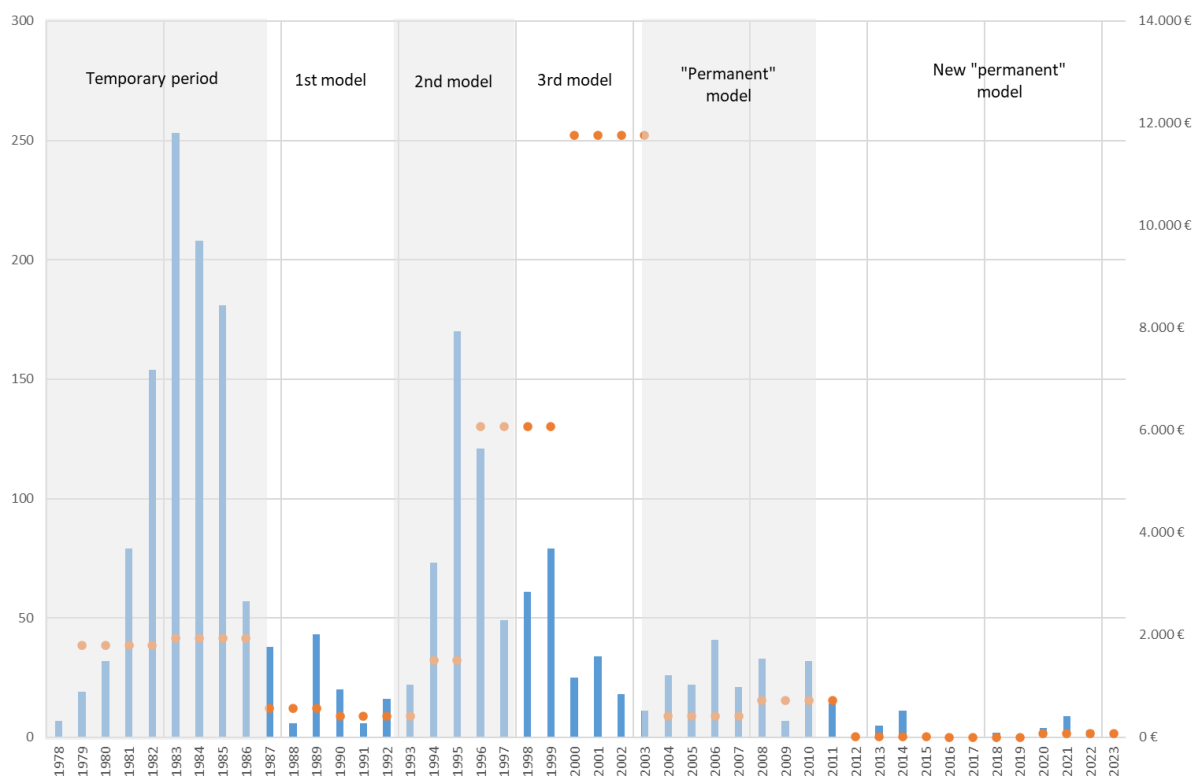
Source: López-Laborda (2018).

3. Objectives, drivers, and results of past reforms: a game theory approach to instability

Since its inception, the Spanish RFS has traditionally been characterised by a chronic instability. Over the last three decades, since the first “definitive” model was agreed in 1987, regions’ revenue stream has been determined by five different schemes. None of them lasted longer than the current design, agreed in 2009 (Figure 1). This served as empirical evidence to support León’s (2009) instability hypothesis, who defined the causes of this phenomenon. She pointed out towards the unfinished competency transfer process, vertical imbalances and horizontal inequalities in terms of per capita funding, as the main reasons why regions used to repeatedly call for the renegotiation of the system. Accordingly, the result was a series of short-lived models.

First, as supported by Figure 3 and narrative evidence listed in Annex A, the constant extension of regional responsibilities during the two first decades of the decentralisation process generated the need to frequently update the RFS to guarantee the sufficiency principle (León, 2009). Indeed, most bilateral decentralisation agreements were signed during the early eighties. After the Second Autonomic Agreements in 1992, a new wave of decentralisation emerged so “slow track” regions catch up with the responsibility ceiling of “fast track” regions. In contrast with this continuous tempo, since the last RFS entered into force in 2009, there have barely been new responsibility transfers -being most of them to *foral* autonomous communities- eliminating this instability element, and thus that incentive for regions to re-open negotiations for reform, aware that wins should be more limited or inexistent in some cases.

Figure 3. Evolution of responsibility decentralisation agreements between Central and regional governments (left axis, blue) and their effective cost by legislative term (M€, right axis, orange)



Source: own elaboration based on Ministry of Territorial Policy. Note: orange points represent the total sum of the effective cost of transferred responsibilities for each legislative term, they do not correspond to a specific year.

Second, the excessive transfer dependence generated by the large vertical fiscal gap between spending and taxing powers across levels of government, justified calls by some regions – in particular by those endowed with high tax capacity- for higher tax autonomy. Successive RFSs would address this demand. Indeed, the evolution towards decreased transfer dependency is observed in Figure 4, as every reform passed caused sharp declines in transfer dependency as the other face of the coin of increased tax autonomy, reaching its minimum – around 10% of non-financial regional revenue- under the current system. Calls for increased tax autonomy are not as loud in the current context, being Catalan calls for full tax autonomy an outlier (Bandrés and Cuenca, 2016; Hinojosa, 2020), in contradiction to regional demands -also by Cataluña and Catalan nationalist parties- for increased tax harmonisation to stop the race to the bottom in Wealth and Inheritance taxes (Agrawal et al., 2020). Currently, the commonly agreed regional VAT rate is one of the few realistic proposals for increasing tax autonomy and, at the same time, to close the vertical gap (Expert Commission, 2017).

At the same time, transfer dependency and potential vertical fiscal imbalances allowed regions to use CG as a scapegoat, responding to citizens demands for better public services alleging that they were underfunded (Ruiz Huerta y López Laborda, 1997; Herrero et al., 2015)¹⁵. This is only possible due to general lack of awareness of which level of government is responsible for each policy (Leon, 2011; Liñeira, 2014; Wilson & Hobolt, 2014; López-Laborda et al., 2023), and sets incentives for regions to incur in larger deficits (Rodden et al., 2003). Trying to block this discourse and in order to set a more efficient incentive scheme in regions' fiscal behaviour, CG affirmatively responded to their calls for increased fiscal co-responsibility (Bandrés and Cuenca, 2016). Again, incentives for opening negotiations for reform are not much as regions are aware there is not much they could achieve (Fernandez, 2019), and CG might not be willing to introduce additional money to the RFS to close an alleged vertical gap (León, 2009), which is very difficult, if not impossible, to calculate.

Figure 4. Evolution of transfer dependency (transfers in % of regional non-financial revenue)

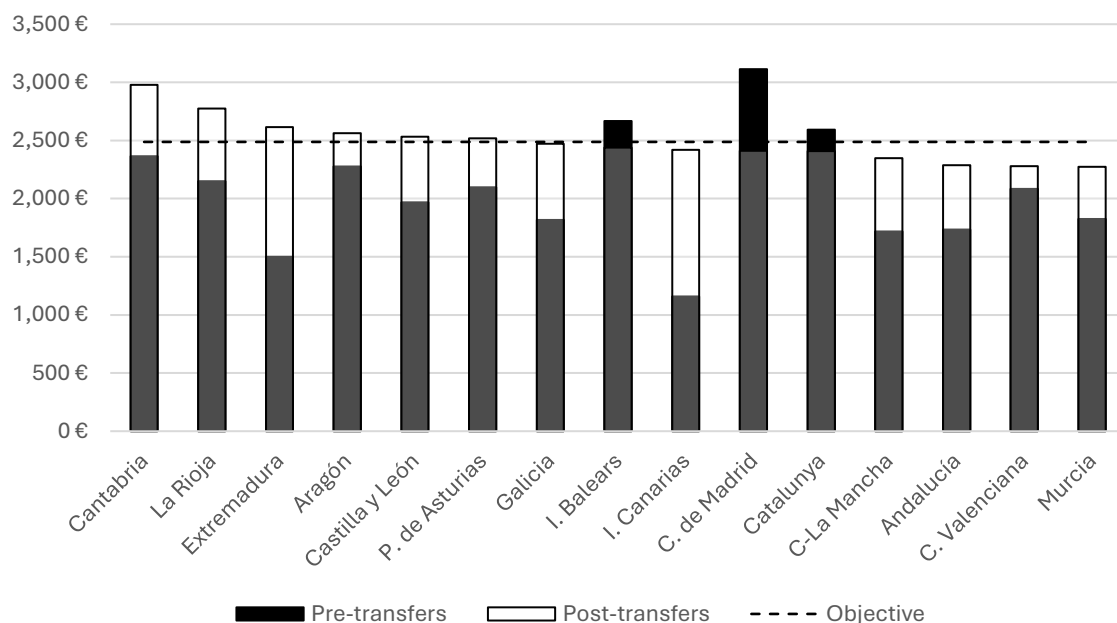


¹⁵ Boadway and Tremblay (2006) explain the difference between the concepts of vertical fiscal gap and vertical fiscal imbalance. The former refers to the fact that regions do not have enough revenue raising power to so as to fund all their expending responsibilities. The latter defines the deviation from the optimum vertical fiscal gap that remains after transfers are paid.

Source: Own elaboration based on data from Ministry of Finance.

The third cause of past instability of the RFS remarked by Leon (2009) was the horizontal inequalities between common regime and charter regions. However, we should add inequities that take place within the common regime RFS. Indeed, RFS treatment in terms of funding per necessity unit (now adjusted population) still differs across common regime regions (Figure 5). As mentioned in the previous section, the original sin of horizontal inequalities resides in the fact that during the transitory period the first responsibility decentralisation agreements were determined according to the effective cost methodology. That methodology consolidated pre-constitutional differences in the provision of public services across territories (Monasterio, 2018). As the *status quo* clause ensured that after each reform every region should be better off, these inequities maintained and could not be corrected (Expert Commission, 2017; De la Fuente, 2017). Consequently, during the last years, regions that receive least than average funding per adjusted population have been the most vocal while demanding to open negotiations for reform. This is particularly the case of Comunitat Valenciana, which is the second to last in this ranking¹⁶.

Figure 5. (Pre-transfer) Fiscal Capacity Index versus (Post-transfer) Spending Capacity Index (2009-2020 average) (€ per adjusted population)



Source: own elaboration based on data from FEDEA and Ministry of Finance.

In addition to the three instability drivers pointed out by Leon (2009), there is a key element that facilitated reaching to so many and frequent agreements between CG and regions: asymmetric information combined with limited rationality. Indeed, only this hypothesis could explain the negotiation behaviour of some regions until 2009. The dynamics of the RFS reform negotiations were marked by the role of Cataluña as it was the most active region in this regard. Although informally, in coalition with the CG, Cataluña contributed to design a draft proposal for a new funding model (Zabalza, 2007; López-Laborda, 2010; Bandrés and Cuenca, 2016; Hinojosa,

¹⁶ Just as an example, the Government of Comunitat Valenciana has published a series of papers on the matter (IVIE, 2018), and the political party Compromís has requested a RSF reform as a condition to vote for the investiture of the Prime Minister and the General Budget several times (Europa Press, 2020a, 2023c; Valencia Plaza, 2023).

2020; Romero, 2024) that was then offered to the rest of regions, who suffered from limited information and knowledge on the outcomes of the reform (as in Kreps and Wilson, 1982; Selten, 1978)¹⁷, except for the total funding allocated to them in each base year. According to the most recent news, the CG-Cataluña axis could have again a leading role in drafting a new proposal for the future RFS reform.

As supported by observed evidence from past reforms, regions would argue horizontal inequalities to call for reform. However, in the moment of actually taking the decision on signing the agreement, they would focus on their own wins, wins they could offer to their region's public opinion, and not on those of the rest of regions. Indeed, regions would sign as long as they would be better off in terms of funding after the reform, even if those wins would be limited to the base year, and even if winning less than other regions (Cinco Días, 2008; Bandrés and Cuenca, 2016; Monasterio, 2018). However, regions could still follow a non-rational negotiation behaviour and reject reaching an agreement depending on their political alignment with the CG (Hinojosa, 2020; Onrubia and Ruiz-Huerta, 2020). We will explain this hypothesis by making use of game theory arrangements that modelled negotiations of past (Section 3.1) and future (Section 4) RFS reforms.

3.1 A game theory view of past instability

Game Theory has been extensively applied by Political Economy literature in order to model and try to predict behavioural responses of institutional actors. Regarding the negotiation of RFS reform, on the one hand, León (2009) modelled a multiple round negotiation process to explain why the funding system was unstable, by adapting the Chain Store model (Selten, 1978). She did so by focusing on the role of Bilateral Commissions, which work as an unanimity clause, meaning that, because of its high political cost, no reform on the funding system can be applied to a region if it does not consent. The paper showed that due to the increasing cost of maintaining tough-player reputation and the decreasing returns from resisting regions' demands, the CG was not capable to mask its weak nature until the last round, condemning the RFS to instability.

On the other hand, Geli and Quilis (2019) made use of Theory of Moves in order to examine moral hazard and deficit-biased behaviours on the context of the RFS. This time the CG was depicted as a weak or tough player depending on the order of its preferences. For the weak CG, soft budget constrain would be the best scenario, when compliance would be the second best and would be more reluctant to intervene in case of a region would not comply with fiscal stability rules. On the contrary, a tough CG would locate compliance as its first-best alternative, being intervention and soft budget constrain second and third choices, correspondingly.

We will mainly build on both previous references to design our game (Figure 6). To start with the game theory analysis of the negotiation process¹⁸, we will first assume that all players, CG and regions, follow a self-interested behaviour pattern consistent with political strategic behaviour as described by Public Choice Theory and Political Economy (Person and Tabellini, 2002). The utility function of CG is composed by three elements: power, probability to get re-elected, and probability of re-election of aligned regional governments.

CG, as any other politically elected incumbent, seeks for re-election (Treisman, 1999). Consequently, its utility function includes the probability of getting re-elected. The incumbent

¹⁷ For instance, this situation is condemned by Extremadura in its particular vote against the 1996 FFPC agreement.

¹⁸ For a more detailed view of the RFS negotiation process, please refer to Figure C1 (Annex C).

believes that gaining votes positively depends on, first, its political capital in Bourdieu terms¹⁹. Reaching an agreement on the funding system (*A*) and thus, achieving institutional peace between the different layers of government are the elements on which political capital of the CG depends. In fact, both factors would help raising a positive public image of effectivity solving problems and usefulness of institutions. Alesina and Cukierman (1990) and Veiga and Veiga (2004) suggested that voting behaviour is performance based, with an increasing intensity in parallel to uncertainty on effectiveness of policies. Due to its complexity, it seems realistic to argue that citizens are uncertain on the consequences of GC's actions towards the RFS (Lago-Peñas, 2023), meaning that they would award the CG with an electoral reward for reaching an agreement in this area. And second, in the view of the CG, probability of maintaining the office positively depends on public expenditure, since it allows to “buy support” (Treisman, 1999); and negatively on tax rates. Of course, the impact of this element on the electoral result will depend on voters' utility from public goods, unwillingness to pay taxes and their knowledge on the competence distribution, necessary to correctly attribute responsibility for policies. Precisely, literature has cast doubts about the ability of the median voter to correctly attribute responsibility across levels of governments and policy areas and reward them correspondingly (Leon, 2011; Liñeira, 2014; Wilson & Hobolt, 2014).

Next, we look deeper into the determinants of CG's budgetary domain. CG cannot retain all the revenue it raises since it has to give a share away to regions. Transfers increase together with the level of pre-equalisation degree of fiscal vertical gap, or in other words, decrease with the level of regional tax autonomy and the level of efficiency. The impact of the efficiency of the design of the equalisation scheme on the size of transfers is negative because *ceteris paribus*, it would allow the CG to achieve the pursued level of equalisation with a lower amount of money transferred (due to a lower DWL and a more rational fund allocation across regions), which would leave more room for expenditure at the central level.

Regarding tax autonomy, an increase would at first glance lead the CG to be worse-off, through a power loss due to a smaller central budget. However, an increase in tax autonomy would be compensated with a lower need for vertical transfers, leaving a higher budget share for the CG to spend or, alternatively, a lower central tax rate. Taking into account that unwillingness to pay taxes is lower at the regional level (Kleven, 2014), thus benefiting chances of aligned regional government to maintain the office, and that fiscal co-responsibility increases efficiency (Dahlby, 2002 and 2008a on type of expenditure; Sato, 2002 and Foremny, 2014 on fiscal stability) proved that increased fiscal co-responsibility sets the incentive scheme for a higher share of expenditure devoted to productive expenditure, there is a high probability that an increased tax autonomy would make the CG to be better-off. Moreover, when considering that the budgetary size abdicated by the CG was not translated into central level expenditure, since it was directly transferred to regions, implying that the utility loss for the CG was only happening through the power channel, but not through the expenditure channel.

Regarding regions, their behaviour follows a purely self-interested pattern too. They want to increase their spending through a bargaining process with the CG for more transfers and tax revenue that would allow them to “buy” more votes; hence, boosting their possibilities to get re-elected. Concerning re-election, at the regional arena citizens' vote would be driven, by their regional government's relative to the average performance, following “yardstick competition

¹⁹ In the Forms of Capital, Bourdieu (1986), explains that political capital is a form of credit accumulated by politicians, which is then used to achieve their goals, such as passing legislation or getting re-elected.

literature”, as tested by Besley and Case (1995) for US states. Therefore, the relevant dimension is the relative size of the “fiscal residue” (Tiebout, 1956), relative policy menu or tax-benefits mix, modulated by voters’ utility from public goods, unwillingness to pay taxes, and their knowledge on the competence distribution. Revenue is also the determinant of power, mediated by the political relevance/salience factor, which is larger for a big regional like Cataluña or Madrid than for a small region.

Regional objective function is simpler, since they are not held responsible for the outcome of the negotiation neither for institutional peace, as the CG is. Treisman (1999) explains that if something, regional governments would gain a prime for confronting the CG when defending local interest. Following the same rationale, they would not be concerned by who wins general elections. In fact, although Solé-Ollé and Sorribas-Navarro (2008) and Curto-Grau et al. (2012) found evidence for an increased funding for municipalities with upper government layers, Simon-Cosano et al. (2013) failed to find a significant impact of political alignment on gains from the re-negotiation of the funding system.

Although apparently, there could exist a contradiction between CG’s interest on aligned regional governments re-election and the lack of evidence on gains from alignment, this is not necessarily true. Indeed, transfers are not the only tool for CG to benefit aligned subnational governments, and therefore existing research is limited in its scope. CG can benefit certain regions through shared taxes. For instance, by decreasing the central tax rate on shared tax bases in order to stimulate a tax base increase (Dahlby, 2008b) or by increasing the share of region’s (cession percentage) on these taxes, regional revenue would increase. This mechanism would be particularly successful in a context of low knowledge on competence attribution and for regions with broad tax bases. This possibility proves that the contradiction does not necessarily exist and that further research in this area is required.

Despite the ambiguities in some variables’ sign, a statement can be extracted from these paragraphs: according to the empirics, the positive effect of an agreement on a new system on the electoral components of the function overcomes the negative effect on the power component.

Figure 6. Extensive form game of regional funding system negotiation

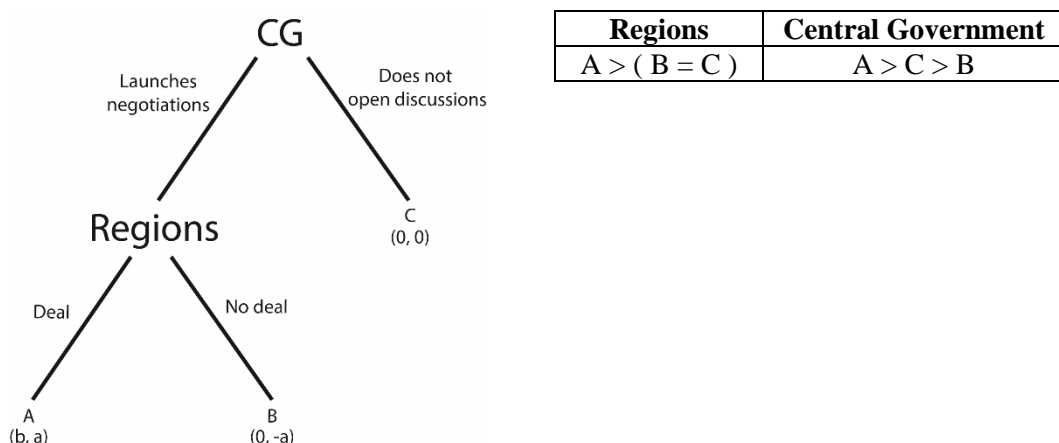


Figure 6 depicts the extended version of this Store Chain game. The preference order of the CG allocates a deal scenario as the first-best alternative. Since it considers that gains from an increased political capital and probability of re-election of aligned regional incumbents would

beat the negative impact of having a smaller budgetary discretion due to the increase of transfers. In addition, the CG would always prefer not to open a discussion rather than reaching a no deal scenario, since the latter context would erode even to a higher extent its political image, due to the public exhibition of the disagreement between regions and the CG. The case for regions is much simpler since they plainly pursue an increase in transfers introduced at the funding system by the CG and are indifferent between B and C scenarios.

The game can be solved by backwards induction. Considering this context, a pure strategy unique Nash equilibrium would be reached at Deal (A) since the CG would always launch negotiations, aware of the determination of regions to always reach an agreement, since they knew that every region would be better-off after the renegotiation of the system. This outcome is the one which explains past reforms and instability of the RFS. Following this line, to the causes of instability pointed out by Leon (2009) we would add the search by the CG for an increased political capital and aligned regional incumbent re-election. The solution of this game helps us showing that until 2009, regions followed non-rational behaviour. Indeed, the fact that actual outcomes of negotiations of the reforms separate from the Nash equilibrium shown in the game, supports this claim. We will focus on the 1997 and 2009 reforms to illustrate this.

As the narrative approach has explained in Section 2, in 1997 there were three regions that decided not to sign the agreement in the Bilateral Commission with the CG to get the new model applied, leading to the extension of the previous one in Andalusia, Extremadura and Castilla-La Mancha. This decision can be partially explained by political misalignment factors. Indeed, they were the only three regions governed by the Spanish social democrat party (PSOE), and thus, misaligned with the conservative CG at the time. Therefore, this would support the rationality limitation hypothesis as their behaviour would be separated from the Nash equilibrium depicted in the game as responded to a political opposition objective rather than to a rational detailed cost-benefit analysis (Bandrés and Cuenca, 2016).

However, undesired results of the system forced it to be reformed twice within the period, in 1997 and 1998. As shown by Bandrés and Cuenca (2016), all regions were better off after the reform in terms of global funding. However, this may only be true because of the middle-term reforms. Indeed, Extremadura had expressed already in 1996 that they did not have enough information so as to evaluate its impact. In this case, the opposed vote could be considered rational. Yet, the opposing three regions not only opposed to the initial agreement in 1996, but also to changes introduced in 1998 to improve healthcare funding and abstained in the voting to modify PIT, which were clearly positive for regions (FFPC, 1997, 1998; López Laborda and Ruiz Huerta, 2000; Ruiz Huerta and Granado, 2004). Moreover, they ended up signing the agreement as the new model turned more beneficial to their financial interest. Furthermore, Extremadura and Castilla-La Mancha obtained wins that almost doubled the average wins in relative terms in the 2002 reform so they could catch up with the funding levels of the regions that had signed the 1997 model.

The opposite situation was true in the 2009 reform, as the Nash equilibrium of the game was reproduced thanks to the non-rational behaviour of several regions that voted affirmatively against their own interest. Again, due to the *status quo* clause, all regions are better off after the reform in terms of funding per adjusted inhabitant. The net contributors, Cataluña, Madrid and Balearic Islands, were particularly benefited as passed from being under the average funding level to

above. However, ten regions became short-term losers with the reform and still signed for it²⁰. In the longer term, six regions lost in relative terms when comparing the average for the 2002-2009 period with the 2009-2020 period. It could be understood that La Rioja and Aragon signed despite modest relative losses as they were (and still are) above the average in funding per adjusted population level (De la Fuente, 2022). Still, Comunitat Valenciana and Murcia, even if becoming losers in the long term (-0.14pp and -2.85pp, respectively) and being under-the average recipients, could have been confounded by the short-term large wins (+4.7pp and +2.9pp, respectively). However, it is difficult to understand how Andalucia and Castilla La Mancha accepted the 2009 model even if it would consolidate and worsen their under-the-average funding position, both in the short (-3.2pp and -2.5pp, respectively) and long term (-4.5pp and -0.32pp, respectively). Not by chance, together with Comunitat Valenciana and Murcia, they are currently among the four most vocal regions calling for a RFS reform (Europa Press, 2023a). Again, if these regions would have followed a rational behaviour they would have rejected the model. In contrast, Andalucia and Castilla La Mancha even casted a positive vote in the FFPC due to their political alignment with the CG.

4. What changed in 2009? Explaining current blockade

After decades of frequent reforms of the RFS, or instability according to Leon (2009), sometimes driven by non-rational behaviour of some regions, since 2009 there has not been any serious attempt to open discussions for a new reform²¹. There are two main types of drivers that help explaining why. Following Cloyne's (2013) approach, they can be classified as endogenous drivers -those motivated by the RFS itself-, and exogenous drivers -those that are not related to the RFS but that respond to other economic and political elements instead-.

On the one hand, there have been changes in drivers endogenous to the RFS, such as the conclusion of the decentralisation process, as suggested by Leon (2009) and developed in Section 2 (Figure 4), that do not exert pressure for the system to require to be amended to guarantee sufficiency anymore. In addition, the expected end of the *status quo*, as proposed by the Expert Commission (2017) and signalled by the CG, eliminated the incentive for regions to continuously bid for a reform, as they are aware that, for the first time, some regions could end up worse off in terms of funding per adjusted inhabitant after a new reform. Finally, asymmetric information and regional non-rational behaviour would have reached their end as every region is now fully aware of the position that must adopt regarding each element of the future reform in order to look out for its own interest. Past experiences of unmatched expectations on the outcomes of the reform and the appointment of a regional expert for the Commission to shape an evidence-based position, could explain why regions have now symmetric information. Therefore, from now on, not only regions would bid for maintaining or increasing their transfer allocation in global terms, but also in relative terms.

²⁰ According to De la Fuente (2022), Galicia, Andalucía, Asturias, La Rioja, Cantabria, Aragón, Castilla La Mancha, Canarias, Extremadura and Castilla y León would have received more funding in 2009 according to the previous system.

²¹ In 2014, the Permanent Technical Evaluation Committee of the FFPC met and received diagnosis documents by regional governments to comply with 7th Additional Disposition of the RFS 2009 Law. Later, in 2017 the CG constituted an Expert Commission to design a new RFS proposal. However, its outcome has never been realistically considered for a legislative process. Finally, the Ministry of Finance released a proposal for a new adjusted population formula in 2021, to what regions formally reacted.

On the other hand, it is possible to find exogenous drivers too. First, political fragmentation at national level has made more difficult to reach bipartisan agreements as central parties are pressed by the political competition in their political space (Rodríguez-Teruel, 2022). The need for the CG to enforce fiscal rules has also lowered incentives to increase transfer allocations to regions as needed to respect the *status quo* clause and gather unanimous support by them. From regions' perspective, there neither are as many incentives to claim for a reform as in the past, since economic growth of the recent decade together with additional funding mechanisms - extraordinary liquidity funds, cooperation agreements, and pandemic response funding provided by CG and the EU- have translated into historic high levels of revenue at the regional level as well (Fernandez, 2019), covering up the weak tissues the system evidenced during the financial crisis. But perhaps, the most important exogenous driver is the Catalan conflict that started in 2012 and led to the divorce of the CG-Cataluña coalition that operated during decades as the main promoter, and even co-designer, of RFS reforms. Indeed, for years, the Catalan government has not even taken part neither in the Expert Commission nor in the meetings of the FFPC. Experts recognise that due to the political and financial relevance of Cataluña, it would be very difficult to pass a new reform without its support (Hinojosa, 2020; Onrubia and Ruiz-Huerta, 2020; Bandrés and Cuenca, 2016; Pérez, 2017). According to the most recent developments, Cataluña would join again the FFPC and play a key role in the negotiation of the future RFS reform.

The dissolution of the CG-Cataluña coalition coincided in time with the formation of new coalitions of regions, that taking advantage of their recent awareness described before as the end of the asymmetric information and non-rational behaviour, aligned not following political reasons, but regional self-interest instead. Table 2 depicts these coalitions formed after 2009.

Table 2. Regional axis and coalitions regarding the RFS

Axis	In favor	Against
End of the <i>status quo</i>	CG + Rest	<i>Status quo</i> regions
Lower redistribution degree	Net contributors	Net recipients
More weight of provision cost variables other than population in the expenditure needs formula	Aged regions and those favoured by geographic variables	Young regions
More tax autonomy	High fiscal capacity	Low fiscal capacity
More tax harmonisation	CG + High tax	Low tax jurisdictions
End of extraordinary funds	CG + Low debt	High debt levels
Debt relief	CG + All (CAT driven)	-
Political alignment with CG	Aligned	Not aligned

Source: Own elaboration.

4.1 Political alignment

There is an axis that overlaps with and dominates the rest. That is political alignment. Indeed, this axis shows that not only policies, but also politics are of key relevance for the reform of the RFS. Consistently, political alignment across government levels is key. Indeed, since the last reform expired, there has been three different government colours at the central level. First, a conservative government with absolute majority in Congress and aligned with most regions first, and in Congress minority and misaligned with most regions later. Second, a minority social democrat cabinet aligned with most regions. And third, a minority left-wing coalition cabinet aligned with most regions first, and with almost no region later. Because of how political parties function, re-election maximisation component in the objective function of regions explained in Section 3.1 -formalised in Annex D- considers the capacity of central-level party leaders to appoint the candidates of their party who run for regional elections. Therefore, regional leaders

might not be able to maintain the position linked to regional self-interest until the end of the negotiation, if pressed by an incumbent that is the national leader of its party too. In other words, beyond regional self-interest regarding the RFS, a regional leader aligned with CG will always be more prone to reach an agreement than that misaligned. Consequently, the first conservative cabinet was the one with the more favourable political context to reach an agreement to reform the RFS, which is currently far more difficult (being the opposite the case regarding the economic context). As this axis is instable on time as might change after each election, and could dominate over all the rest of axes, it will be left out of the following discussion.

4.2 End of *status quo* clause

As explained before, due to this explicitly agreed rule, no region would be worse-off in absolute terms after a new reform is agreed. Meaning that every region would win by renegotiating the model. By its own, this clause has been a powerful incentive for regions to constantly call for a new system. It sets the funding a region receives according to the rules of the previous system and ensures that the new model provides extra transfers in case the equalisation fund (nowadays embodied by the Fundamental Public Services Guarantee Fund) does not provide with enough financial resources so as to reach that minimum threshold. This is materialised by the Global Sufficiency Fund in the context of the 2009-model. It limits the scope of reforms since it heavily restricts the effect that modifications on the new design could have on per adjusted population funding results. Therefore, inefficiencies of previous schemes could not be fixed and have been dragged during decades (De la Fuente, 2019).

As explained above, the origin of the clause rests in the beginning of the decentralisation process. Whenever competencies were transferred from the CG to regions, frequently asymmetrically, meaning that not every region would receive the same set of competencies at the same period of time, the CG would commit to transfer also the funds to provide that policy. The amount would equate the “effective cost” or, in other words, the expenditure the CG had devoted to that particular policy area during the previous year within that specific territory (Monasterio, 2018). This method is probably not the most accurate. However, it allowed to ensure that regions received enough transfers so as to fund their policies in a multi-speed decentralisation process scenario (Fernández and Monasterio, 2018). What considered a starting point at first, became into the so-called *status quo* and has remained as a main determinant of the RFS.

Precisely, because of the *status quo*, allocation of transfers in the RFS is still influenced by regionalised expenditure the CG used to devote to the so-called “essential public services” before they were decentralised. Interestingly, the *status quo* benefits small or sparsely populated regions the most -in this order: Cantabria, Extremadura, La Rioja, Castilla y León, Galicia, Balearic Islands, Aragón, Castilla-La Mancha, Asturias, according to De la Fuente (2017)-, where fixed costs of service provision were larger in the eighties and, in a probably different scale, also today. Therefore, it could be interpreted that this is an implicit channel to consider fixed costs, as they are not explicitly present in the equalisation formula. However, the *status quo* has limited the effect reforms of expenditure needs formula could have.²² Therefore, if its aim is to consider fixed cost of provision, it should be replaced by its explicit inclusion within the adjusted population

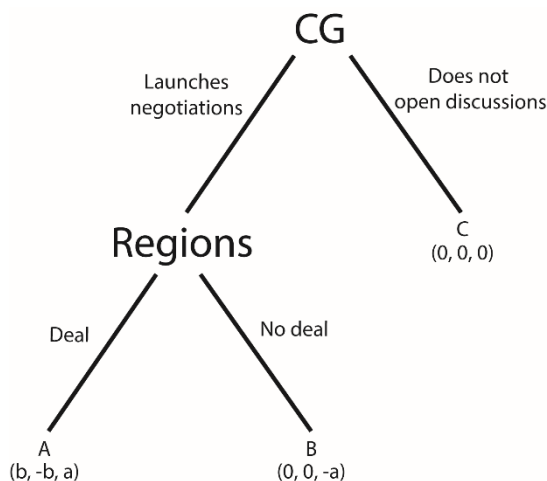
²² Effective cost methodology gain accuracy after decades of experience applying it during service decentralisation. Therefore, biases could be larger for “fast track” regions, who assumed healthcare and education already in the eighties, than for the rest.

formula, to consider updated data on fixed costs in a more transparent way, as it was proposed by the Ministry of Finance in 2021.

Nevertheless, the majority of the Expert Commission called for the elimination of the *status quo*. They proposed to do so in a gradual basis, so every year during a total period of four, transfers would include a record to erase a quarter of the effect of this highly controversial clause. This way, in a four-year time, the *status quo* would disappear from the system and an adjusted population that better resembles the provision costs (e.g. fixed costs) would take its position on determining the outcome of the RFS, which could be not that different. Of course, regions' positions on this proposal were not aligned, since some of them would be worse-off in case the *status quo* would disappear. In fact, experts appointed by Cantabria, Aragón, Extremadura, Castilla y León and La Rioja; and one of the five experts designated by the CG, signed a separate opinion to remark they did not agree with the hegemonic position against the *status quo*. Paradoxically, every signatory region is benefited from the clause, but not all the beneficiaries signed, leaving rational and self-interested characteristics of positions up for discussion.

Going back to the game proposed in the previous section (Figure 7), in this case, the preference order for regions benefited from the *status quo* would differ from that expressed before. Indeed, while non-*status quo* regions would respond to it, pro-*status quo* regions, aware that would be worse-off both in global and relative terms after the elimination of this clause, would prefer a no deal (B) scenario rather than reaching an agreement (A). This scenario could reproduce the 1997 situation, when some regions decided to veto the application of the RFS reform. As a consequence, the CG would not open discussions to avoid the risk of reaching a no deal scenario (B), and thus its political cost. This solution of the game suggests that a future reform cannot address the elimination of the *status quo* in an isolated way.

Figure 7. Extensive form game of regional funding system negotiation with regional coalitions for and against the end of the *status quo* clause



✓ Regions for the end of the <i>status quo</i>	X Regions against the end of the <i>status quo</i>	Central Government
		✓
$A > (B = C)$	$(B = C) > A$	$A > C > B$

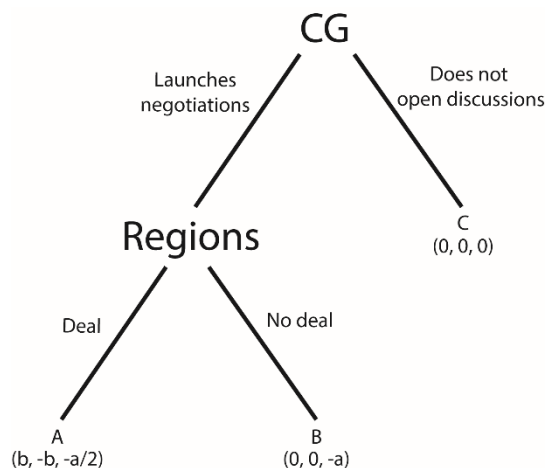
4.3 Lower redistribution degree



The RFS is a redistributive tool by definition, from high-capacity / low-needs jurisdictions towards low-capacity / high-needs territories. Since the 2009 reform, the RFS not only includes pure fiscal equalisation mechanisms, but also includes other redistributive mechanisms, named after “regional convergence” funds that aim to close the income gap between regions. The equalisation degree results from the difference between fiscal capacity per necessity unit (e.g. adjusted population) – this is, how much revenue each region would have available if no RFS would exist-, and total funding after transfers per necessity unit for each region (Figure 5).

It is possible to classify regions in two blocks of regions depending on the outcome of the RFS rules on their finances. On the one hand, a group of net contributors, formed by Madrid, Balearic Islands and Cataluña, even if just the latter is vocal about it, due to their higher per capita fiscal capacity. These three regions, together with the CG, fund the equalisation system and would manage a higher revenue in their budgets in absence of redistributive mechanisms. On the other hand, there is a group of net recipients, formed by the rest of the regions, who receive more than they contribute with. However, being in the latter group does not necessarily mean that the RFS treats these regions better. Indeed, regions that receive less funding per adjusted population are net recipients. This explains why these regions (Murcia, C. Valenciana, Andalucía and Castilla La-Mancha), together with the block of net contributors (Europa Press, 2023b; 2024a; La Vanguardia, 2024), are intensely calling for a reform of the system (Europa Press, 2023a). In this case, CG is aligned with pro-redistribution regions as its responsibility is to ensure that solidarity across regions is maintained.

Regarding this axis, again the game (Figure 8) would find its solution in C, no discussion opened, and therefore the blockade is maintained. On the one hand, regions would replicate the dual preference order depicted in Section 4.1, but with regions aligned according to their position with respect net contributor/recipient of the RFS. On the other hand, the preferences for the CG would change from the original game, as it would prefer not opening discussions than doing it, as it would lose from both deal (A) and no deal (B) outcomes, because of lowered redistribution across regions (A) and the political cost (B), respectively. By backwards induction, the CG would avoid opening discussions for reform to dissipate the risk of net recipient regions vetoing the application of the reform.

Figure 8. Extensive form game of regional funding system negotiation with regional coalitions for and against lowering the redistribution degree



✓Regions for lower redistribution	X Regions against higher redistribution	Central Government
		X
$A > (B = C)$	$(B = C) > A$	$C > A > B$

This debate could also be modelled by using Dinner’s dilemma (Gneezy et al., 2004), that explains whether individuals order the cheap or the expensive meal. According to it, while all would opt out for the cheap dish when paying for its own meal, the alternative would be true in case they would know in advance that the dinner will be paid at equal shares between all the participants. This game has been applied to willingness for redistribution through subnational grants by Brien and Eger (2021) to explain the share of project cofunding regions are ready to pay to the CG, as neighbouring jurisdictions might be the beneficiaries. Indeed, the three net contributor regions in the Spanish RFS, Madrid, Balearic Islands, and Cataluña, demand to pay for their own dish as they are aware they are paying a higher share of the bill while eating the same meal, or even a cheaper meal, than the rest of regions. In an extreme scenario, it could lead to calls for exiting the RFS, inspired by the foral regime, according to which some Catalan voices are asking to only pay for their own dish (Europa Press, 2024b). In a more moderated position, would be the current proposal for a “singular funding model”.²³

As Dinners’ Dilemma shows, this self-interested position responds to two elements. On the one hand, that regions do not include within their utility function cross-regional externalities CG do consider. And on the other hand, that they know in advance which is their position regarding being net contributor or recipient. Indeed, if regions would not know their net position until the negotiation is ended, they would be more prone to accept higher degrees of redistribution.

4.4 Higher weight of provision cost variables (other than population) in the expenditure needs equalisation (adjusted population) formula

The expenditure needs component of the fiscal equalisation formula includes a set of variables used to estimate service provision costs. The 30% of the formula is determined by population, 38% by protected (aged) population, 20.5% by young <16 population, 8.5% by aged >65 population, 1.8% by geographic extension, 0.6% by insularity, and 0.6% by dispersion. During last years, regions have also formed coalitions around this formula, as older, disperse, and depopulated regions in the centre and north of the country argue that they face higher fixed and per capita costs while providing public services than younger Mediterranean regions.

The weight of these variables does not bias the formula from raw population much, and therefore, they have a very modest impact on the final allocation of transfers. However, as it might be the easiest element of the RFS for regions to understand, it is the one that has attracted more media attention and that has focused the political discussion around this issue. In this line, Galicia, Asturias, Castilla y León, Castilla-La Mancha, Aragón and La Rioja created a “rural region axis”, to which Cantabria and Extremadura joined later, in order to increase pressure to CG to keep in mind the interest and needs of the so called “empty Spain”. One of their main objectives is to increase the weight of land extension, dispersion and elderly population criteria in the distribution

²³ When this thesis has been finished, ERC and PSC had signed a political agreement on a “singular funding model” for Cataluña that could include full tax autonomy and serve as a base for drafting the new RFS proposal for the rest of regions. However, at this point, we lack enough details so as to discuss the potential role this political agreement could actually play.

Precisely, RFS has two elements that sets incentives to deter tax competition across regions. On the one hand, the Competitiveness Fund supports regions whose funding per adjusted population index is lower than its fiscal capacity per adjusted population index, thus limiting the reranking phenomenon and aiming to stop “race to the bottom” kind of tax competition (López Laborda, 2010). On the other hand, the fiscal equalisation mechanism within the RFS has a revenue-side mechanism that sets incentives to prevent cross regional tax competition (Köthenburger, 2002). It is the use of potential tax capacity (called “recaudación normativa”) instead of actual tax revenue, to compute the share each region needs to contribute with to the common money box. Therefore, disregards how much revenue regions raise, they need to contribute according to their defined tax capacity, meaning that they need to bear revenue decreases due to lowered taxation but that they also accrue revenue increases due to increased taxation. Some experts have criticised how this theoretical revenue is computed and have proposed alternative methodologies (Martínez López, 2022). However, this mechanism is not accurately applied to the Inheritance and Gift Tax nor to Wealth Tax, which is treated as a regional own tax since it got reinstated in 2011, therefore with no incentives against race to the bottom kind of tax competition. This should be addressed in the context of an integral fiscal reform. Because of these competitive dynamics, tax harmonisation has been the element of the RFS that has attracted most attention (Europa Press, 2020b), together with the expenditure needs formula.

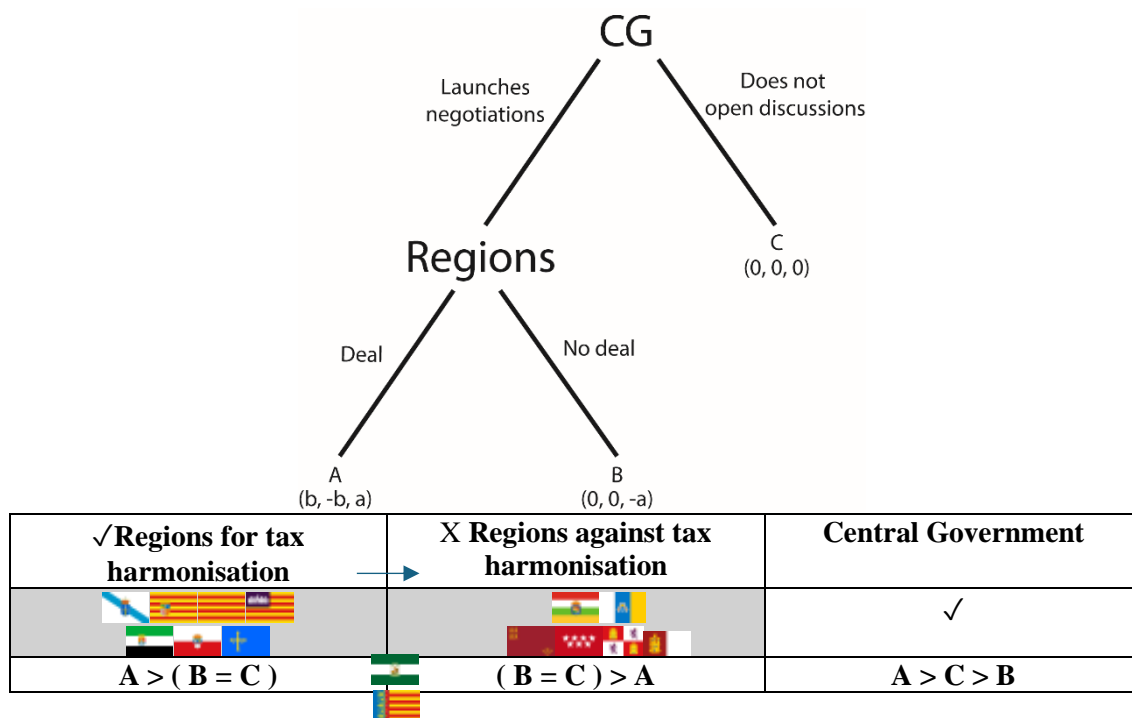
The two opposed regional coalitions around tax harmonisation are less intuitive in this case than in the previous ones. In theory, only low tax regions or regions with a strong self-government demand, or without financial difficulties (e.g. low public debt levels) should align against increased tax harmonisation. For instance, we observe that Cataluña, despite its strong preference for self-government, aligns with calls for harmonisation due to its higher-than-average taxation and leverage levels (Europa Press, 2020c). In contrast, despite not all low tax regions are governed by a conservative cabinet, there are high tax and debt regions publicly positioned against tax harmonisation, such as Andalucía or Comunitat Valenciana, who should be aligned for it, as their actual tax revenue exceeds their theoretical tax capacity, meaning that are high-tax regions in comparative terms. The fact of this being the only element of the RFS the latter region changed its position about after the government change in 2023, is particularly revealing (Europa Press, 2020c; Valencia Plaza, 2024). The high salience and ideological divide around taxes makes out of this axis the only at which non-rational behaviours remain, positioning regions according to ideological lines (Esteban, 2023).

In addition to purely ideological determinants of the political colour of the regional government, yardstick competition represents the mechanism that has contributed to transmit some regions’ preference for lower taxes. Indeed, even the wealthy taxpayers moves identified by Agrawal et al. (2020) due to its small weight on the global tax mix, it is unlikely for this mobility to have a large revenue impact on regional budgets. Therefore, we conclude that governments pursue tax decreases due to an ideological conviction and electoral reasons. In Hirschman’s terms: it is not about exit, but about voice (vote) (Hirschman, 1970; Bordignon, 2015).

In this axis, the CG has clearly positioned for increased tax harmonisation as, in response to the race to the bottom in the Wealth Tax, it created a new national-level tax on wealth to charge tax bases untaxed -above a high threshold- at the regional level – most of them in Madrid-. After a legal dispute on the constitutionality of the policy, the CG won the appeal and Madrid has reinstated its Wealth Tax to avoid CG to collect otherwise regional revenue. Even if CG position could be determined by its ideological left-wing leaning, as explained for regional redistribution, any CG should be concerned by the tax competition dynamics, independent of its political colour.

Despite the separate rationale for actors' alignment in this case, the solution of the game is repeated (Figure 10), as blockade is reproduced. CG maintains its preference for reaching an agreement (A), however it does not open discussion (C) aware of the division of regions that oppose to increased tax harmonisation, which prefer a no deal (B) or not opened discussion (A) scenario better than a deal (A) that reduces their tax autonomy.

Figure 10. Extensive form game of regional funding system negotiation with regional coalitions for and against increasing tax harmonisation



4.6 Implicit and explicit bailouts

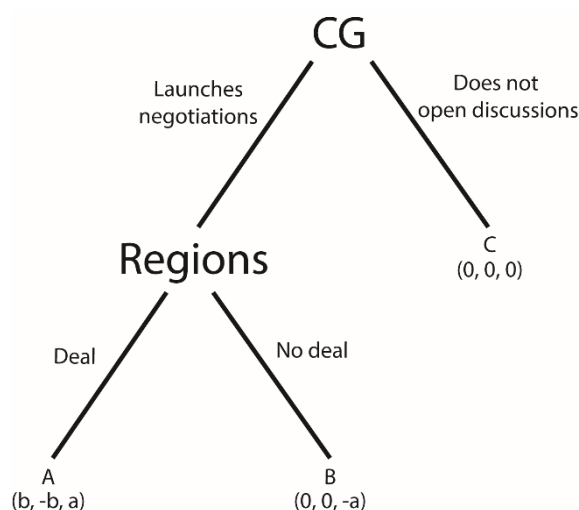
Despite being the reform that injected most CG additional funding, the entry into force of the 2009-model coincided with a dramatic fall on revenues of the RFS. Since fund allocation to regions is based on predicted revenues and only settled after two years, when regions perceived the 2010 revenue fall was already too late to apply expenditure cuts or tax increases which could have reduced the red numbers on their budgets. The CG created the so-called “extraordinary” liquidity mechanisms to avoid regions’ finances to get worse. One of them was devoted to help regions to pay for regular supplies (Fondo de Pago a Proveedores) and the other (Fondo de Liquidez, also known as FLA) aimed to fund their deficits (and the negative settlements of the funding system) in a context at which financial markets were closed for them due to high-risk premiums. These mechanisms have saved millions of euros in interests for regions since they increased their leverage at the interest rate of the CG, which was far lower (De la Fuente, 2019b).

However, the initially conceived as extraordinary mechanisms to support regions with troubles to access private debt markets have become chronic, as they still exist after more than a decade since first created. This is the case of the FLA, which has merged into the Funding Fund for regions (FFCCAA) together with two new credit lines created in 2014, the Financial Facility and the Social Fund. In particular, the Financial Facility provided regions with access to low-cost borrowing almost all regions resorted to. According to authors, such as De la Fuente (2019b) and Arespa and González-Alegre (2023), they could even be considered as “implicit bailouts”.

The maintenance of this extra funding tools, which *de facto* work as a cheap line of credit for regions²⁴, together with low expectations for an agreement to be reached, could be among the reasons why the CG has not opened yet discussions in order to agree a new system. In fact, it could be argued that both, regions and CG are better-off this way. On the one hand, the CG provides the amount of funding regions “need” without giving up the ownership of more resources, thus maintaining its budgetary power. At the same time, the CG reinforces control on regions, since “extraordinary” funding tools rather involve conditionality (FLA line) or are only meant for regions reaching deficit and debt objectives (this is the case for the Financial Facility line). In some cases, it can even be spuriously used to interfere into finances of non-aligned regional governments. On the other hand, regions do not have to face the political cost from raising taxes and continue making responsible the CG when not matching citizens’ demands for public goods (Ruiz Huerta y López Laborda, 1997; Herrero et al., 2015). However, this last channel is not that straightforward since gaining tax autonomy would play also a positive role for regions due to an increased budgetary control. Therefore, only Madrid, which is the region that made the most limited use -in relative terms- of extraordinary liquidity mechanisms since 2012 - having all its debts with CG cancelled for 2020-, and which has repeatedly presumed for it (Mateo, 2023), would be for the end of extraordinary funds.

Among all the axes laid out in this store chain game, this is the most obvious case in which the CG would avoid a negotiation restricted to this element of the RFS (Figure 11). CG would prefer reaching a deal (A), however only Madrid would give priority to reaching an agreement (A). Consequently, the CG would never open discussions, setting the result of the game in blockade (C) situation again.

Figure 11. Extensive form game of regional funding system negotiation with regional coalitions for and against the end of extraordinary funds



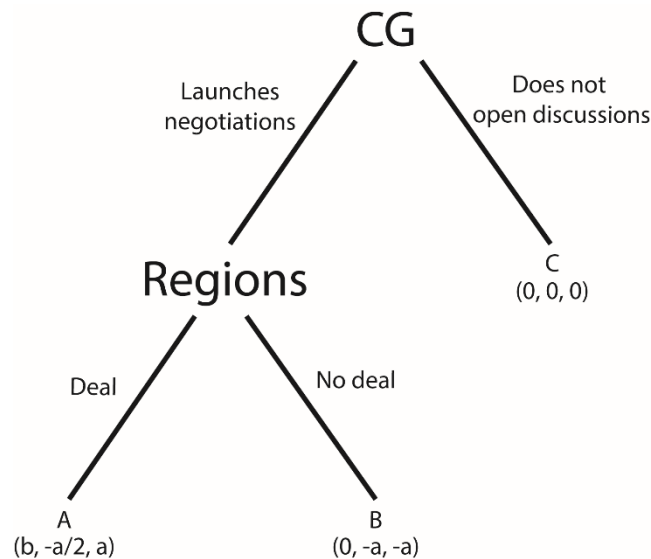
✓Regions for elimination of extraordinary funds	X Regions against elimination of extraordinary funds	Central Government
		X
$A > (B = C)$	$(B = C) > A$	$C > A > B$

²⁴ The maintenance in time of “extraordinary” liquidity mechanisms has led CG to own around 60% of regional debt, according to data by Banco de España.

Despite scholars from the Expert Commission remarked the importance that regional debt of regions with the CG was paid in order to avoid financial sustainability risks from moral hazard (Onrubia and Sánchez-Fuentes, 2023), in the last months an agreement between political parties so a new CG was formed included a partial relief of regional debt. This is, an explicit bailout. The agreement, that still needs to be detailed, includes the 20% of regional debt relief (Europa Press, 2023d). The fact that one of the parties involved in the agreement was Catalan nationalistic parties, as Cataluña could be the most benefited region by this policy in absolute terms, suggests that the CG-Cataluña coalition could be starting to be reconstructed once the Catalan conflict reached its end in 2022 (Europa Press, 2022).

The CG, which was the only institutional stakeholder involved that used to oppose to the debt relief, would have therefore joined the coalition formed by all regions, interested in getting bailed out in order to reduce their debt, that would now be assumed by the CG (Figure 12). This would be the only axis for which the game would have a Nash equilibrium equating “Deal” (A) after negotiations would be opened by CG, as we have observed in the past months. This example corroborates: one, the key importance the CG-Cataluña coalition has in order to allow a new RFS reform is likely to be reached (Onrubia and Ruiz-Huerta, 2020; Romero, 2024), and thus for negotiations to open; and two, that the unanimity clause still operates in the RFS reform, as the CG would always avoid the risk of opening a discussion that could not reach a positive end, a “Deal”.

Figure 12. Extensive form game of regional funding system negotiation with regional coalitions for and against applying a debt relief



✓Regions for debt release	Central Government before	Central Government now
	X	✓
$A > (B = C)$	$C > A > B$	$A > C > B$
















Dinner's Dilemma has also been applied in this area by Goodspeed (2017), who explained that the efforts for increasing transfers by a jurisdiction could increase grants allocation for neighbouring jurisdictions too. This is also empirically confirmed in the Spanish RFS case, as the demands from Cataluña and Catalan nationalist parties (initially for policy responsibility increases, afterwards for increased transfers and tax autonomy, and for a debt relief now) have ended up extending to all regions.

5. And now, how do we solve this sudoku?

Chain store game has helped us to better understand the past and current dynamics surrounding the RFS reform. Similarly, the popular Japanese puzzle *sudoku* helped the former Minister of Finance, Pedro Solbes, illustrating how difficult was to match all actors' positions with respect to the RFS (Cinco Días, 2008; Portillo, 2023). As concluded from the result of the games solved in the previous section, blockade prevails in virtually all domains of the RFS sphere. This is consistent to the views of experts, such as De la Fuente, who summarised it in the most comprehensible way possible by stating: "players in the game are beating around the bush because there is no expectation to reach agreement, since they have different aims from the negotiation" (Fernández, 2019), meaning that the CG will not launch formal discussions until is sure that the process will end up with white smoke.

Hence, looking to the diverging incentives and positions of each institutional actor involved, it is difficult to envisage possible solutions to the deadlock. On the one hand, returning to the asymmetrical information plus non-rational combination could give back the "Deal" Nash equilibrium. However, this is neither feasible, nor desirable. On the other hand, as already suggested, the reconstruction of the CG-Cataluña coalition could contribute to knit an agreement. The recent political agreement for a partial regional debt relief signals this is likely taking place. Indeed, according to Table 3, which shows how the coalitions defined in Section 4 interact with each other and to which extent they overlap, CG and Cataluña only diverge on the equalisation degree. However, in contrast to the past, we can observe that new coalitions have formed since 2009.

Table 3. Summary of regional coalitions formed around the six axes of the RFS reform

		Zaragoza Declaration Coalition						Mediterranean Coalition			Castillas Coalition		Net Contributors						
																	% regions	% pop	Blockage?
	CG	ARA	AST	CANT	EXT	GAL	RIO	AND	MUR	CVA	CYL	CLM	BAL	CAT	MAD	CAN			
End of <i>status quo</i>	✓							✓	✓	✓				✓	✓	✓	40%	72%	Yes
Lower redistribution degree													✓	✓	✓		20%	35.7%	Yes
More weight to provision cost variables (other than population)	✓	✓	✓	✓	✓	✓	✓				✓	✓				✓	60%	30.2%	Yes
More tax harmonisation	✓	✓	✓	✓	✓	✓	✓						✓	✓			53.3%	35.8%	Yes
End of extraordinary funds	✓														✓		6.7%	15.4%	Yes
Debt relief	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100%	100%	No
		40% of regions 15.5% of population						20% of regions 34% of population			13.3% of regions 9.9% of population		20% of regions 35.7% of population			6.7% of regions 5% of population			

Source: Own elaboration. Population 1/1/2024 INE.

Table 3 depicts three clear coalitions. First, the broadest coalition in terms of the number of regions aligned (40% regions and 15.5% of population), is formed by those signatories of the “Zaragoza Declaration”: Aragón, Asturias, Cantabria, Extremadura, Galicia, and La Rioja. These regions are for maintaining the status quo and a higher degree of fiscal equalisation and tax harmonisation, while giving more weight to provision cost variables (other than population) within the adjusted population formula. This can be explained by two main factors: they are regions with an above the average funding per adjusted inhabitant in the 2009-model, and with high levels of old population. This position defends that, in these regions, the per capita provision costs are higher.

Second, the Mediterranean coalition (20% of regions and 34% of population) is formed by Andalucía, Murcia and Comunitat Valenciana, and is aligned around the exact opposite position of the previous coalition. These regions receive funding per adjusted population under the average level, therefore are against the *status quo*. In addition, they are regions that are relatively less aged, so giving more weight to provision cost variables (other than population) would be against their interest.

And third, the two “Castillas” (13.3% of regions and 9.9% of population) are somewhere in between the two coalitions as they are against the end of the *status quo*, and favour the increase of the weight of provision cost variables (other than population) due to an elderly population. However, while Castilla y Leon is relatively well off under the current system, Castilla La Mancha is, together with the regions included in the Mediterranean coalition, one of the regions with lower funding per adjusted population. Consequently, the incentives for the latter to work for a new RFS are higher than for the former.

Finally, the three net contributor regions do not form an actual coalition, as they only coincide in benefiting from limiting the degree of equalisation. They differ in their positions regarding the *status quo* (only Balearic Islands for), increasing tax harmonisation (Balearic Islands and Cataluña for), and eliminating extraordinary funds (only Madrid for). The Canary Islands is also an unaligned free verse, as it has its own special funding regime.

Going back to the games presented in the previous section, we will introduce four possibilities to facilitate negotiations of the RFS to a successful end, this is, to solve the sudoku: 1) by changing the rules of the game; 2) by eliminating games; 3) by merging games; and 4) by limiting the frequency games are played.

5.1 Changing the rules of the game

Currently, CG has half of voting rights at the FFPC, plus the power to untie. Agreements are adopted in the FFPC by two-thirds majority, or the vote of the CG plus seven regions (art. 10.3 FFPC Regulation). If rejected, members cast their vote again in a second voting that is successful if the proposal is backed by the absolute majority of the votes (half plus one). According to terminology used by Game Theory, the CG could act as a dictator (at least in negative terms). Indeed, no agreement can be passed without the affirmative vote of the CG, and any agreement could be passed just with the votes of CG. However, in practice, CG lacks the political capital to impose a decision that is not widely backed by regions, as shown by CG’s preference order defined in previous sections. Current voting system leads to an informal veto power of regions, as experienced during the 1996 RFS reform. The first proposal entails changing the rules of the game. Two alternatives to change the voting rule at the FFPC are presented here. The first one is

inspired by the discussion on the reform of the Senate, and the second one influenced by the voting system at the Council of the EU.

A proposal inspired by discussions on Senate reform

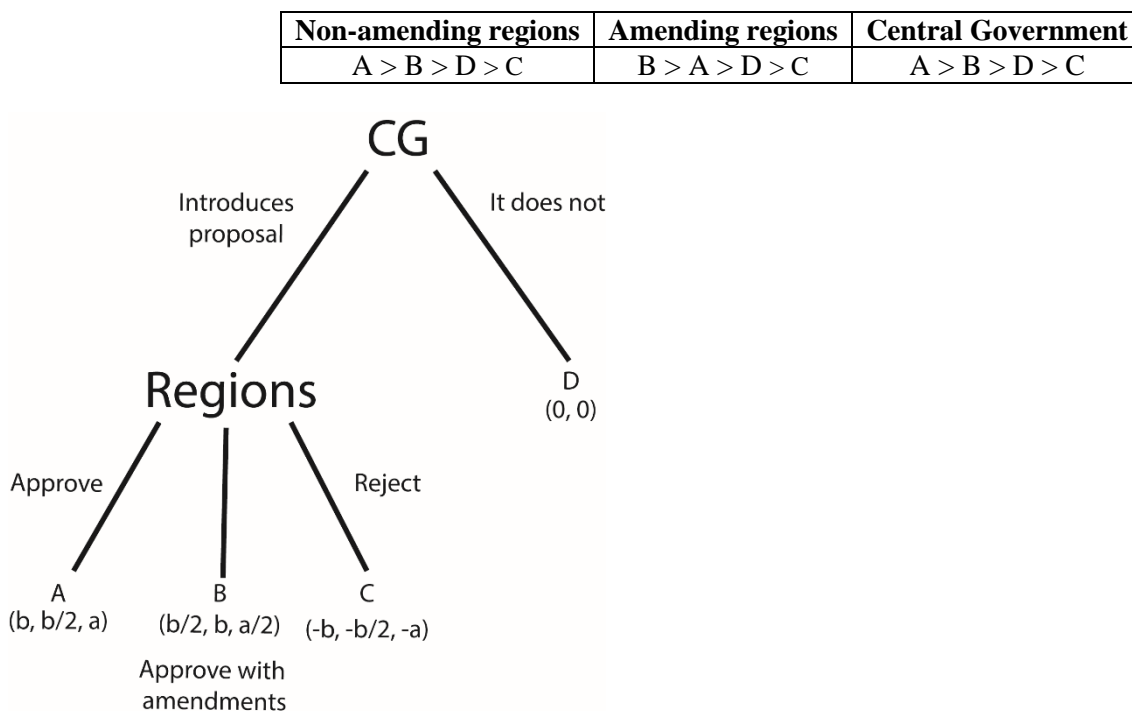
One of the most often mentioned reforms in the context of Spanish decentralisation model is the role of the Senate (Aja, 2005; López-Laborda, 2015; Bosch et al., 2022). There is broad consensus on the fact that current status of the upper chamber does not fulfil its pretended constitutional role for representing regions' views on national legislation as positions are drawn along political families instead of regional interests. Criticism against the role for Spanish Senate often forget that its role as a second reading chamber is similar to that in most countries around the world. Indeed, the German Bundesrat, which is usually presented as an example to follow, constitutes an exception, since it is not citizens or regions -but regional governments- that are represented (Aja, 2005; López-Laborda, 2015; Bosch et al., 2022). Presumably, the FFPC would be embedded within a new Senate in case it would be finally reformed (López-Laborda, 2005).

Although the example of the Bundesrat has been hackneyed, it has never been discussed at an institutional forum with real probability of being passed. Indeed, replacing current representation of citizens at Senate for representatives of regional governments could both, entail a democratic deficit and misrepresent regional positions. Indeed, governments, despite representing majorities, are a simplified picture of rich political pluralism represented in legislative chambers. This case was defended by a broad group of lawyers, economists, and intellectuals that signed in 2017 the so-called Manifesto for the Democratisation of Europe (T-Dem) (Henette et al., 2017). This body would be composed by directly elected legislators of the Euro Area countries and would be co-responsible for taking decisions on financial and fiscal issues. Inspired by the proposal by T-Dem, we pose the possibility of adapting it to the Spanish context, by turning FFPC into a political body of regional chambers. Nowadays, in Spain, only 58 out of the 266 members of the Senate are directly elected by regional chambers.

Inspired by these discussions, this first proposal would work as follows: as RFS is an exclusive competence of CG, it would decide whether to introduce a proposal through the reformed FFPC. This initiative power is similar to CG's role when introducing legislation proposals through Congress or that of the European Commission when doing so through the Council of the EU and Parliament. Therefore, in this context, CG would not have specific voting rights as currently has at FFPC. Regions would own voting rights according to their seats at the new FFPC, for which three alternatives will be presented.

As Figure 13 shows, by changing the rules of the game through a new FFPC, the game would take a new structure, as regions aligned with the proposal sent by CG would share the preference order with CG. Indeed, by sending the discussion to the new FFPC, regions would become fully co-responsible for the failure of negotiations, therefore becoming as little interested as CG in it. This situation could be key for regions to be more prone to accept a reform, that they could try to amend. Regions would divide between those willing to amend the initial proposal and those price-acceptant, in coalition with the CG. Of course, as this policy area is of exclusive responsibility of the CG, it would maintain the right to drop the proposal in case it does not agree with the final text, as the European Commission at the EU legislative process.

Figure 13. Extensive form game of regional funding system negotiation with a reformed FFPC


















In order to try to simulate potential majorities in the new FFPC around the negotiation axes presented before, it is first required to allocate a number of FFPC members to regions. We will follow three alternative approaches: 1) an USA Senate style approach, with three seats for each region²⁵; 2) T-Dem style approach, fully proportional to population; and 3) based on the current model for regionally designated senators, that allocates 1 seat to each region, plus a seat each millions of inhabitants. While the first method would particularly benefit the Zaragoza Declaration Coalition, Mediterranean Coalition and Net Contributors would be benefitted by the second approach. Note that this simulation excludes regions that do not take part of fiscal equalisation (e.g. Basque Country, Navarre), and the Autonomous Cities of Ceuta and Melilla.

Table 4 shows that, on the one hand, the most likely reform to pass would be the end of the *status quo*, under seat allocation methods II (proportional) and III (mixed), together with unanimous debt relief, solved in all the scenarios. One other hand, it is the first seat allocation method (all equal) the one that could solve blockage in three axes: the adjusted population formula, tax harmonisation, and the unanimous debt relief. However, this prediction should be cautiously interpreted as the party alignment axis could alter results to a larger extent than under current FFPC context, as experience from Senate teaches that members of new FFPC could respond to party lines rather than to regional interest (Aja, 2014).

²⁵ Setting three seats for each regional assembly would contribute to plural composition of the new FFPC, as it is more likely that at least two parties from each chamber are represented.

Table 4. Summary of regional coalitions formed around the six axis of the RFS reform with a FFPC reform inspired by discussions on the Senate

		Zaragoza Declaration Coalition						Mediterranean Coalition			Castillas Coalition		Net Contributors						
																			
	CG	ARA	AST	CANT	EXT	GAL	RIO	AND	MUR	CVA	CYL	CLM	BAL	CAT	MAD	CAN	Vote I	Vote II	Vote III
% pop		3	2.2	1.3	2.3	5.9	0.7	18.9	3.4	11.7	5.3	4.6	2.7	17.6	15.4	4.9			
Seats I (US)		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45		
Seats II (T-Dem)		3	2	1	2	6	1	19	3	12	5	5	3	18	15	5		100	
Seats III (ES)		2	2	1	2	3	1	9	2	6	3	3	2	8	7	3			54
End of <i>status quo</i>	✓							✓	✓	✓				✓	✓	✓	18/45	72/100	35/54
Lower redistribution degree													✓	✓	✓		9/45	36/100	17/54
More weight to provision cost variables (other than population)	✓	✓	✓	✓	✓	✓	✓				✓	✓				✓	27/45	30/100	19/54
More tax harmonisation	✓	✓	✓	✓	✓	✓	✓						✓	✓			34/45	36/100	21/54
End of extraordinary funds	✓														✓		3/45	15/100	7/54
Debt relief	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	45/45	100/100	54/54
		40% of regions 15.5% of population						20% of regions 34% of population			13.3% of regions 9.9% of population		20% of regions 35.7% of population			6.7% of regions 4.9% of population			

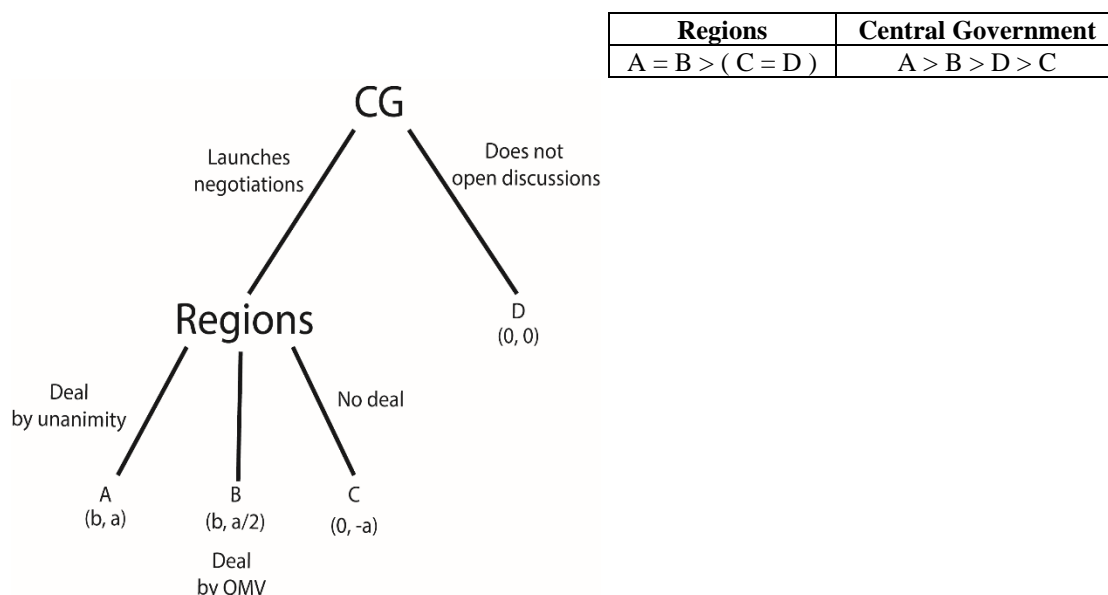
Source: Own elaboration. Population 1/1/2024 INE.

Qualified Majority Voting at the FFPC

Another possible way to address this situation could be learning from the experience at the Council of the EU. Qualified Majority Voting (QMV) replaced weighted majority rule in 2014, with the aim to avoid deadlocks generated by unanimity rule while maintaining the legitimacy of the European democratic process by requiring broad majorities (Scharpf, 2017; Dourado, 2019). QMV is a compound rule based on three requirements. In our case, as in the Council of the EU, agreement would be reached when the 55% of autonomous communities which gathered at least the 65% of the population would agree. This equates to the affirmative vote of nine autonomous regions. In contrast, a minority blocking coalition could be built by gathering four regions equating at least the 35% of the Spanish population. Strictly following EU's QMV system, the blocking minority would require just three regions to join forces, however no pair of autonomous communities adds up the 35% of the population, a context that leaves meaningless the three-region requirement.

The elimination of the formal possibility for the CG to act as a “dictator”, and the increased say recognised to regions by QMV rule would improve the legitimacy of agreements signed by coalitions of regions and the GC, despite being rejected by some other regions. Consequently, QMV would contribute to eliminate the de facto veto clause of the negotiations, that defined the preference order of CG. Indeed, in this scenario (Figure 14), CG would prefer reaching an unanimous agreement as first-best scenario (A), but would rather reach an agreement that passes the QMV vote (B), than not opening conversations (D). Still, not reaching an agreement (C) would be the least preferred option.

Figure 14. Extensive form game of regional funding system negotiation with QMV rule at the FFPC



Overall, Table 3 evidences that, *ceteris paribus*, the application of the exact rules of EU's QMV would not solve the deadlock around the reform of the RFS. However, the new voting rule alone would already make CG make more prone to open discussions, as illustrated in Figure 14. Moreover, QMV could be combined with the following scenarios to contribute to finally resolve the sudoku. The following simulations in Tables 5 and 6 will be based on the QMV voting rule

proposal as it is our preferred and more feasible in political terms if compared to Senate inspired ones.

5.2 Eliminating games

The second possible treatment to the blockade could consist in eliminating some of the games currently played. Suppressing some of the axes that work as dividing lines across actors in the RFS negotiation could help building agreements around the remaining axes. Of course, this is not feasible for axes such as the level of redistribution/equalisation or the political alignment, which should always be the result of political decisions, but it is for others. How could these games be eliminated from the negotiation? By leaving some elements of the design of the RFS under the responsibility of an independent institution, that would calculate dimensions such as adjusted population or fiscal capacity through an evidence-based process. The Australian Commonwealth Grants Commission²⁶ is a great example of how an independent body could facilitate well-functioning of intergovernmental fiscal transfer frameworks (Williams, 2005). In the case of Spain, a Grants Commission could take out from the political debate the composition of the adjusted population, redrawing current regional coalitions, as reflected in Table 5.

Indeed, if controversies on the calculation of adjusted population would become outside the conversation by making the Grants Commission responsible for it, the two Castillas and Canary Islands would join Mediterranean coalition to form a new “passive” coalition that would represent 40% of regions and almost half of population. The name responds to their lack of interest on further important changes to the RFS, with the exception of a one-time debt relief. The Zaragoza Coalition would become very close to the positions of the CG, which suggest a potential agreement between them.

In this context, the main remaining difference between the two main regional coalitions would focus on the degree of tax harmonisation. As observed in Section 4.4, in recent times, positions around tax harmonisation have turned into very political, suggesting that, after future regional elections, regional positions could move and QMV be reached. Similarly, discussions on the end of extraordinary funds could ease when regional debt is alleviated and regions get better access to private debt markets. It is indeed, the degree of redistribution still represents the element of the RFS for which gathering consensus would remain least feasible.

²⁶ The website of the Australian Commonwealth Grants Commission provides useful analysis available in the following link: <https://www.cgc.gov.au/>

Table 5. Summary of regional coalitions formed around the six axes of the RFS reform with a “Grants Commission”

		Zaragoza Declaration Coalition						Passive Coalition						Net Contributors					
	CG	ARA	AST	CANT	EXT	GAL	RIO	AND	MUR	CVA	CYL	CLM	CAN	BAL	CAT	MAD	% regions	% pop	Blockage?
End of <i>status quo</i>	✓							✓	✓	✓					✓	✓	40%	72%	Yes
Lower redistribution degree														✓	✓	✓	20%	35.7%	Yes
More tax harmonisation	✓	✓	✓	✓	✓	✓	✓							✓	✓		53.3%	35.8%	Yes
End of extraordinary funds	✓															✓	6.7%	15.4%	Yes
Debt relief	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100%	No
		40% of regions 15.5% of population						40% of regions 48.9% of population						20% of regions 35.7% of population					

Source: Own elaboration. Population 1/1/2024 INE.

5.3 Merging games

Lack of many overlaps between coalitions makes it difficult for partial reforms to take place. Alternatively, merging games or negotiation axes could help to gather consensus. A comprehensive reform that compensates wins and losses coming from changes in different elements of the RFS could facilitate reaching a deal. For instance, a regional debt relief or the consolidation of extraordinary funds could “buy” regions’ support by compensating potential losses derived from the end of the *status quo* or from lowered redistribution degree. This way, CG could turn the negotiation into a positive sum game, as in all the previous reforms. This move could be justified to a certain extent, as despite lack of responsibility increases, it is true that the intense aging process Spain is facing starts exerting pressure on demand for healthcare and long-term care, which translates in larger spending needs, particularly for older regions (OECD, 2021).
















Table 6 shows an example of how merging games or axes of the RFS negotiation in packages could contribute to overcome blockage. On the one hand, if the decision-making process and its rules would adopt QMV and adjusted population formula would be in hands of the Grants Commission, the end of status quo (as demanded by Mediterranean Coalition and the Net Contributors) could be negotiated together with the debt relief, so wins and losses would be compensated. In addition to the debt relief, consolidation of a share of “extraordinary funds” could also be considered to compensate regions that would end up being worse off after a reform. This merged game would have the support of at least a third of regions representing two thirds of population. We remark “at least” because support of rest of regions would depend on how much they would be compensated through the debt relief or the consolidation of extraordinary funds. Majorities required by QMV could then be reached this way.

On the other hand, a lower degree of redistribution could be discussed together with an increase in tax harmonisation, so high fiscal capacity and low needs regions would be compensated for not being allowed anymore to engage into tax competition dynamics that rest of regions could not afford. Table 6 shows that reaching qualified majority of regions and population would be more difficult in this merged game than in the previous one, as only support of a quarter of regions representing a fifth of regions would be guaranteed. More regions would ask for a compensation to agree to reform of these merged axes. This is also consistent with the fact that gains/losses due to lowered redistribution degree are expectedly to exceed losses/gains from accepting higher tax harmonization.

According to this game merge, coalitions would be redrawn: the Mediterranean half of the “Passive Coalition” would join “Net recipients” in a cheap to compensate new coalition. In contrast, the two Castillas and Canary Islands²⁷ would join the members of the Zaragoza Declaration Coalition in an expensive to compensate coalition, less prone to support involved marginal reforms.

²⁷ Note that Canary Islands represent a special case within common regime regional funding system. Therefore, mentions to this region should be interpreted cautiously.

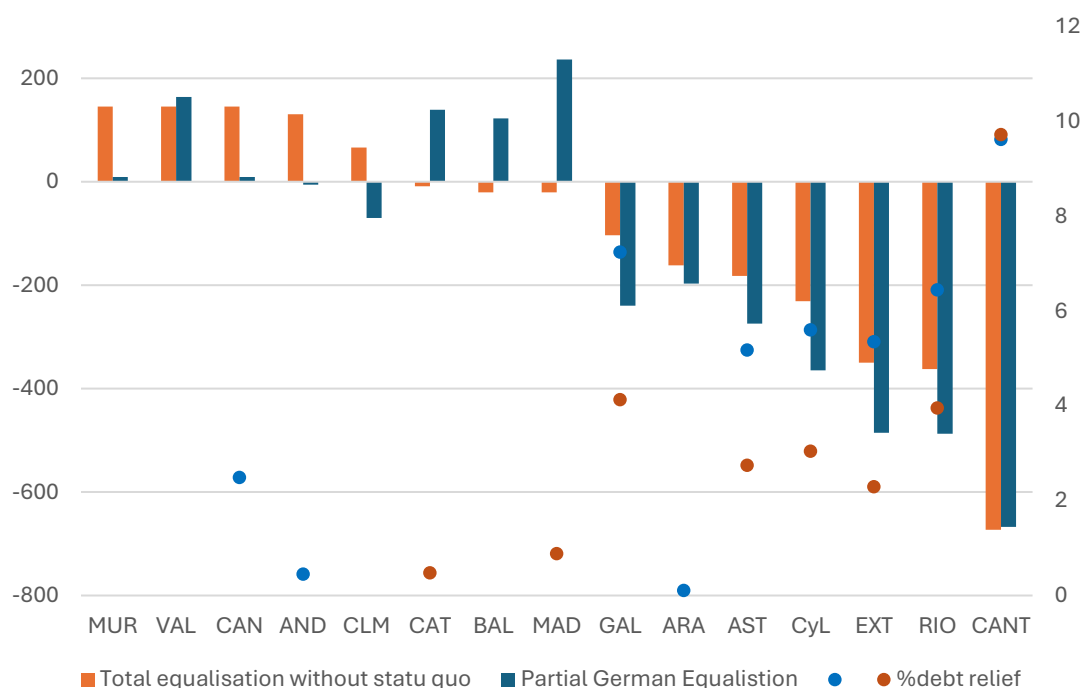
Table 6. Summary of regional coalitions formed around the six axes of the RFS reform with QMV, Grants Commission, and merged games

		Expensive Compensation Coalition									Cheap Compensation Coalition						%regions	%pop	Blockage?
	CG																		
End of <i>status quo</i>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	≥33.3%	≥67%	?
Debt relief	✓										✓	✓	✓		✓	✓			
Lower redistribution degree	✓	✓	✓	✓	✓	✓	✓							✓	✓	✓	≥26.7%	≥20.3%	?
More tax harmonisation														✓	✓				
End of extraordinary funds	✓															✓	≥6.7%	≥15.4%	?
		60% of regions 30.3% of population									40% of regions 69.7% of population								

Source: Own elaboration. Population 1/1/2024 INE.

Figure 15 illustrates the impact -in the baseline year 2021, the last year for which we have the necessary information- that the accumulation of reforms could have on each region’s funding per adjusted inhabitant. Annex E provides detailed results in Table E1. Calculations assume the new expenditure needs formula elaborated by the Grants Commission, which, for the purposes of this illustrative exercise, coincides with that proposed by CG in December of 2021 (Ministry of Finance, 2021). Two alternative scenarios are depicted. The first one corresponds to the end of the status quo, as current level of funding would be entirely allocated according to the new adjusted population formula proposed by the Grants Commission. This would represent a total equalisation scenario, providing all regions with 2,910.24€ of funding per adjusted population (in normative terms, and for homogeneous competences). The second scenario corresponds to a decrease in the degree of redistribution as it applies partial equalisation to close the horizontal gap by following the German approach of progressive transfers that respects how regions are ranked according to their fiscal capacity (in normative terms)²⁸. It should be noted that wins and losses with respect to the baseline scenario do not necessarily coincide with vote expressed in coalitions analysis, which represent rational decision that considers effects in the longer term.

Figure 15. Wins/losses caused by reforms compared with the baseline year 2021 (€ per new adjusted inhabitant) and percentage of regional public debt required to fully compensate losses



Note: wins and losses are calculated as the difference between new allocations per new adjusted population and current allocations per current adjusted population. The percentage of regional public debt required is calculated as the percentage of funds lost in absolute terms. In some cases, despite losing in terms of per

²⁸ This mechanism would progressively close 100% of the gap of those regions positioned under the 92% of average funding level, and the 37.5% of the gap between 95% and 100%. Regions above the average funding level would contribute with an amount that equates 15% of the gap between 100% and 101% of average funding, with the 66% of the gap between 101% and 110%, and with the 80% of the gap if located above 110% of the average funding level. The remaining progressive contributions made by “high fiscal capacity” regions, summed to the vertical transference paid by CG, would be lineally allocated across all regions to ensure ranking is maintained.

adjusted population, the debt relief required to compensate losses is zero, because they still represent wins in absolute terms.

Source: Own elaboration based on data from Ministry of Finance and De la Fuente (2021).

On the one hand, the end of the status quo combined with the new expenditure needs formula would generate relative wins for Murcia, C. Valenciana, Canary Islands, Andalucía, and Castilla-La Mancha in the baseline year. In contrast, largest relative loses in the baseline year would be recorded for Cantabria, La Rioja, Extremadura, and Castilla y León. The reform would be costless if losses would be accepted. Yet, a debt relief could be offered in exchange so regions would accept the end of the status quo. In that case, loss compensation would cost 2,327 M€ of additional funding in the baseline year, equating a 1.8% increase in the global funding for the model. In the baseline year, compensation could be set through a debt relief ranging between 0.48% of regional debt for Cataluña, and 9.72% for Cantabria.

On the other hand, the decrease in the redistribution degree combined with the new expenditure needs formula would generate large relative wins for Madrid, Cataluña, Balearic Islands, and C. Valenciana in the baseline year, while largest losses in relative terms would be for Cantabria, La Rioja and Extremadura. Again, the reform would be costless if losses would be accepted. On the contrary, CG could offer to compensate generated losses in exchange of increased tax harmonisation and an affirmative vote to the reform. This would require introducing up to 2,951 M€ of additional resources to the RFS, representing 2.3% increase in global funding. Similarly to the previous alternative, a compensation could be applied by passing debt relief ranging from a negligible 0.11% of regional debt for Aragón, to the 9.62% for Cantabria (Figure 15).

5.4 Setting restrictions to the frequency games are played

Finally, previously posed tools for facilitating agreement could be complemented by setting limits to the frequency games are played. Indeed, in addition to the adoption of the QMV at the FFPC, the creation of the Grants Commissions, and the compensation of wins and losses with financial support, time could support a successful end of RFS negotiations in three distinct ways. First, as explained by León (2009), the expectation of potential wins after every RFS introduced incentives for regions to adopt irresponsible behaviours that generated the instability of the system until 2009, as regions would constantly call for reform. Therefore, setting regular negotiation time limits could contribute to stability. In Austria, the fiscal equalisation framework is passed for four years periods, which forces a new negotiation to take place with this frequency (Finance Ministry of Austria, 2023). This is also the case of the Basque or Navarre Agreement model, which is negotiated every five years.

Second, time-related arrangements can contribute to overcome blockade by setting long transitory periods. Indeed, long transitory periods can cushion losses and reduce the need for financial compensations described in the previous section. Switzerland represents an interesting example of this technique, as it set a twenty-six year transitory compensation mechanism specifically designed with this aim when it reformed its fiscal equalisation framework in 2008 (Finance Ministry of Switzerland, 2024). Some experts also suggested this possibility in their particular votes attached to the Report by the Expert Commission for the reform of the RFS (2017).

Our preferred approach would entail combining annual updates of elements of the RFS considered purely technical, such as the determination of expenditure needs indicators by Grants Commission, while ensuring that major revisions of the model would only take place after thresholds set for some indicators are surpassed. For instance, after the 5-year mobile average of

a dispersion indicator for funding per adjusted inhabitant, of regional expenditure in essential services per adjusted inhabitant, or of adjusted population suffer a large deviation.

Finally, some kind of punishment should be incorporated to ensure that set timelines are respected. Otherwise, the paradox could be repeated. As a matter of fact, the 2002 model lasted for only seven years despite being indefinite, while current 2009 system recovered the five years application deadline but has lasted already for fifteen years.

6. Conclusions

Spanish RFS remains unreformed because of blockage for more than ten years now, after decades of frequent reform, or instability (León, 2009; Bandrés and Cuenca, 2016; Utrilla, 2020; Bosch et al., 2022). This paper has compared both pre-2009 and post-2009 contexts and has made use of narrative approach and game theory to explain current situation. Accordingly, blockage can be explained by two kinds of determinants. On the one hand, there have been changes in drivers endogenous to the RFS, such as the conclusion of the decentralisation process and asymmetric information (that led to coalitions formation), together with the expected end of the *status quo* clause. On the other hand, exogenous drivers, such as political fragmentation, the Catalan conflict, fiscal rules, and macroeconomic cycle have altered incentives for actors not to move.

This paper examines the new formation of regional coalitions along six different axis – vertical political alignment between CG and regions as an axis has been left out due to previously explained reasons-: the end of the *status quo*, the equalisation/redistribution degree, the weight of cost of provision cost variables (other than population) in the formula, the level of tax harmonisation, and the concession of bailouts. According to them, three separate coalition are identified: the old rural coalition, the Mediterranean coalition, and a third coalition of “Castillas”, being the net contributor regions and Canarias unaligned regions, with the exception of Cataluña, that little by little is rebuilding its coalition with the CG.

As going back to the asymmetric information plus non-rational scenario is neither possible nor desirable, the outcome suggests that the following elements could contribute to overcome blockade: 1) A reform of the decision-making process and rules could be introduced to facilitate that CG opens negotiations even if no unanimity is expected to be reached on political aspects; 2) an independent Grants Commission could determine technical aspects, such as region expenditure needs (and fiscal capacity, although it has been left out of this discussion), taking out of the political discussion one of the most controverted elements; 3) as isolated reforms would still be very unlikely some axes of RFS negotiation could be merged in order to compensate losses and wins, for instance, in exchange of a regional debt relief; 4) limiting the frequency reforms can take place and making major revisions dependent on the activation of automatic mechanisms could contribute to overcome blockade without going back to instability; and finally, 5) rebuilding the CG-Cataluña coalition, which emerges as a closer reality in the view of recent agreement on regional debt relief and exploring contacts with the Zaragoza Declaration Coalition, which is the closest to CG’s position.

Future research could incorporate to narrative and game theory evidence, qualitative evidence coming from interviews to the actors involved and explore a comparative approach of the dynamics of RFS negotiations in other countries.

Few weeks before this thesis has been finished, the Party of Socialists of Catalonia (PSC), the Catalan branch of the Spanish Socialist Workers' Party (PSOE), which now governs both the Catalan and Spanish Governments, and the pro-independence party Esquerra Republicana de Catalunya (ERC), reached an agreement to work for a singular regional funding model for Catalonia in the context of the negotiations to form a new Government of Catalonia.

This agreement, albeit lacking precise detail at this stage, suggests an alternative model in which Catalonia would be offered a "unique" financing arrangement. Under this arrangement, Catalonia would progressively assume responsibility for collecting all taxes levied within its territory through its own tax administration. In return, it would make a payment to the State to cover the cost of non-devolved services provided by the central government, alongside a compensatory contribution to interregional solidarity. While this agreement has not yet been formally tabled in Parliament, it has sparked significant debate across Spain, particularly among other Autonomous Communities operating under the common regime.

In our point of view, while this scenario presents a highly pertinent topic, it is not the subject of detailed analysis in this thesis for two main reasons. On the one hand, this is still a pre-agreement between two political parties, that has not yet been translated into a defined legislative proposal. Secondly, at the time this thesis has been finished, there is not enough information available so as to elaborate an accurate analysis of its potential impact on the topics addressed in the three chapters of this thesis. Nevertheless, should this debate evolve further within the broader context of reforming the existing system, it would undoubtedly present an intriguing avenue for future research.

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ANNEX A – Narrative approach references

Legislation and court sentences

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Ley Orgánica 10/1998, de 17 de diciembre, complementaria de la Ley sobre introducción del euro.

Ley Orgánica 5/2001, de 13 de diciembre, complementaria a la Ley General de Estabilidad Presupuestaria.

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Ley Orgánica 3/2009, de 18 de diciembre, de modificación de la Ley Orgánica 8/1980, de 22 de septiembre, de Financiación de las Comunidades Autónomas.

Ley 22/2009, de 18 de diciembre, por la que se regula el sistema de financiación de las Comunidades Autónomas de régimen común y Ciudades con Estatuto de Autonomía y se modifican determinadas normas tributarias.

Ley Orgánica 2/2012, de 27 de abril, de Estabilidad Presupuestaria y Sostenibilidad Financiera.

Ley Orgánica 8/2013, de 9 de diciembre, para la mejora de la calidad educativa.

Ley Orgánica 9/2013, de 20 de diciembre, de control de la deuda comercial en el sector público.

Ley Orgánica 6/2015, de 12 de junio, de modificación de la Ley Orgánica 8/1980, de 22 de septiembre, de financiación de las Comunidades Autónomas y de la Ley Orgánica 2/2012, de 27 de abril, de Estabilidad Presupuestaria y Sostenibilidad Financiera.

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en educación y régimen lingüístico: nulidad de los preceptos legales que regulan el derecho a recibir las enseñanzas en las lenguas oficiales y la repercusión a las comunidades autónomas de los gastos de escolarización de alumnos en centros privados con oferta educativa en castellano y habilitan al Gobierno para el establecimiento de las bases de la educación plurilingüe.

Ley Orgánica 9/2022, de 28 de julio, por la que se establecen normas que faciliten el uso de información financiera y de otro tipo para la prevención, detección, investigación o enjuiciamiento de infracciones penales, de modificación de la Ley Orgánica 8/1980, de 22 de septiembre, de Financiación de las Comunidades Autónomas y otras disposiciones conexas y de modificación de la Ley Orgánica 10/1995, de 23 de noviembre, del Código Penal.

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ANNEX B – Latent Dirichlet Allocation (LDA) Topic Analysis

Latent Dirichlet Allocation (LDA) is a machine learning generative probabilistic model that organises text data into topics that are representative of a document (Blei et al., 2012). It is a widely used methodology, based in a Bayesian model, for document modelling and for text classification. In this case, we have applied LDA to the agreements reached between CG and regions within the FFPC since 1982. The results reported in Table B1 and Figure B1, allow to understand the topics (between quotation marks) that were on the centre of each agreement and the words associated with each of those main topics. Most representative words have been marked in bold. Indeed, “autonomous region”, “funding”, “competence”, “agreement”, “cost”, “service”, are among most representative words.

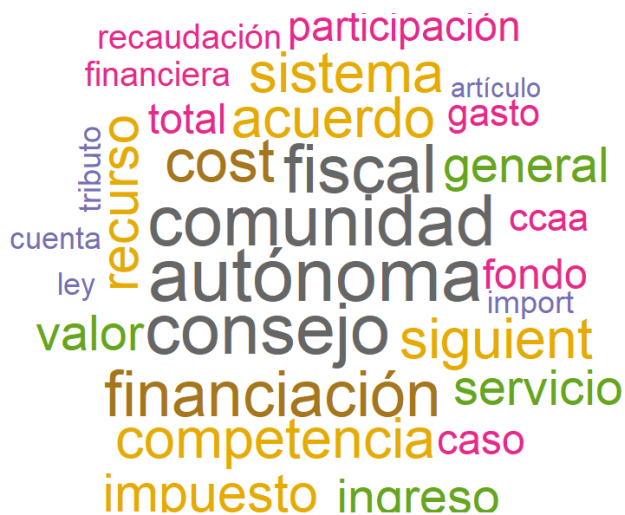
Table B1. Latent Dirichlet Allocation (LDA) Topic Analysis

Agreement Year	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
1982	“servicio” cost unidad comunidad orgánica	“servicio” orgánica proceso cost autónoma	“servicio” cost comunidad unidad consejo	“prestación” unidad cost autónoma servicio	“cost” unidad servicio competencia ministerio
1986	“total” autónoma financiación fci siguient	“comunidad” financiación autónoma servicio competencia	“comunidad” participación autónoma total sistema	“financiación” comunidad art autónoma tributo	“financiación” total servicio part general
1992	“autónoma” comunidad financiera recurso grupo	“comunidad” fiscal ingreso financiero presupuesto	“comunidad” ingreso autónoma fiscal gasto	“comunidad” autónoma ingreso consejo gasto	“comunidad” fiscal ingreso financiero financiación
1993	“autónoma” término sistema participación norma	“autónoma” comunidad financiación irpf base	“comunidad” participación financiación autónoma artículo	“comunidad” fiscal financiación irpf procedimiento	“comunidad” fiscal norma aplicación autónoma
1995	“cost” servicio gasto total efectivo	“person” comunidad caso cost transferencia	“unidad” nivel servicio person efectivo	“nivel” orgánica servicio autónoma transferencia	“servicio” cost total comunidad unidad
1996	“comunidad” autónoma servicio sistema siguient	“autónoma” comunidad sistema recurso acuerdo	“autónoma” irpf comunidad siguient ingreso	“comunidad” autónoma irpf quinquenio financiación	“comunidad” irpf sistema siguient participación
1997	“autónoma” comunidad financiera recurso grupo	“comunidad” fiscal ingreso financiero presupuesto	“comunidad” ingreso autónoma fiscal gasto	“comunidad” autónoma ingreso consejo gasto	“comunidad” fiscal ingreso financiero financiación
1998	“consejo” tarifa financiera fiscal reforma	“política” irpf fiscal voto autónoma	“comunidad” incremento financiera voto reforma	“consejo” fiscal votación irpf financiera	“consejo” financiera irpf tarifa fiscal
2001	“comunidad” autónoma financiación financiera consejo	“financiación” impuesto comunidad autónoma financiera	“sistema” comunidad autónoma consejo impuesto	“autónoma” comunidad fiscal consejo recaudación	“sistema” autónoma líquida competencia recaudación
2003 I	“autónoma” endeudamiento	“deuda” endeudamiento	“endeudamiento” deuda	“sector” financiera	“comunidad” deuda

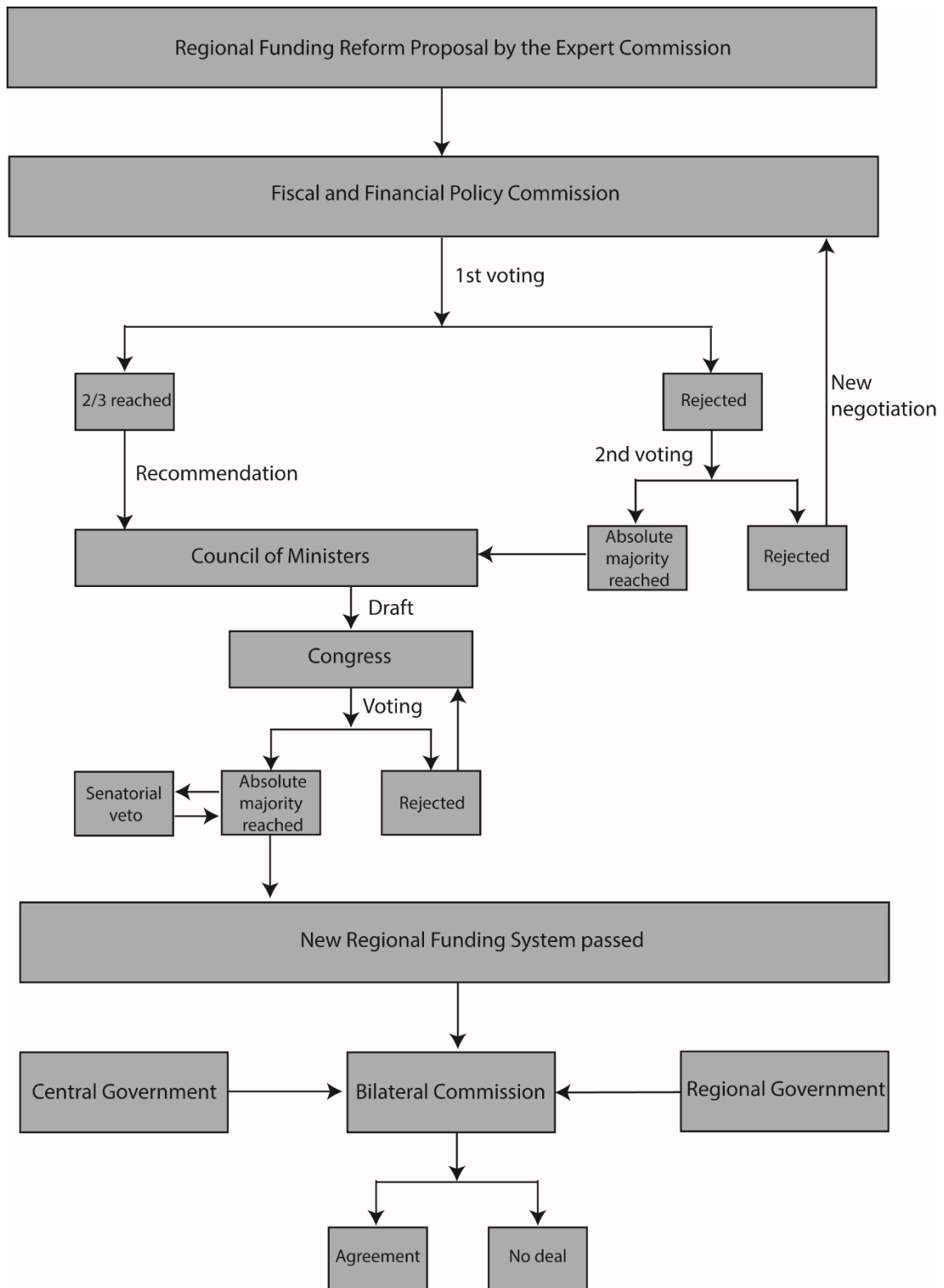
	comunidad presupuestaria estabilidad	comunidad financiera fiscal	administración sector objetivo	endeudamiento autónoma comunidad	consejo viva estabilidad
2003 II	“comunidad” general financiera información acuerdo	“autónoma” consejo general administración entidad	“información” fiscal comunidad autónoma acuerdo	“autónoma” información comunidad política acuerdo	“información” comunidad consejo financiera fiscal
2007	“comunidad” programa general inversión economía	“estabilidad” programa consejo déficit fecha	“programa” autónoma ejercicio consejo anual	“ley” general comunidad endeudamiento autónoma	“programa” ley general inversión estabilidad
2009	“financiación” sistema reforma recaudación impuesto	“comunidad” recurso sistema ccaa impuesto	“sistema” ccaa financiación comunidad fiscal	“financiación” ccaa autónoma fondo import	“financiación” acuerdo ccaa reforma recurso
2012	“autónoma” comunidad pago general obligación	“autónoma” comunidad acuerdo financiera fiscal	“autónoma” mecanismo comunidad acuerdo fiscal	“comunidad” acuerdo mecanismo incluido proveedor	“comunidad” pública pago ministerio consejo
ALL	"comunidad" financiación autónoma fondo cost	"autónoma" comunidad sistema cuadro total	"comunidad" fiscal consejo ingreso sistema	"comunidad" consejo fiscal autónoma gasto	"financiación" comunidad autónoma sistema cost

Note: LDA Topic Analysis of the political agreements between CG and regions along the last decades has been carried out by using R. Before running the LDA model, all words have been transformed into lower case, punctuation signs and numbers have been eliminated. Also, stopwords and all words shorter than 3 characters have been dropped, together with “año”, “cada”, “columna”, “cuadro”, “den”, “dicho”, “diciembre”, “lan”, “mediante”, “nº”, “octubre”. Furthermore, white spaces have been stripped and documents have been stemmed in order to account together for all words that share the same root. Five topics (between brackets) have been selected for each document, at the same time, five words have been chosen for each topic. Finally, keywords defining the content of each agreement have been marked in bold letters.

Figure B1. Word Cloud of 20 most relevant words across topics in all CG-regions agreements at the FFPC



ANNEX C - Figure C1. The regional funding reform decision-making process



Source: own elaboration.

ANNEX D – Extended formalisation of the Game

The formalisation and design of our Game is mainly built on León (2009) and Geli and Quilis (2019). To start with the game theory analysis of the negotiation process, we will first assume that all players, CG (C) and regions (i), follow a self-interested behaviour pattern consistent with Public Choice Theory. The utility function of CG is composed by three elements: power, probability to get reelected [$p(\text{reelection}_C)$], and probability of reelection of aligned regional governments [$p(\text{reelection}_i)$].

On the one hand, CG pursues to maximise the size of its budget (R_C) to gain power, in the terms settled by the Theory of Bureaucracy (Niskanen, 1994). CG's budget is the sum of central tax revenue -tax base (b_C) multiplied by tax rate (τ_C)- and the revenue from the central share of tax sharing schemes ($\frac{b_s * \tau_{sC}}{1-\alpha}$) -resulting from shared tax base (b_s) multiplied by central tax rate on shared tax (τ_{sC}), divided by the central participation share ($1 - \alpha$)-. Translation of budget into power is mediated by CG's political salience/relevance factor (ρ_C) that will depend on the specific context.

On the other hand, the CG, as any other politically elected incumbent, seeks for re-election (Treisman, 1999). Consequently, its utility function includes the probability of getting re-elected. The incumbent believes that gaining votes positively depends on, first, its political capital (k) in Bourdieu terms, which positively depends on reaching an agreement (A) with regions (i). And second, on the view of the CG, probability of maintaining the office positively depends on public expenditure (G_C) – defined as $R_C - T$, under the assumption of balanced budget and after transfers (T) are paid), since it allows to “buy support” (Treisman, 1999); and negatively on tax rates (τ_C). Of course, their impact on the electoral result will depend on voters' utility from public goods (g_C), unwillingness to pay taxes (w_C) and their knowledge on the competence distribution (γ), since this later element will be the one allowing them to correctly attribute responsibility for policies.

Next, we look deeper into the determinants of CG's budgetary domain. CG cannot retain all the revenue it raises since it has to give a share away to regions. Transfers (T) increase together with the level of pre-equalisation degree of fiscal vertical gap (v), or in other words, decrease with the level of regional tax autonomy (α) and the level of efficiency (f). The impact of the efficiency of the design of the equalisation scheme on the size of transfers is negative because *ceteris paribus*, it would allow the CG to achieve the pursued level of equalisation with a lower amount of money transferred (due to a lower DWL and a more rational fund allocation across regions), which would leave more room for expenditure at the central level (thus, increasing G_C).

Regarding tax autonomy, an increase would at first glance lead to the CG to be worse-off, through a power loss due to a smaller central budget. However, an increase in tax autonomy would be compensated with a lower need for vertical transfers, leaving a higher budget share for the CG to spend (R_C) or, alternatively, a lower central tax rate (τ_C). Taking into account that unwillingness to pay taxes is lower at the regional level ($w_i < w_C$) (Kleven, 2014), thus benefiting chances of aligned regional government to maintain the office, and that fiscal co-responsibility increases efficiency. Moreover, when considering that the budgetary size abdicated by the CG was not translated into central level expenditure, since it was directly transferred (T) to regions (i), implying that the utility loss for the CG was only happening through the power channel, but not through the expenditure channel.

The following formula represents the maximisation objective of a self-interested CG with regards the negotiation of the RFS. CG aims to maximise power, and probability of re-election, of its own and of aligned regions, which are defined here:

$$\begin{aligned}
& \max U_{CG}[power_C, p(reelection_C), p(reelection_\lambda)] \\
& \lambda \subset i \\
& power_C = \rho_C R_C \\
& p(reelection_C) = k(A) + \gamma[g_C(G_C) - w_C(\tau_C + \tau_{SC})] \\
& G_C = R_C - T \\
& R_C = b_C * \tau_C + \frac{b_s * \tau_{SC}}{\alpha} \\
& T = \frac{R_C}{\alpha f}
\end{aligned}$$

We know that,

$$MgU_{CG}(p(reelection_C)) > MgU_{CG}(p(reelection_i))$$

Regarding regions, their behaviour follows a purely self-interested pattern too. They want to increase their spending (G_i) through a bargaining process with the CG for more transfers (T_i) -that depends on the global RFS funding (T), the relative needs ($\frac{adjpop_i}{\sum adjpop_i}$), and the *status quo* and rest of minor elements that influence transfer allocation- and tax revenue (R_i) -which is the sum of own tax revenue $b_i * \tau_i$) and the regional share (α) of shared tax revenue ($b_s * \tau_{si}$)- that would allow them to “buy” more votes; hence, boosting their possibilities to get re-elected. Concerning re-election, at the regional arena citizens’ vote would be driven, not directly by their regional government performance, but by the relative performance relative to the average. Therefore, the relevant dimension is the relative size of the “fiscal residue” (Tiebout, 1956) relative policy menu or tax-benefits mix -relative spending ($g_i(G_i - \bar{G}_i)$) minus relative taxation ($w_i((\bar{\tau}_i - \tau_i) * (\bar{\tau}_{si} - \tau_{si}))$)- modulated by voters’ utility from public goods (g_i), unwillingness to pay taxes (w_i) and their knowledge on the competence distribution (γ). Revenue (R_i) is also the determinant of power, mediated by the political relevance/salience factor (ρ_i), which is larger for a big regional like Cataluña or Madrid than for a small region.

The following formula represents the regional objective function. It is simpler than CG’s, since regions are not held responsible for the outcome of the negotiation neither for institutional peace. Following the same rationale, they would not be concerned by who wins general elections. Therefore, regions aim to maximise power and their probability of getting re-elected:

$$\begin{aligned}
& \max U_i[power_i, p(reelection_i)] \\
& power_i = \rho_i R_i \\
& p(reelection_i) = \gamma[g_i(G_i - \bar{G}_i) - w_i((\bar{\tau}_i - \tau_i) * (\bar{\tau}_{si} - \tau_{si}))] \\
& G_i = R_i + T_i \\
& R_i = b_i * \tau_i + \alpha(b_s * \tau_{si})
\end{aligned}$$

$$T_i = T * \frac{adjpop_i}{\sum adjpop_i} + \text{status quo}$$

Despite the ambiguities in some variables' sign, a statement can be extracted from these paragraphs: according to the empirics, the positive effect of an agreement on a new system on the electoral components of the function overcomes the negative effect on the power component.

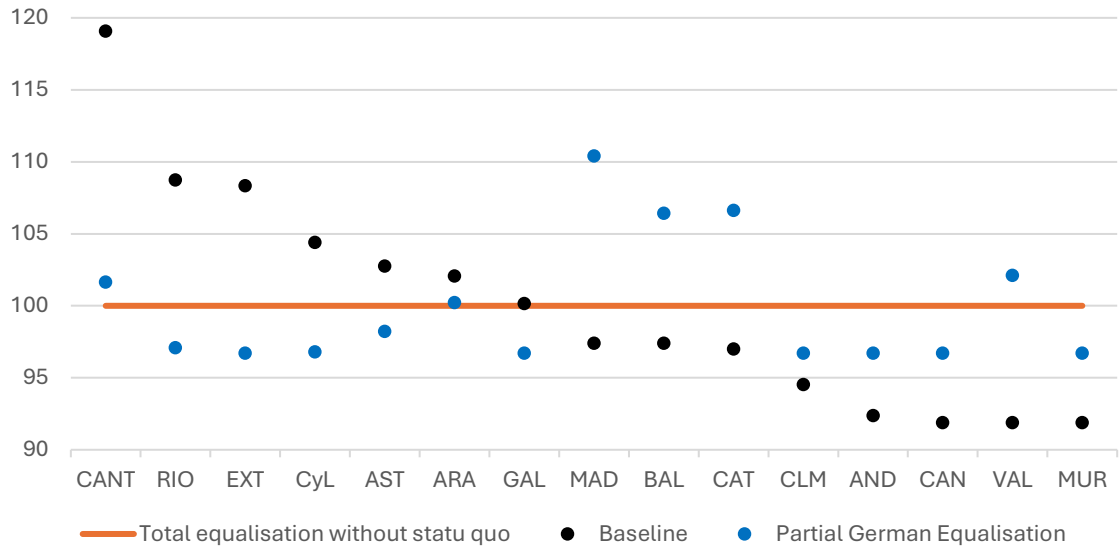
ANNEX E - Table E1. Main descriptive statistics of the RFS and proposed reforms for the baseline year (2021)

Region	Baseline				Grants Commission	Total Equalisation without Status Quo		Partial German-Style Equalisation	
	Adjusted Population (inhabitants)	RFS Funding (thousand M€)	Funding per adjusted inhabitant (€)	Funding per new adjusted inhabitant (€)	New adjusted population (inhabitants)	Funding (thousand M€)	Funding per new adjusted inhabitant (€)	Funding (thousand M€)	Funding per new adjusted inhabitant (€)
Cataluña	7,575,423	22,112,000	2,918.91	2,966.95	7,452,762	21,689,297	2,910.24	22,793,232	3,058.36
Galicia	2,907,197	8,762,000	3,013.90	3,091.00	2,834,684	8,249,600	2,910.24	7,863,770	2,774.13
Andalucía	8,301,282	23,075,000	2,779.69	2,795.10	8,255,531	24,025,544	2,910.24	22,901,879	2,774.13
Asturias	1,077,266	3,331,000	3,092.09	3,015.06	1,104,787	3,215,190	2,910.24	3,112,797	2,817.55
Cantabria	592,494	2,123,000	3,583.16	3,430.53	618,855	1,801,015	2,910.24	1,804,347	2,915.62
La Rioja	328,811	1,076,000	3,272.40	3,108.82	346,112	1,007,268	2,910.24	963,921	2,785.00
Murcia	1,490,483	4,121,000	2,764.88	2,675.47	1,540,289	4,482,606	2,910.24	4,272,956	2,774.13
C. Valenciana	4,923,774	13,614,000	2,764.95	2,814.10	4,837,786	14,079,099	2,910.24	14,170,112	2,929.05
Aragón	1,412,229	4,338,000	3,071.74	2,881.50	1,505,465	4,381,259	2,910.24	4,327,790	2,874.72
Castilla-La Mancha	2,123,502	6,040,000	2,844.36	2,760.69	2,187,858	6,367,184	2,910.24	6,069,393	2,774.13
Canary Islands	2,214,335	6,123,000	2,765.16	2,847.60	2,150,233	6,257,686	2,910.24	5,965,017	2,774.13
Extremadura	1,112,046	3,625,000	3,259.76	3,012.36	1,203,375	3,502,105	2,910.24	3,338,313	2,774.13
Balearic Islands	1,164,589	3,413,000	2,930.65	2,872.78	1,188,049	3,457,504	2,910.24	3,626,943	3,052.86
Madrid	6,528,308	19,133,000	2,930.77	2,962.95	6,457,420	18,792,616	2,910.24	20,451,048	3,167.06
Castilla y León	2,588,060	8,130,000	3,141.35	3,069.56	2,648,592	7,708,027	2,910.24	7,354,482	2,776.75
TOTAL	44,339,799	129,016,000	3,008.92	2,953.63	44,331,799	129,016,000	2,910.24	129,016,000	2,868.12

Note: RFS Funding is reported in normative terms and homogeneous competences.

Source: Own elaboration based on data from Ministry of Finance and De la Fuente (2021).

Figure E1. Results of RFS and proposed reforms in the baseline year (2021) (Index of funding in € per adjusted inhabitant)



Source: Own elaboration based on data from Ministry of Finance and De la Fuente (2021).

CONCLUSIONS

Fiscal equalisation is on the centre of intergovernmental fiscal relations. This thesis has addressed key issues in the discussion of fiscal equalisation from three different approaches, with a specific focus on equity, efficiency, environmental sustainability, and the political economy of fiscal equalisation reform. Although the three chapters have used the Spanish and Basque fiscal equalisation systems and data, both at regional and local levels, conclusions can be extrapolated to other institutional contexts at the international panorama. Indeed, the takeouts obtained represent useful insights for other compared systems too. This section goes back to the three main questions posed in each of the three chapters of this thesis and summarizes the responses to them.

Should fiscal equalisation and regional policy goals and tools be disentangled?

Results suggest a positive response to this first question. We exploit the mixture of policy goals and instruments of the Spanish Regional Funding System (RFS) to test whether equalisation transfers have an impact on regional convergence. Using FE and 2SLS-IV models and data for 15 regions for the 2002-2018 period, we find that both fiscal equalisation and regional transfers show a significant concave convergence promoting effect, being that effect larger for the latter. However, excess/deficit funding caused by overlapping tools and objectives in the RFS does not have a significant relationship with regional convergence. These results are in line with Tinbergen rule's, since it is more cost-effective to promote regional convergence through regional policy funds.

How can contribute local fiscal equalisation to ecological transition?

Success of centrally set environmental objectives requires the engagement of subnational governments. However, they often do not have the capacities or the incentives to apply ambitious climate mitigation and adaptation policies. Indeed, stricter environmental policies can lead to a decrease in local revenue collection as a consequence of the reduced activity resulting from the correction of externalities. To address this issue, in the line of Ecological Fiscal Transfers, we propose the inclusion of incentives linked to environmental objectives in local equalisation that would compensate for the opportunity costs faced by municipalities. In particular, we suggest greening fiscal equalisation by including a multidimensional index of local environmental performance that could be complemented by a green expenditure needs component as criteria for the allocation of equalisation grants. To illustrate how this proposal would work, we examine the financial effect that environmental fiscal equalisation would have had across Basque municipalities for the 2016-2019 period. As a main result, we find that less sustainable cities could lose up to the 5% of their per capita transfers, while small and most sustainable municipalities could win up to 13% of their per capita allocations.

What changed in the negotiation of the Spanish regional funding system and how can blockade be overcome?

After decades of frequent reform, or instability (Leon, 2009), of the regional funding system in Spain, the model has not been modified since 2009. Despite calls from some regions to carry out changes, the Central Government has not even opened discussions for negotiating a new reform. Therefore, instability has been replaced by coalitions blockade. Why? We follow a narrative game-theoretic approach to respond to this question. On the one hand, there have been changes in drivers endogenous to the RFS, such as the conclusion of the decentralisation process and asymmetric information (that led to coalitions formation), together with the expected end of the status quo clause. On the other hand, exogenous drivers, such as political fragmentation, the Catalan conflict, fiscal rules, and macroeconomic cycle have altered incentives for actors not to move. We identify three regional coalitions and conclude that a comprehensive reform that

compensates wins and losses from isolated changes, rebuilding Central Government-Catalonia coalition, and changing FFPC rules, could contribute to overcome current paralysis.

Despite the increased interest for fiscal federalism in general, and fiscal equalisation in particular, observed during recent years, many important research gaps remain. Some of them respond to the lack of data. And some other, to the existing limitations to design identification strategies that allow isolating relationships and impacts in such complex contexts. Yet, we believe that this dissertation represents a valuable contribution towards covering some of these gaps by looking to them from a new perspective. First, Chapter 1 exploiting existing data, but in a novel way, as it dissects intergovernmental fiscal transfers according to their actual objective, regional convergence, or fiscal equalisation. Second, Chapter 2 applies a still emerging tool, Ecological Fiscal Transfers, in a manner that is innovative due to its comprehensive and more ambitious character, as an element that internalises revenue opportunity cost derived from local environmental policies required to achieve goals committed at higher levels of government. And finally, Chapter 3 departs from previous game theoretical analysis of regional funding negotiations, by adding narrative approach, updating it to a scenario that has completely changed and by being constructive as it provides creative solutions to solve the sudoku and overcome current blockade.

To conclude, this dissertation, in which me and my supervisors have invested countless time, effort, and willingness, aims to become into just the first step of a career that continues the research line opened by these years of work, translated into this thesis. As part of this research agenda, we aspire to find ways to find identification strategies that allow us to stablish causality channels by applying quasi-experimental methods (e.g. difference in difference designs, regression discontinuity designs, or synthetic control methods). In addition, we would like to extrapolate the analysis made for Spain to other decentralised settings and, in particular, to the supranational level of the European Union.