Université de Strasbourg

BETA Bureau d'économie théorique et appliquée UMR 7522

Augustin Cournot Doctoral School

UNIVERSITÉ DE STRASBOURG

ÉCOLE DOCTORALE AUGUSTIN COURNOT ED 221

BUREAU D'ÉCONOMIE THÉORIQUE ET APPLIQUÉE UMR 7522

THÈSE

pour l'obtention du titre de Docteur en Sciences Économiques

Présentée et soutenue le 26 Novembre 2024 par

ANTOINE EBELING

Climate Change and European Intervention

Préparée sous la direction de Amélie BARBIER-GAUCHARD

Membres du jury :

Mouez FODHA	Professeur, Université Paris 1 Panthéon Sorbonne	Président
Camélia TURCU	Professeure, Université d'Orléans	Rapporteure
Katheline SCHUBERT	Professeure, Université Paris 1 Panthéon Sorbonne	Rapporteure
Olivier DAMETTE	Professeur, Université de Lorraine	Examinateur
Stéphane DEES	Economiste Senior, Banque de France	Examinateur
Amélie BARBIER-GAUCHARD	Professeure, Université de Strasbourg	Directrice

Membre invité :

Samuel LIGONNIÈRE	Maître de conférences, Université Evry Paris-Saclay

L'Université de Strasbourg n'entend donner aucune approbation, ni improbation aux opinions émises dans cette thèse ; elles doivent être considérées comme propres à leur auteur.

Direction de la **recherche**
et de la **valorisation**
Collège **doctoral**
Université de Strasbourg

Déclaration sur l'Honneur

Declaration of Honour

J'affirme être informé que le plagiat est une faute grave susceptible de mener à des sanctions administratives et disciplinaires pouvant aller jusqu'au renvoi de l'Université de Strasbourg et passible de poursuites devant les tribunaux de la République Française.

Je suis conscient(e) que l'absence de citation claire et transparente d'une source empruntée à un tiers (texte, idée, raisonnement ou autre création) est constitutive de plagiat.

Au vu de ce qui précède, j'atteste sur l'honneur que le travail décrit dans mon manuscrit de thèse est un travail original et que je n'ai pas eu recours au plagiat ou à toute autre forme de fraude.

I affirm that I am aware that plagiarism is a serious misconduct that may lead to administrative and disciplinary sanctions up to dismissal from the University of Strasbourg and liable to prosecution in the courts of the French Republic.

I am aware that the absence of a clear and transparent citation of a source borrowed from a third party (text, idea, reasoning or other creation) is constitutive of plagiarism.

In view of the foregoing, I hereby certify that the work described in my thesis manuscript is original work and that I have not resorted to plagiarism or any other form of fraud.

Nom Prénom : Antoine Ebeling
Ecole doctorale : Augustin Cournot ED 221
Laboratoire : Bureau d'Économie Théorique et Appliquée UMR 7522

Remerciements

Je souhaite ici exprimer toute ma gratitude envers les personnes qui ont contribué à la réalisation de ce travail de recherche.

Je tiens tout d'abord à remercier mes directeurs de thèse, Amélie Barbier-Gauchard et Samuel Ligonnière. Merci à Amélie de m'avoir transmis le goût de la recherche et d'avoir éveillé mon intérêt pour les questions européennes et la macroéconomie. Je la remercie également pour ses nombreuses relectures de mes travaux ainsi que pour l'ensemble des conseils qu'elle m'a prodigués. Enfin, je la remercie pour le soutien financier qu'elle m'a apporté pour ma mobilité en Italie grâce à sa chaire Jean Monnet. Je remercie Samuel pour son soutien constant tout au long de ce parcours, ainsi que pour ses conseils précieux qui ont enrichi mon travail de thèse. Je le remercie pour ses nombreux retours , commentaires -toujours pertinents- sur mes travaux de recherche.

Je tiens à exprimer ma reconnaissance et à remercier les membres du jury, Mouez Fodha, Katheline Schubert, Camélia Turcu, Olivier Damette et Stéphane Dees, pour avoir accepté de lire et d'évaluer mes travaux.

Je remercie le Bureau d'Économie Théorique et Appliquée (BETA) et l'École doctorale Augustin Cournot (EDAC), ainsi que leurs représentants Jocelyn Donce et Christophe Godlewski, pour leur soutien financier et matériel tout au long de ces quatre années de thèse. Je tiens particulièrement à remercier Virginie Gothié pour avoir supervisé les aspects financiers de ma mobilité en Italie. Un merci également à Géraldine Del Fabbro pour son aide précieuse. Merci également à Fanny Hund.

Merci à Pierre Lesuisse, mon voisin de bureau, pour nos discussions enrichissantes entre deux sessions de travail. Je remercie Thierry Betti, mon ancien chargé de TD en macroéconomie, désormais collègue, d'avoir accepté de commenter mon travail lors d'un séminaire doctoral. Un grand merci à Jamel Saadaoui pour ses nombreux conseils avisés, à Corentin Roussel pour ses conseils sur la soutenance et l'après-thèse. Je tiens également à remercier Meixing Dai pour m'avoir donné l'opportunité de vulgariser mes travaux dans sa revue, le *Bulletin de L'Observatoire des Politiques Économiques en Europe*, ce qui m'a même conduit jusqu'à l'Assemblée Nationale. Un merci aussi à Moise Sidiropoulos pour son soutien.

Je tiens à remercier Alexandre Mayol et Veronica Acurio Vasconez pour m'avoir intégré à la chaire RENEL, ainsi que pour m'avoir permis de bénéficier de son soutien financier et d'avoir présenté mes travaux lors des conférences annuelles de la chaire.

Mes camarades doctorants du BETA (certains, désormais docteurs) méritent aussi une mention spéciale : Émilien Veron, avec qui j'ai débuté cette aventure, sans oublier Ioannis (Σας εύχομαι τα καλύτερα !), Théo, Pierre (merci pour le template!), Sarah, Anne-Gaëlle, Jérôme, Agathe, Alexandre, Eva, Julie, Lucie, Yann, Laetitia, Kenza, Jean-Baptiste et Pauline.Un merci chaleureux à mes coauteurs, Jules Ducept et Samuel Ligonnière, pour cette collaboration enrichissante.

J'ai également une pensée chaleureuse pour tous les étudiants que j'ai pu encadrer en cours ou en tant que directeur de mémoire/stage. Une mention particulière à Matéo Dib, pour son aide précieuse dans la construction d'une base de données non présentée ici. Je te souhaite de réaliser tous tes rêves.

Je tiens à exprimer ma gratitude envers le Joint Research Center de la Commission Européenne, et plus particulièrement l'unité C5 Clean Air and Climate pour leur accueil au sein de leur unité à Ispra en Italie. Merci tout particulièrement à Manjola Banja pour m'avoir fait découvrir le monde de la recherche en sciences atmosphériques. *Grazie a te* !

Je remercie aussi mes amis, Antonin, qui a toujours su être une épaule solide lors des moments difficiles, ainsi que Cloé et Emilien, Ioannis et Maria, Antoine, Erwan, Hassib et Colin pour leur soutien. Merci également à Stella et Jean-Marie.

Mes remerciements s'adressent également à ma famille. À mes parents, Carine et Jean-François, les mots me manquent pour exprimer tout ce que je vous dois. Merci de m'avoir instruit et de m'avoir toujours soutenu dans tous mes projets. Je vous en suis extrêmement reconnaissant. Je vous aime. À mes frères Martin et Nicolas, je suis fier de vous, mes petits frères.

Je remercie mes grands-parents : Christiane, pour nos discussions sur la grammaire, l'orthographe, l'étymologie et les langues régionales. Dr Hermann Ebeling, titulaire d'un doctorat [Ebeling, 1964] en Histoire. Merci à Danielle, dont la cuisine réchauffe le cœur presque autant que ses câlins, et à Gilbert, pour les fins de glace partagées dans mon enfance. Je suis si fier d'avoir passé autant de temps à vos côtés. Une pensée particulière pour Jacques. Je remercie également mes oncles et tantes.

Je souhaite, pour clore ces remerciements, m'adresser à ma compagne, Carla. Tu es à mes côtés depuis tant d'années. Nous avons grandi ensemble, et je suis fier du chemin que nous avons parcouru. Je repense avec emotion à nos nuits cannoises, à ce train de nuit entre Strasbourg et Perpignan, à nos moments au bord du lac Majeur, à nos journées passées au chantier à décoller du papier peint et à manger des pizzas sur le parquet de notre futur appartement, ainsi qu'à nos soirées tranquilles passées à la maison avec Ramses.

Tu as toujours su me soutenir, m'encourager, me conseiller et me guider dans mes réflexions. Pour cela, je te serai éternellement reconnaissant. J'ai hâte d'écrire la suite de notre histoire, que ce soit à Strasbourg, Paris, Lille, Bruxelles, Sesto Calende ou ailleurs. Je sais qu'elle sera belle, car je la vivrai avec toi. Je t'aime.

À mes parents, à mes frères,
à Carla

Contents

Reading note / Note de lecture

This thesis is written entirely in English to facilitate the discussion and dissemination of its results. For French readers, translated versions of the general introduction and conclusion are available. The thesis includes three independent chapters, each contributing to the analysis of European institutions in the framework of the financing of the ecological transition. To ensure that each chapter can be read independently, certain elements are repeated across multiple chapters, particularly those related to economic literature and institutional context. Each chapter includes its own contextual elements and a literature review specific to the topic addressed. Consequently, the general introduction provides only a brief overview of the literature to avoid unnecessary repetition.

****

Cette thèse est entièrement rédigée en anglais afin de faciliter la discussion et la diffusion de ses résultats. Pour les lecteurs français, des versions traduites de l'introduction générale et de la conclusion sont disponibles. La thèse se compose de trois chapitres indépendants, chacun contribuant à l'analyse des institutions européennes dans le cadre du financement de la transition écologique. Afin de rendre chaque chapitre lisible de manière indépendante, certains éléments sont répétés dans plusieurs chapitres, en particulier ceux relatifs à la littérature économique et au contexte institutionnel. Chaque chapitre comprend ses propres éléments contextuels et une revue de la littérature spécifique au sujet abordé. Par conséquent, l'introduction générale ne fournit qu'un bref aperçu de la littérature afin d'éviter les répétitions inutiles.

General introduction

> *"All EU actions and policies will have to contribute to the European Green Deal objectives"*
>
> *Communication of the Commission, The European Green Deal, 11/12/2019*

EU climate action in a nutshell

According to the European Environment Agency [2023], the 27-member European Union emitted around 3.138 billion tonnes of greenhouse gases (GHGs, in CO2 equivalent) in 2022. This makes the European Union the world's 4th biggest polluter, behind China, the United States and India. Greenhouse gas emissions are not a problem per se; it is the process of GHG concentration in the atmosphere through the greenhouse effect that causes climate change. The greenhouse effect occurs when the sun's light radiation encounters the Earth's surface. Some of this radiation is reflected back into space, but some remains in the atmosphere, leading to its warming. The greenhouse effect is a natural process generated by water vapor. Beyond this natural greenhouse effect process, human activity appears to play a significant role in the upward trend in temperatures. Indeed, the average temperature has increased by 0.7°C over the last 120 years, with 0.5°C of that increase occurring since 1970. There is now a consensus on the role of human activity in the upward trend in GHG emissions [IPCC, 2018].

Extreme weather events like floods, droughts, and heatwaves have caused economic losses of approximately €453 billion between 1980 and 2017 [European Environment Agency, 2017]. These losses are due to the degradation of physical capital and the paralysis of economic activity caused by an extreme weather event. According to the German reinsurance company Munich RE[1], 2011 was the most costly year in terms of economic losses, with over €120 billion in damages. The Stern Review [2006] indicated that combating climate change would represent 1% of global GDP, while inaction could cost between 5% and 20% of global GDP.

The 2017 report by the European Environment Agency [2017] highlights that Europe is experiencing significant climate change impacts, with temperatures rising 1.5°C above pre-industrial levels over the past decade, and even more dramatically in the Arctic region. The economic costs of climate change are expected to be significant, potentially reaching €120 billion annually by 2100 in southern Europe alone. The report calls for urgent global mitigation efforts to limit temperature rise and stresses the importance of regional adaptation strategies, including enhanced policy coherence, adaptive management, and better monitoring systems to address the diverse and growing impacts of climate change across Europe.

According to Eurostat [2020], three quarters of greenhouse gas emissions in Europe, are due to fuel combustion. This includes the production of electricity, heat and other derived fuels, the transport of goods and people, electricity and heat used by households, businesses and institutions, and by companies to produce goods or construct buildings and infrastructure.

Several players are therefore in need of financing. Households need to change their energy consumption and transportation practices [Schueftan et al., 2021], for example by switching to energy-efficient appliances and electric vehicles. Industry needs substantial funding [Karltorp and Maltais, 2024] to decarbonize industrial production by implementing cleaner technologies and processes. Farmers need financial support to produce with fewer polluting inputs, adopting sustainable farming practices that reduce emissions and improve soil health [Havemann et al., 2022]. The services sector needs investment to reduce the harmful effects of storing massive amounts of data, focusing on energy-efficient data centers and sustainable IT solutions. According to a

[1]Les catastrophes naturelles ont atteint un coût record en 2011, Les Echos, 05/01/20212

McKinsey report[2], achieving carbon neutrality by 2050 will require the EU to invest 28 trillion euros in clean technologies over the next 30 years. Of this, 23 trillion euros would be reallocated from carbon-based to non-carbon activities, leaving a funding gap of 5 trillion euros by 2050.

Public pressure and the signing of international agreements (Paris Agreements, 2015) have led the EU to the ambition of becoming the *first climate-neutral continent* by 2050 [European Commission, 2020b] as planned in the European Green Deal. In the *2023 Special Eurobarometer Climate Change* [European Commission, 2023], 56% of respondents believe that it is up to the European Union to take action on climate change. European citizens place national governments and the European Union on an equal footing in the fight against climate change. In addition, several economists have called on the European Union to take direct action through the creation of various mechanisms and instruments: a reform of the Stability and Growth Pact that would allow member states to go beyond the 3% annual deficit to finance low-carbon investments [Fitoussi et al., 2007], or the purchase of green assets by the ECB [Espagne and Aglietta, 2016].

Environmental concerns have long been a focus for the European Union. As environmental degradation has worsened and awareness of its impacts has increased, the EU has progressively expanded its authority in this area. In this context, the 1979 Birds Directive (Directive 79/409/EEC), aimed at the conservation of wild birds, is often regarded as a foundational element of European environmental policy. More formally, the Single European Act of 1986 marked the first time since the beginning of European integration that the EU was granted specific authority in the field of environmental policy. This policy area later became subject to the co-decision procedure (now known as the ordinary legislative procedure) with the Maastricht Treaty of 1992. Another significant milestone was the Amsterdam Treaty of 1997, which formally recognized the principle of sustainable development—defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs," as outlined in the 1987 Brundtland Report and further clarified at the Rio Earth Summit in 1992.

[2]How the European Union could achieve net-zero emissions at net-zero cost, December 3, 2020 Report.

More recently, the Lisbon Treaty of 2007 introduced a new objective for EU environmental policy: the "promotion, at an international level, of measures to address regional or global environmental issues, particularly the fight against climate change."

As the quotation chosen to start the introduction illustrates, financing the transition requires an overhaul of all the European Union's policies. The European Green Deal can therefore be seen as a turning point in European climate action, insofar as it is based on an integrated approach that includes all European policy sectors and fields of action [Dupont et al., 2024]. Among them is the European Union Emissions Trading System (EU-ETS). Introduced in 2005, this is a greenhouse gas emissions trading scheme designed to reduce pollution.

The primary economic mechanism behind this market is the internalization of costs associated with production. By assigning a "social" value to carbon, the EU aims to encourage private actors to move away from fossil fuels and invest heavily in the development of clean energy. The relatively recent reform (Phase IV, 2021-2028) aims to limit surplus allowances but requires the absence of unanticipated shocks leading to price drops in order to have a significant effect. The EU plans to end free allocation of allowances to the aviation sector in 2026, and to create a second carbon market for road transport and buildings in 2027 [Boungou and Dufau, 2024]. The EU's green deal also introduces the Carbon Border Adjustment Mechanism [European Commission, 2020b] in order to prevent carbon leakage and ensure fair competition for EU companies.

Europe also acts by directly funding environmental projects across all member states. This is primarily done through the LIFE program, its main instrument for the environment and nature conservation. The LIFE program is divided into two pillars: environment and climate action. It is endowed with a budget of €5.4 billion for the period 2021-2027.

However, the environment is increasingly integrated into other areas of the Union's actions : the new Horizon Europe research program, for instance, is partly oriented towards environmental issues. This "greening" logic is also applied to cohesion policy: the European Regional Development Fund (ERDF) thus contributes to the transition to a low-carbon economy. Additionally, a Just Transition Fund (JTF) [European Commission, 2020b] has been established with the new 2021-2027 budget

to mitigate the economic and social consequences of the ecological transition in regions most dependent on fossil fuels.

The economic literature has therefore turned its attention to structural funds, in an attempt to understand whether they can become a tool for financing the transition to a low-carbon economy (Santos et al., 2023 ; Feld and Hassib, 2024). For example, Włodarski and Martyniuk-Peczek [2017] focuses on the allocation of EU Structural Funds in Poland, particularly in relation to air pollution challenges. It examines how Regional Operational Programmes are designed to address energy efficiency in residential buildings, a key factor in air pollution. The paper analyzes the effectiveness of these programmes in combating air pollution, scrutinizing the distribution and utilization of funds across various regions in Poland. The results highlight disparities in fund allocation among regions, especially concerning energy efficiency in residential and public buildings, sustainable transportation, and renewable energy.

In a guide addressed to the Member States [European Commission, 2020a] for the drafting of the national resilience plan the EC insists on highlighting the key objectives[3] to be met by national recovery plans post Covid 19. With regard to the green transition, the Member States must explain : *"How the plan supports actions in full respect of the climate, environmental, social and digital priorities of the Union and the 'do no significant harm principle', and how each plan will concretely achieve the 37% climate mainstreaming target."* In this way, the EU is encouraging member states to increase their investment in this area by making the release of funds conditional on the green use of European funds.

Cohesion policy traditionally focuses on reducing economic disparities between regions by promoting economic development and job creation, while climate policy is centered on mitigating climate change and transitioning towards a low-carbon economy. These two objectives can conflict when cohesion funds are allocated to projects that increase greenhouse gas emissions or support fossil fuel-dependent regions, which directly counteract the EU's climate neutrality goals. For instance, large infrastructure projects, such as transportation and energy, funded by cohesion policy often prioritize short-term economic growth, potentially overlooking sustainability and cli-

[3]Promoting the Union's economic, social and territorial cohesion ; Strengthening economic and social resilience ; Mitigating the social and economic impact of the crisis ; Supporting the green and digital transitions

mate resilience. This misalignment undermines the EU's Green Deal ambitions and hampers the transition to renewable energy sources [Feld and Hassib, 2024].

All the above funding comes from the European Union's own budget. To avoid having to resort to public finance, the EU can rely on the European Investment Bank. Conceived in 1957 to finance growth and employment in the new European European Economic Community, the European Investment Bank is set to become a major player in Europe's post-COVID-19 recovery (Clifton et al., 2020 ; Howarth and Kavvadia, 2024). As part of the European Green Deal, the European Union's financial institution is in the process of transforming itself into a climate bank.

This transformation can be analyzed through the lens of the principal-agent model [Kavvadia, 2021a] suggesting that this "metamorphosis" represents a paradigm shift in the institutional behavior of the EIB. Traditionally viewed as a technocratic entity following policies set by its principals (the EU Member States and the European Commission), the EIB now appears to be taking on a more active, even proactive, role in policy-making (Liebe and Howarth, 2020 ; Clifton et al., 2014b), particularly in the area of climate finance. But the dual framing of the EIB as both a development bank (through EIB Global) and a climate bank may lead to conflicts in priorities, as these mandates do not always align. The EIB's attempt to cater to both the development and climate agendas could stretch its resources and focus, potentially undermining its effectiveness in either domain [Erforth and Keijzer, 2024].

In addition to this direct financing of ecological transition through European financial instruments, the EU also wants to use monetary policy to support these investments [European Central Bank, 2022b]. The ECB will take climate change into account in its corporate bond purchases, collateral arrangements, reporting requirements and risk management, in line with its climate action program. Climate change and its environmental damages are indeed likely to have direct consequences on price stability due to their impact on food and energy prices [IPCC, 2018]. The term "heatflation" (a contraction of the words "heat" and "inflation" in English) was first used by the American magazine specializing in environmental issues, Grist. It is defined as inflation that can be directly attributed to global warming. The ultimate goal of monetary policy is to keep inflation at a low level (around 2% for the ECB).

There is increasing pressure on central banks to act as the "climate rescuers of last resort" [Bolton et al., 2020]. The role of monetary policy in the fight against climate

change can therefore be summed up in two objectives: i) financing the transition to a low-carbon economy (Dafermos et al., 2017, Campiglio, 2016), ii) integrating physical and transitional risks into the conduct of monetary policy via macro- and micro-prudential supervision (Matikainen et al., 2017, Boneva et al., 2022).

The integration into banking supervision appears to have had a positive effect on bank behavior, particularly in managing climate-related risks. Beyer and Schreiner [2024] examines how the ECB's climate-risk supervision influences banks' actions. Using a difference-in-difference approach, the study finds that banks under ECB supervision have improved their management of climate-related risks and increased their involvement in green finance activities, such as issuing green bonds and providing sustainable loans. The results suggest that ECB supervision is contributing to changes in the banking sector related to sustainability. However, the authors note the need for enhanced environmental data and additional regulatory measures to ensure effective long-term outcomes in sustainable finance.

However, the EU needs to pay particular attention to the transition of non-eurozone EU member states. Indeed, the central banks of these countries seem more reluctant to finance the transition directly, preferring to confine themselves to the main objectives of a central bank [Vollmer, 2024].

Finally, the EU is using a wide range of instruments and mechanisms to support its transition to climate neutrality. These tools aim to integrate climate action in different sectors, provide financial support to regions and workers affected by the transition, modernize energy systems, promote research and innovation in green technologies and stimulate private investment in sustainable projects.

This thesis is a contribution to the literature that seeks to evaluate the climate action of European players. It examines the way in which the European Union has taken up the issue of climate change over time.

I investigate the climate actions of three major EU players in this transition : The European Investment Bank in **chapter 1**, The Structural Funds in **chapter 2** and the European Central Bank in **chapter 3**.

Thesis contribution and main results

The first contribution of this thesis is that it assesses the contribution to the climate neutrality of European policies and instruments whose initial objective (as defined in the official treaties) is not to combat climate change but are set to play a key role in financing a carbon-neutral European economy. The second original feature of this thesis is the use of textual analysis to identify climate projects or speeches. Indeed, given that the primary objective of these different actors is not to combat climate change, the literature has shown little interest in studying them from a climate perspective. Moreover, even these institutions do not necessarily provide data and information on their climate actions (at the time of data collection for this thesis). Table 1 summarizes the actors studied in the various chapters, and their contribution to climate action.

Table 1: Overview of actors studied, climate action and period

Chapter	**Actor**	**Action**	**% of green**	**Period**	**Analysis level**
1	European Investment Bank	Loans	30.00 %	1960-2020	UE 27
2	European Structural funds	Grants	14.10%	2007-2020	France
3	European Central Bank	Speeches	5.08 %	1999-2022	Euro area

Chapter 1 – European investment Bank loan appraisal, the EU climate bank ?

The European Investment Bank (EIB) was established in 1957 [European Economic Community, 1957] with the objective of promoting equitable development across the EU by providing loans to less developed regions and supporting the EU's internal market. In November 2019, the EIB announced its transformation into a "Climate Bank"[4]. Notably, the EIB was the first international financial institution (IFI) to issue a green bond (referred to as a Climate Awareness Bond or CAB) in 2007. Since then, the EIB has maintained its leadership in this sector, raising an estimated EUR 30.8 billion through green bonds by 2020[5].

Previous studies of the EIB focused on its role in financing convergence [Clifton et al., 2018], stimulating investment [Griffith-Jones and Naqvi, 2020] and acting as a development bank [Langan, 2014].

In this chapter, we aim to understand the extent to which the European Investment Bank (EIB) can become the European Union's Climate Bank. To achieve this, we propose a breakdown of its portfolio of loans granted to economic entities within the EU from 1959 to 2020. These entities include private companies, local authorities, consortia of companies, and public-private partnerships. The EIB provides access to the projects it finances by regularly updating its project database[6]. On the other hand, loans granted are classified by activity sector, such as industry, services, transport, etc. This categorization does not allow us to assess the project's impact on the environment. However, each project financed has a brief description. By systematically reading these descriptions, we can assess the project's environmental impact. As the project descriptions are brief (3 to 4 sentences maximum), the use of topic modelling methods [Arseneau and Mitsuhiro, 2023] should be ruled out. We therefore use keyword approaches to identify green projects. Specifically, we use the keywords contained in a typology of pro-climate activities defined by the EIB in an internal document in 2015.

[4]The EIB Group Climate Bank Roadmap 2021-2025, November 2020.
[5]10th anniversary of "green bonds" celebrated in Luxembourg, 5/07/2017.
[6]https://www.eib.org/en/projects/all/

The results of this environmental breakdown indicate that the majority of the EIB's green investments are concentrated in the transport and energy sectors, predominantly benefiting the most developed EU countries such as France, Germany, and Italy (2100 of the 4375 green investments during the period 1960-2020). Green investments have significantly increased as a proportion of the EIB's lending portfolio since the 2000s, reaching up to 25% of its portfolio in 2015. The corresponding econometric analysis suggests that EIB green investments are positively correlated with the GDP per capita and environmental expenditure of beneficiary states. Specifically, a 1% increase in GDP per capita is associated with a 3.8% increase in EIB green investments, and a 1% increase in national environmental expenditure is associated with a 0.5% increase in EIB green investment in the recipient country, indicating that public investment in this area has a leverage effect. Furthermore, we develop a logit model to estimate the probability of obtaining a green project. Our findings demonstrate that the probability of obtaining a green loan from the EIB increases with the country's level of development (measured by GDP per capita).

Chapter 2 – The Political Economy of Green Transition: Evidence from EU Allocation to French Municipalities

The European Structural and Investment Funds are the European Union's five funds designed to enable member states to show solidarity while remaining competitive in the global economy. Although the initial mandate was "to achieve greater economic and social cohesion by reducing disparities between the levels of development of various regions"[7], several key elements have integrated environmental considerations into the EU Cohesion Policy. Specifically, the most developed regions were required to allocate 20% of the ERDF to projects promoting a low-carbon economy. This minimum share decreases to 15% for regions in transition and 12% for the least developed regions[8]. For the 2007-2020 period, we are focusing on two funds from which France has benefited: the European Regional Development Fund (ERDF) and the European Social Fund Plus (ESF+). The majority of empirical studies devoted to structural funds focus on the effects on economic convergence and social cohesion across regions i.e. their main objectives [Pellegrini et al., 2013, Le Gallo et al., 2011, Mohl and Hagen, 2010, Becker et al., 2010].

[7]See Treaty on the Functioning of the European Union, Consolidated Version, Article 174
[8]See Official Journal of the European Union L 231 30/06/2021

The objective of the current study is to address the existing gap in the literature by investigating the political and financial factors driving the utilization of European structural funds towards green initiatives by French municipalities. For this purpose, we have developed a novel database comprising projects located in French cities with a population of over 10,000 inhabitants, which were financed under the European Regional Development Fund (ERDF) and the European Social Fund (ESF) between 2007 and 2020. We use the project theme associated with each funded project. As with EIB projects, the Structural Funds database does not distinguish between projects according to their environmental impact. In addition, project descriptions are again very brief. On the other hand, each project is associated with a theme (soft mobility, public transport, regional redevelopment, etc.).

Using an iterative approach, we classified each of these themes by environmental impact. To date, the literature has focused on the total amounts received by European regions or municipalities (Bouvet and Dall'Erba, 2010 ; Veiga, 2012). By disaggregating the nature of the projects financed, we can provide a more detailed analysis and identify the types of projects financed in French communes.

We aim to investigate the factors driving the substantial heterogeneity in the distribution of green funds across French municipalities, taking into account economic, financial, and political variables. Our findings indicate that the financial situation and political orientation of municipalities significantly influence the allocation of green funds. Specifically, variables such as debt per capita, self-financing capacity, and funding provided by the state positively affect the utilization of green funds by municipalities, emphasizing the role of local public debt and government support in addressing environmental concerns. Moreover, when we consider political orientation, we find that political contestability (measured by the inverse of the electoral margin) significantly increases the probability of a municipality funding a green project. We use the number of appeals submitted by municipal opposition in French public courts as an instrumental variable. Our results highlight how green-leaning voters and political contestability drive the acceleration of the green transition.

Chapter 3 – ECB's Climate Speeches and Market Reactions

The European Central Bank (ECB) is the European Union's principal monetary institution since 1999. The ECB's primary objective is to maintain price stability and annual inflation "below, but close to, 2% over the medium term". On July 4, 2022, the European Central Bank (ECB) announced[9] its decision to integrate environmental criteria into its asset purchase policy (Quantitative Easing or QE). The incorporation of these environmental criteria into monetary policy marks a significant departure from the ECB's traditional approach of sectoral "neutrality" and sends a strong signal to all financial markets. The analysis of central bank communication on climate change and its impact on financial market is a recent burgeoning field of literature. [Arseneau et al., 2022, Deyris, 2023, Neszveda and Siket, 2023, Arseneau and Mitsuhiro, 2023]. However, no prior studies have explored the macroeconomic impact of the ECB's climate-related speeches at the Eurozone level, nor have they performed comprehensive sentiment analysis and topic modeling to assess how the ECB addresses these issues.

This chapter aims to study the reaction of major European stock markets following the ECB's speeches on global warming. We identify the ECB's speeches that address climate change and examine the differentiated effects of these speeches on European financial markets. To identify climate-related speeches delivered by the ECB, we employ a keyword-based approach along with topic modeling techniques to detect narratives characterized by distinct lexicons. To assess the impact of these climate-related speeches on European financial markets using an event study, we will use a diverse array of stock indices that reflect a wide range of market segments.

Our findings demonstrate that the European Central Bank (ECB) has increasingly addressed climate change in its communications since 2015, the year the Paris Agreement was signed. The textual analysis, utilizing topic modeling, reveals that the ECB explores various facets of climate change, including climate risks and the future of monetary policy in this context. We classify climate-related speeches into two primary categories: (i) those aimed at encouraging stakeholders to incorporate forthcoming public policy changes and consider their implications, and (ii) those intended to inform stakeholders about the current economic landscape concerning risks (both physical and transition) and opportunities associated with climate change.

[9]ECB takes further steps to incorporate climate change into its monetary policy operations, Press Release, July 4, 2022.

The event study we conducted seeks to identify market reactions to ECB climate-related speeches, with a particular focus on green stock market indices. We observed abnormal returns in these indices during the post-speech event window, indicating a market shift towards green portfolios, with sustained effects extending beyond the immediate post-event period. Overall, all climate-related speeches lead to positive cumulative abnormal returns (CARs), reflecting a general market preference for green assets following the ECB's communication. Speeches that focus on green finance and policies—addressing specific financial instruments and sustainability-supporting measures—result in significant increases in CARs, suggesting that investors respond favorably to these targeted messages. In contrast, speeches centered on climate risks generate more moderate CARs.

Introduction générale

> *"Toutes les actions et politiques de l'UE devront contribuer à la réalisation des objectifs du Pacte vert européen."*
>
> *Communication de la Commission,*
> *Le pacte vert européenl, 11/12/2019*

L'action climatique de l'UE, tour d'horizon

Selon l'European Environment Agency [2023], l'Union Européenne a émis environ 3,138 milliards de tonnes de gaz à effet de serre (GES, en équivalent CO2) en 2022. Cela fait de l'Union européenne le 4e plus grand pollueur au monde, derrière la Chine, les États-Unis et l'Inde. Les émissions de gaz à effet de serre ne posent pas de problème en soi ; c'est le processus d'accumulation des GES dans l'atmosphère, via l'effet de serre, qui provoque le changement climatique. L'effet de serre se produit lorsque les radiations lumineuses du soleil atteignent la surface de la Terre. Une partie de cette radiation est réfléchie vers l'espace, mais une autre partie reste dans l'atmosphère, entraînant ainsi son réchauffement. L'effet de serre est un processus naturel généré par la vapeur d'eau. Au-delà de ce processus naturel, l'activité humaine semble jouer un rôle significatif dans la tendance à la hausse des températures. En effet, la température moyenne a augmenté de 0,7°C au cours des 120 dernières années, dont 0,5°C depuis 1970. Il existe désormais un consensus sur le rôle de l'activité humaine dans la tendance à la hausse des émissions de GES [IPCC, 2018].

Les événements météorologiques extrêmes tels que les inondations, les sécheresses et les vagues de chaleur ont causé des pertes économiques d'environ 453 milliards d'euros entre 1980 et 2017 [European Environment Agency, 2017]. Ces pertes sont dues à la dégradation du capital physique et à la paralysie de l'activité économique causée par un événement météorologique extrême. Selon la société allemande de réassurance Munich RE[10], l'année 2011 a été l'année la plus coûteuse en termes de pertes économiques, avec plus de 120 milliards d'euros de dommages. Le rapport Stern [Stern Review, 2006] a indiqué que la lutte contre le changement climatique représenterait 1% du PIB mondial, tandis que l'inaction pourrait coûter entre 5% et 20% du PIB mondial.

Le rapport de 2017 de l'Agence Européenne de L'environnement [European Environment Agency, 2017] souligne que l'Europe subit des impacts significatifs du changement climatique, avec une augmentation des températures de 1,5°C par rapport aux niveaux préindustriels au cours de la dernière décennie, et de manière encore plus marquée dans la région arctique. Les coûts économiques du changement climatique devraient être considérables, atteignant potentiellement 120 milliards d'euros par an d'ici 2100 rien qu'en Europe du Sud. Le rapport appelle à des efforts mondiaux urgents d'atténuation pour limiter la hausse des températures et insiste sur l'importance des stratégies d'adaptation régionales, notamment une meilleure cohérence des politiques et une gestion adaptative pour faire face aux impacts divers et croissants du changement climatique à travers l'Europe.

Selon Eurostat [2020], les trois quarts des émissions de gaz à effet de serre en Europe sont dus à la combustion de combustibles. Cela inclut la production d'électricité, de chaleur et d'autres combustibles dérivés, le transport de marchandises et de personnes, l'électricité et la chaleur utilisées par les ménages, les entreprises et les institutions pour produire des biens ou construire des bâtiments et des infrastructures.

Plusieurs acteurs sont donc en besoin de financement. Les ménages ont besoin de financements pour changer leurs pratiques de consommation d'énergie et de transport [Schueftan et al., 2021], par exemple en adoptant des appareils écoénergétiques et des véhicules électriques. L'industrie a besoin de financements considérables [Karltorp and Maltais, 2024] pour décarboner la production industrielle en mettant en place des technologies et des processus plus propres. Les agriculteurs nécessitent un soutien

[10]Les catastrophes naturelles ont atteint un coût record en 2011, Les Echos, 05/01/20212

financier pour produire avec moins d'intrants polluants, en adoptant des pratiques agricoles durables qui réduisent les émissions et améliorent la santé des sols [Havemann et al., 2022]. Le secteur des services a besoin d'investissements pour réduire les effets néfastes du stockage massif de données, en se concentrant sur des centres de données écoénergétiques et des solutions informatiques durables. Selon un rapport de McKinsey[11], atteindre la neutralité carbone d'ici 2050 nécessitera que l'UE investisse 28 trillions d'euros dans des technologies propres au cours des 30 prochaines années. Sur ce montant, 23 trillions d'euros seraient réaffectés des activités basées sur le carbone vers des activités non-carbonées, laissant un déficit de financement de 5 trillions d'euros d'ici 2050.

La pression citoyenne et la signature d'accords internationaux (Accord de Paris, 2015) ont conduit l'UE à l'ambition de devenir le *premier continent neutre en carbone* d'ici 2050 [European Commission, 2020b], comme prévu dans le Pacte vert pour l'Europe. Dans le *Baromètre spécial 2023 sur le changement climatique* [European Commission, 2023], 56% des personnes interrogées estiment qu'il appartient à l'Union européenne d'agir contre le changement climatique. Les citoyens européens placent les gouvernements nationaux et l'Union européenne sur un pied d'égalité dans la lutte contre le changement climatique. De plus, plusieurs économistes ont appelé l'Union européenne à prendre des mesures directes par la création de divers mécanismes et instruments : une réforme du Pacte de stabilité et de croissance qui permettrait aux États membres de dépasser le déficit annuel de 3% pour financer des investissements bas carbone [Fitoussi et al., 2007], ou l'achat d'actifs verts par la BCE [Espagne and Aglietta, 2016].

Les préoccupations environnementales sont depuis longtemps au centre des priorités de l'Union européenne. À mesure que la dégradation de l'environnement s'est aggravée et que la sensibilisation à ses impacts a augmenté, l'UE a progressivement élargi son autorité dans ce domaine. Dans ce contexte, la directive Oiseaux de 1979 (Directive 79/409/CEE), visant à la conservation des oiseaux sauvages, est souvent considérée comme un élément fondateur de la politique environnementale européenne. Plus formellement, l'Acte unique européen de 1986 a dotée l'UE de compétences spécifiques en matière de politique environnementale. Ce domaine politique est ensuite devenu soumis à la procédure de codécision (désormais appelée

[11] How the European Union could achieve net-zero emissions at net-zero cost, December 3, 2020 Report.

procédure législative ordinaire) avec le traité de Maastricht de 1992. Un autre traité fondateur fut le traité d'Amsterdam de 1997, qui a formellement reconnu le principe du développement durable — défini comme « un développement qui répond aux besoins du présent sans compromettre la capacité des générations futures à répondre à leurs propres besoins », tel que formulé dans le rapport Brundtland de 1987 et précisé lors du Sommet de la Terre de Rio en 1992. Plus récemment, le traité de Lisbonne de 2007 a introduit un nouvel objectif pour la politique environnementale de l'UE : la « promotion, au niveau international, de mesures visant à traiter les problèmes environnementaux régionaux ou mondiaux, en particulier la lutte contre le changement climatique ».

Comme l'illustre la citation choisie pour débuter l'introduction, le financement de la transition nécessite une refonte de l'ensemble des politiques de l'Union européenne. Le Pacte vert pour l'Europe peut donc être considéré comme un tournant dans l'action climatique européenne, dans la mesure où il repose sur une approche qui inclut tous les secteurs et domaines d'action de la politique européenne [Dupont et al., 2024]. Parmi eux figure le système d'échange de quotas d'émission de l'Union européenne (EU-ETS). Introduit en 2005, il s'agit d'un système d'échange de quotas d'émissions de gaz à effet de serre conçu pour réduire la pollution.

Le principal mécanisme économique derrière ce marché est l'internalisation des coûts associés à la production. En attribuant une valeur "sociale" au carbone, l'UE vise à encourager les acteurs privés à s'éloigner des combustibles fossiles et à investir massivement dans le développement des énergies propres. La réforme relativement récente (Phase IV, 2021-2028) vise à limiter les excédents de quotas, mais elle nécessite l'absence de chocs inattendus entraînant des baisses de prix pour avoir un effet significatif. L'UE prévoit de mettre fin à l'allocation gratuite de quotas au secteur de l'aviation en 2026 et de créer un deuxième marché du carbone pour le transport routier et les bâtiments en 2027 [Boungou and Dufau, 2024]. Le pacte vert de l'UE introduit également le mécanisme d'ajustement carbone aux frontières [European Commission, 2020b] afin de prévenir les fuites de carbone et d'assurer une concurrence équitable pour les entreprises de l'UE.

L'Europe agit également en finançant directement des projets environnementaux dans tous les États membres. Cela se fait principalement par le biais du programme LIFE, son principal instrument pour l'environnement et la conservation de la nature. Le programme LIFE est divisé en deux piliers : l'environnement et l'action

pour le climat. Il est doté d'un budget de 5,4 milliards d'euros pour la période 2021-2027. Cependant, l'environnement est de plus en plus intégré dans d'autres domaines d'action de l'Union : le nouveau programme de recherche Horizon Europe, par exemple, est en partie orienté vers les questions environnementales. Cette logique de "verdissement" s'applique également à la politique de cohésion : le Fonds européen de développement régional (FEDER) contribue ainsi à la transition vers une économie à faible émission de carbone. De plus, un Fonds pour une transition juste (FTJ) [European Commission, 2020b] a été créé avec le nouveau budget 2021-2027 afin d'atténuer les conséquences économiques et sociales de la transition écologique dans les régions les plus dépendantes des combustibles fossiles. La littérature économique s'est donc tournée vers les fonds structurels, dans le but de comprendre s'ils peuvent devenir un outil de financement de la transition vers une économie à faible émission de carbone (Santos et al., 2023 ; Feld and Hassib, 2024).

Par exemple, Włodarski and Martyniuk-Peczek [2017] se concentre sur l'allocation des Fonds structurels de l'UE en Pologne, en particulier en lien avec les défis de la pollution de l'air. L'étude examine comment les Programmes opérationnels régionaux sont conçus pour répondre à l'efficacité énergétique dans les bâtiments résidentiels, un facteur clé de la pollution de l'air. L'article analyse l'efficacité de ces programmes dans la lutte contre la pollution atmosphérique, en examinant la répartition et l'utilisation des fonds dans diverses régions de Pologne. Les résultats mettent en évidence des disparités dans l'allocation des fonds entre les régions, notamment en ce qui concerne l'efficacité énergétique dans les bâtiments résidentiels et publics, les transports durables et les énergies renouvelables.

Dans un guide adressé aux États membres [European Commission, 2020a] pour la rédaction du plan national de résilience, la Commission européenne insiste sur l'importance de mettre en avant les objectifs clés[12] à atteindre par les plans nationaux de relance post-Covid-19. En ce qui concerne la transition verte, les États membres doivent expliquer : *"Comment le plan soutient des actions dans le plein respect des priorités climatiques, environnementales, sociales et numériques de l'Union et du principe de 'ne pas causer de dommages significatifs', et comment chaque plan atteindra concrètement l'objectif de 37% de contribution au climat."* De cette manière, l'UE encourage les États membres à accroître leurs investissements dans ce domaine

[12]Promouvoir la cohésion économique, sociale et territoriale de l'Union ; Renforcer la résilience économique et sociale ; Atténuer l'impact social et économique de la crise ; Soutenir les transitions verte et numérique

en conditionnant le déblocage des fonds à une utilisation verte des fonds européens.

La politique de cohésion se concentre traditionnellement sur la réduction des disparités économiques entre les régions en promouvant le développement économique et la création d'emplois, tandis que la politique climatique est centrée sur l'atténuation du changement climatique et la transition vers une économie à faible émission de carbone. Ces deux objectifs peuvent entrer en conflit lorsque les fonds de cohésion sont alloués à des projets qui augmentent les émissions de gaz à effet de serre ou soutiennent des régions dépendantes des combustibles fossiles, ce qui va à l'encontre des objectifs de neutralité climatique de l'UE. Par exemple, les grands projets d'infrastructure, tels que les transports et l'énergie, financés par la politique de cohésion, privilégient souvent la croissance économique à court terme, au détriment parfois de la durabilité et de la résilience climatique. Ce manque d'alignement compromet les ambitions du Pacte vert de l'UE et freine la transition vers des sources d'énergie renouvelables [Feld and Hassib, 2024].

Tous les financements mentionnés ci-dessus proviennent du budget propre de l'Union européenne. Afin d'éviter de recourir aux finances publiques, l'UE peut compter sur la Banque européenne d'investissement. Conçue en 1957 pour financer la croissance et l'emploi dans la nouvelle Communauté économique européenne, la Banque européenne d'investissement est en passe de devenir un acteur majeur de la relance post-COVID-19 en Europe (Clifton et al., 2020 ; Howarth and Kavvadia, 2024). Dans le cadre du Pacte vert pour l'Europe, l'institution financière de l'Union européenne est en train de se transformer en une banque climatique.

Cette transformation peut être analysée à travers le prisme du modèle principal-agent [Kavvadia, 2021a], suggérant que cette "métamorphose" représente un changement de paradigme dans le comportement institutionnel de la BEI. Traditionnellement considérée comme une entité technocratique suivant les politiques définies par ses principaux (les États membres de l'UE et la Commission européenne), la BEI semble désormais jouer un rôle plus actif, voire proactif, dans l'élaboration des politiques (Liebe and Howarth, 2020 ; Clifton et al., 2014b), notamment dans le domaine du financement climatique. Cependant, la double mission de la BEI en tant que banque de développement (via la BEI Global) et banque climatique peut entraîner des conflits de priorités, ces mandats n'étant pas toujours alignés. La tentative de la BEI de répondre à la fois aux agendas de développement et climatique pourrait diluer ses ressources et son attention, risquant de compromettre son efficacité dans l'un ou

l'autre domaine [Erforth and Keijzer, 2024].

En plus de ce financement direct de la transition écologique via des instruments financiers européens, l'UE souhaite également utiliser la politique monétaire pour soutenir ces investissements [European Central Bank, 2022b]. La BCE prendra en compte le changement climatique dans ses achats d'obligations d'entreprises, ses accords de garantie, ses exigences de reporting et sa gestion des risques, conformément à son programme d'action climatique. Le changement climatique et ses dommages environnementaux sont en effet susceptibles d'avoir des conséquences directes sur la stabilité des prix en raison de leur impact sur les prix des denrées alimentaires et de l'énergie [IPCC, 2018]. Le terme "heatflation" (une contraction des mots "chaleur" et "inflation" en anglais) a été utilisé pour la première fois par le magazine américain spécialisé dans les questions environnementales, Grist. Il est défini comme une inflation directement attribuable au réchauffement climatique. L'objectif ultime de la politique monétaire est de maintenir l'inflation à un niveau bas (environ 2% pour la BCE).

Les banques centrales sont de plus en plus sous pression pour agir en tant que "sauveurs climatique de dernier recours" [Bolton et al., 2020]. Le rôle de la politique monétaire dans la lutte contre le changement climatique peut donc être résumé en deux objectifs : i) financer la transition vers une économie à faible émission de carbone (Dafermos et al., 2017, Campiglio, 2016), ii) intégrer les risques physiques et de transition dans la conduite de la politique monétaire via la supervision macro- et micro-prudentielle (Matikainen et al., 2017, Boneva et al., 2022).

L'intégration dans la supervision bancaire semble avoir eu un effet positif sur le comportement des banques, en particulier dans la gestion des risques liés au climat. Beyer and Schreiner [2024] examine comment la supervision des risques climatiques par la BCE influence les actions des banques. En utilisant une approche de différence en différences, l'étude constate que les banques sous supervision de la BCE ont amélioré leur gestion des risques climatiques et ont accru leur implication dans les activités de finance verte, telles que l'émission d'obligations vertes et l'octroi de prêts durables. Les résultats suggèrent que la supervision de la BCE contribue aux changements dans le secteur bancaire en matière de durabilité. Cependant, les auteurs soulignent la nécessité d'améliorer les données environnementales et de prendre des mesures réglementaires supplémentaires pour garantir des résultats efficaces à long terme dans la finance durable.

Cependant, l'UE doit accorder une attention particulière à la transition des États membres de l'UE qui ne font pas partie de la zone euro. En effet, les banques centrales de ces pays semblent plus réticentes à financer directement la transition, préférant se cantonner aux principaux objectifs d'une banque centrale [Vollmer, 2024].

Finalement, l'UE utilise une large gamme d'instruments et de mécanismes pour soutenir sa transition vers la neutralité climatique. Ces outils visent à intégrer l'action climatique dans différents secteurs, à fournir un soutien financier aux régions et aux travailleurs affectés par la transition, à moderniser les systèmes énergétiques, à promouvoir la recherche et l'innovation dans les technologies vertes et à stimuler l'investissement privé dans des projets durables.

Cette thèse est une contribution à la littérature qui cherche à évaluer l'action climatique des acteurs européens. Elle examine la manière dont l'Union européenne s'est progressivement emparée de la question du changement climatique.

J'examine les actions climatiques de trois grands acteurs de l'UE dans cette transition: La Banque européenne d'investissement dans **le chapitre 1**, Les Fonds structurels dans **le chapitre 2** et la Banque centrale européenne dans **le chapitre 3**.

Contribution de la thèse et principaux résultats

La première contribution de cette thèse est d'évaluer la contribution à la neutralité climatique des politiques et instruments européens dont l'objectif initial (tel que défini dans les traités officiels) n'est pas de lutter contre le changement climatique, mais qui sont amenés à jouer un rôle clé dans le financement d'une économie européenne neutre en carbone. La deuxième originalité de cette thèse réside dans l'utilisation de l'analyse textuelle pour identifier les projets ou discours liés au climat. En effet, étant donné que l'objectif principal de ces différents acteurs n'est pas de lutter contre le changement climatique, la littérature s'est peu intéressée à les étudier sous cet angle. De plus, même ces institutions ne fournissent pas nécessairement de données ou d'informations sur leurs actions climatiques (au moment de la collecte des données pour cette thèse). Le tableau 2 résume les acteurs étudiés dans les différents chapitres, ainsi que leur contribution à l'action climatique.

Table 2: Vue d'ensemble des acteurs étudiés, actions climatiques et période

Chapitre	Acteur	Action	% de vert	Période	Niveau d'analyse
1	Banque européenne d'investissement	Prêts	30,00 %	1960-2020	UE 27
2	Fonds structurels européens	Subventions	14,10 %	2007-2020	France
3	Banque centrale européenne	Discours	5,08 %	1999-2022	Zone euro

Chapitre 1 – European investment Bank loan appraisal, the EU climate bank ?

La Banque européenne d'investissement (BEI) a été créée en 1957 [European Economic Community, 1957] avec pour objectif de promouvoir un développement équitable à travers l'UE en accordant des prêts aux régions les moins développées et en soutenant le marché intérieur de l'UE. En novembre 2019, la BEI a annoncé sa transformation en "Banque climatique"[13]. Notamment, la BEI a été la première institution financière internationale (IFI) à émettre une obligation verte (appelée Climate Awareness Bond ou CAB) en 2007. Depuis lors, la BEI a maintenu son leadership dans ce secteur, levant environ 30,8 milliards d'euros par le biais d'obligations vertes d'ici 2020[14].

[13] Feuille de route du Groupe BEI pour la Banque climatique 2021-2025, novembre 2020.
[14] 10e anniversaire des "obligations vertes" célébré à Luxembourg, 5/07/2017.

Les études précédentes sur la BEI se sont concentrées sur son rôle dans le financement de la convergence [Clifton et al., 2018], la stimulation de l'investissement [Griffith-Jones and Naqvi, 2020] et son action en tant que banque de développement [Langan, 2014].

Dans ce chapitre, nous cherchons à comprendre dans quelle mesure la Banque européenne d'investissement (BEI) peut devenir la Banque climatique de l'Union européenne. Pour cela, nous proposons une analyse de son portefeuille de prêts accordés aux entités économiques au sein de l'UE de 1959 à 2020. Ces entités incluent des entreprises privées, des collectivités locales, des consortiums d'entreprises et des partenariats public-privé. La BEI fournit un accès aux projets qu'elle finance en mettant régulièrement à jour sa base de données de projets[15]. D'autre part, les prêts accordés sont classés par secteur d'activité, tels que l'industrie, les services, les transports, etc. Cette catégorisation ne permet pas d'évaluer l'impact environnemental du projet. Cependant, chaque projet financé est accompagné d'une brève description. En lisant systématiquement ces descriptions, nous pouvons évaluer l'impact environnemental du projet. Comme les descriptions de projets sont brèves (3 à 4 phrases maximum), l'utilisation des méthodes de topic modelling [Arseneau and Mitsuhiro, 2023] doit être écartée. Nous utilisons donc des approches basées sur des mots-clés pour identifier les projets verts. Plus précisément, nous utilisons les mots-clés contenus dans une typologie des activités pro-climat définie par la BEI dans un document interne en 2015.

Les résultats de cette répartition environnementale indiquent que la majorité des investissements verts de la BEI sont concentrés dans les secteurs du transport et de l'énergie, bénéficiant principalement aux pays les plus développés de l'UE tels que la France, l'Allemagne et l'Italie (2100 des 4375 investissements verts durant la période 1960-2020). Les investissements verts ont considérablement augmenté en proportion du portefeuille de prêts de la BEI depuis les années 2000, atteignant jusqu'à 25% de son portefeuille en 2015. L'analyse économétrique correspondante suggère que les investissements verts de la BEI sont positivement corrélés avec le PIB par habitant et les dépenses environnementales des États bénéficiaires. Plus précisément, une augmentation de 1% du PIB par habitant est associée à une augmentation de 3,8% des investissements verts de la BEI, et une augmentation de 1% des dépenses environnementales nationales est associée à une augmentation de 0,5% des investissements

[15] https://www.eib.org/en/projects/all/

verts de la BEI dans le pays bénéficiaire, indiquant que l'investissement public dans ce domaine a un effet de levier. De plus, nous développons un modèle logit pour estimer la probabilité d'obtenir un projet vert. Nos résultats montrent que la probabilité d'obtenir un prêt vert de la BEI augmente avec le niveau de développement du pays (mesuré par le PIB par habitant).

Chapitre 2 – The Political Economy of Green Transition: Evidence from EU Allocation to French Municipalities

Les Fonds structurels et d'investissement européens sont les cinq fonds de l'Union européenne conçus pour permettre aux États membres de faire preuve de solidarité tout en restant compétitifs dans l'économie mondiale. Bien que le mandat initial soit "de renforcer la cohésion économique et sociale en réduisant les écarts de développement entre les différentes régions"[16], plusieurs éléments clés ont intégré des considérations environnementales dans la politique de cohésion de l'UE. En particulier, les régions les plus développées étaient tenues d'allouer 20% du FEDER à des projets promouvant une économie à faible émission de carbone. Cette part minimale diminue à 15% pour les régions en transition et à 12% pour les régions les moins développées[17].

Pour la période 2007-2020, nous nous concentrons sur deux fonds dont la France a bénéficié : le Fonds européen de développement régional (FEDER) et le Fonds social européen Plus (FSE+). La majorité des études empiriques consacrées aux fonds structurels portent sur les effets sur la convergence économique et la cohésion sociale entre les régions, c'est-à-dire leurs principaux objectifs [Pellegrini et al., 2013, Le Gallo et al., 2011, Mohl and Hagen, 2010, Becker et al., 2010].

L'objectif de la présente étude est de combler une lacune existante dans la littérature en étudiant les facteurs politiques et financiers qui déterminent l'utilisation des fonds structurels européens pour des initiatives vertes par les municipalités françaises. À cette fin, nous avons développé une base de données innovante comprenant des projets situés dans des villes françaises de plus de 10 000 habitants, financés dans le cadre du Fonds européen de développement régional (FEDER) et du Fonds social européen (FSE) entre 2007 et 2020. Nous utilisons le thème du projet associé à chaque projet financé. Comme pour les projets de la BEI, la base de données des Fonds structurels ne distingue pas les projets selon leur impact environnemental. De plus, les descrip-

[16]Voir le Traité sur le fonctionnement de l'Union européenne, version consolidée, article 174
[17]Voir Journal Officiel de l'Union Européenne L 231 30/06/2021

tions des projets sont à nouveau très brèves. En revanche, chaque projet est associé à un thème (mobilité douce, transport public, réaménagement régional, etc.). En utilisant une approche itérative, nous avons classé chacun de ces thèmes selon leur impact environnemental. À ce jour, la littérature s'est concentrée sur les montants totaux reçus par les régions ou les municipalités européennes (Bouvet and Dall'Erba, 2010 ; Veiga, 2012). En désagrégeant la nature des projets financés, nous pouvons fournir une analyse plus détaillée et identifier les types de projets financés dans les communes françaises.

Nous visons à étudier les facteurs qui expliquent la forte hétérogénéité dans la répartition des fonds verts entre les municipalités françaises, en tenant compte des variables économiques, financières et politiques. Nos résultats indiquent que la situation financière et l'orientation politique des municipalités influencent de manière significative l'allocation des fonds verts. En particulier, des variables telles que la dette par habitant, la capacité d'autofinancement et les subventions de l'État affectent positivement l'utilisation des fonds verts par les municipalités, soulignant le rôle de la dette publique locale et du soutien de l'État dans la lutte contre les enjeux environnementaux. De plus, lorsque nous prenons en compte l'orientation politique, nous constatons que la contestabilité politique (mesurée par l'inverse de la marge électorale) augmente de manière significative la probabilité qu'une municipalité finance un projet vert. Pour tenir compte de cet effet, nous utilisons le nombre de recours déposés par l'opposition municipale dans les tribunaux publics français comme variable instrumentale. Nos résultats mettent en évidence comment les électeurs pro-environnement et la contestabilité politique accélèrent la transition verte.

Chapitre 3 – ECB's Climate Speeches and Market Reactions

La Banque centrale européenne (BCE) est la principale institution monétaire de l'Union européenne depuis 1999. L'objectif principal de la BCE est de maintenir la stabilité des prix et une inflation annuelle "inférieure, mais proche de 2% à moyen terme". Le 4 juillet 2022, la Banque centrale européenne (BCE) a annoncé[18] sa décision d'intégrer des critères environnementaux dans sa politique d'achat d'actifs (Assouplissement Quantitatif ou QE). L'intégration de ces critères environnementaux dans la politique monétaire marque un écart significatif par rapport à l'approche traditionnelle de "neutralité" sectorielle de la BCE et envoie un signal fort à l'ensemble des marchés financiers. L'analyse de la communication des banques centrales sur le changement climatique et de son impact sur les marchés financiers est un domaine de recherche récent en pleine expansion [Arseneau et al., 2022, Deyris, 2023, Neszveda and Siket, 2023, Arseneau and Mitsuhiro, 2023]. Cependant, aucune étude préalable n'a exploré l'impact macroéconomique des discours climatiques de la BCE au niveau de la zone euro, ni effectué une analyse de sentiment et de classifcation thématique approfondies pour évaluer la manière dont la BCE aborde ces enjeux.

Ce chapitre a pour objectif d'étudier la réaction des principaux marchés boursiers européens suite aux discours de la BCE sur le réchauffement climatique. Nous identifions les discours de la BCE qui abordent le changement climatique et examinons les effets différenciés de ces discours sur les marchés financiers européens. Pour identifier les discours liés au climat prononcés par la BCE, nous utilisons une approche basée sur des mots-clés ainsi que des techniques de topic modelling afin de détecter des narratifs caractérisés par des lexiques distincts. Pour évaluer l'impact de ces discours liés au climat sur les marchés financiers européens à l'aide d'une étude d'événements, nous utiliserons un éventail diversifié d'indices boursiers reflétant un large éventail de segments de marché.

Nos résultats montrent que la Banque centrale européenne (BCE) a de plus en plus abordé le changement climatique dans ses communications depuis 2015, année de la signature de l'Accord de Paris. L'analyse textuelle, utilisant du topic modelling, révèle que la BCE explore divers aspects du changement climatique, y compris les risques climatiques et l'avenir de la politique monétaire dans ce contexte. Nous classons les discours liés au climat en deux catégories principales : (i) ceux visant

[18] La BCE prend de nouvelles mesures pour intégrer le changement climatique dans ses opérations de politique monétaire, Communiqué de presse, 4 juillet 2022.

à encourager les marchés financiers à intégrer les futurs changements de politiques publiques et à en considérer les implications, et (ii) ceux destinés à informer les marchés financiers sur le paysage économique actuel concernant les risques (physiques et de transition) et les opportunités associés au changement climatique.

L'étude d'événements que nous avons menée cherche à identifier les réactions du marché aux discours de la BCE liés au climat, avec un accent particulier sur les indices boursiers verts. Nous avons observé des rendements anormaux sur ces indices durant la fenêtre d'événements post-discours, indiquant un déplacement du marché vers les portefeuilles verts, avec des effets soutenus au-delà de la période post-événement immédiate. Dans l'ensemble, tous les discours liés au climat conduisent à des rendements anormaux cumulatifs (CAR) positifs, reflétant une préférence générale du marché pour les actifs verts après la communication de la BCE. Les discours axés sur la finance verte et les politiques—abordant des instruments financiers spécifiques et des mesures de soutien à la durabilité—entraînent des augmentations significatives des CAR, suggérant que les investisseurs réagissent favorablement à ces messages ciblés. En revanche, les discours centrés sur les risques climatiques génèrent des CAR plus modérés.

Chapter 1

European Investment Bank loan appraisal, the EU climate bank ?

Summary of the chapter

What are the determining factors in the allocation of European Investment Bank (EIB) green investments? Using data describing more than 17,000 EIB loans to European Union (EU) member states from 1960 to 2020, we first break down EIB loans into green, neutral and brown loans. We then provide evidence that EIB green investments tend to be allocated to the most advanced economies, specifically, that green investment is positively correlated with high GDP per capita and increases with national environmental expenditure. Our findings illustrate the dichotomy between economic development and environmental objectives faced by the EIB[1].

[1]The author is grateful to Amélie Barbier-Gauchard, Thierry Betti, Christophe Godlewski, Samuel Ligonnière, Jamel Saadaoui, Wouter Van der Wielen and Emilien Veron for their helpful comments and suggestions. The author would also like to thank the participants and discussants at the following conferences and workshops: Euroframe, LAGV, Environmental Finance, ERMEES, Augustin Cournot, GDRE.
This Chapter was published in a similar version as Antoine Ebeling, European Investment Bank Loan Appraisal, the EU Climate Bank?, *International Economics*, Volume 172, 2022, Pages 203-216

1.1 Introduction

Climate change is now a matter of consensus among scientists (Oreskes, 2004; IPCC, 2018; Cook et al., 2013). According to a study conducted by McKinsey[2], to achieve carbon neutrality by 2050, the EU would have to invest 28 trillion euros in new clean technologies and techniques over the next 30 years. Twenty-three of the 28 trillion would come from shifting investments from carbon-based to non-carbon activities, leaving a funding requirement of 5 trillion by 2050.

The EIB, the EU's financial arm, announced in November 2019 that it would become a "Climate Bank"[3]. The EIB was the first international financial institution (IFI) to issue a green bond (a Climate Awareness Bond or CAB) in 2007. The EIB has since remained a leader in the field, with an estimated EUR 30.8 billion (compared with EUR 600 million in 2007) raised in the form of green bonds by 2020[4].

This study is at the intersection of several strands of the literature: contributions on the challenges and the role of the EIB in the EU's green transformation (Kavvadia, 2021b; Fayolle, 2020; Griffith-Jones and Carreras, 2020), studies of the macroeconomic determinants of EIB investments in general [Clifton et al., 2018], and of the determinants of green investments (Eyraud and Clements, 2013; Yuan and Gallagher, 2018). However, none of these studies have looked at the EIB's past activity in green investments, how its investments are allocated in the EU, or what the main macroeconomic determinants of these investments are.

The present study of the key drivers of EIB green investments aims to fill this gap in the literature. We use the EIB loan-level database of projects financed in the EU between 1960 and 2020[5]. As the EIB database does not provide information on the environmental friendliness of the projects, the first contribution of this study is to break down EIB loans by type of investment, i.e. green, neutral and brown (*A la* Mielke and Gesine A, 2018; Garrett-Peltier, 2017). The aim of our empirical analysis is to identify the factors that determine how green investments are allocated in the EU.

[2]How the European Union could achieve net-zero emissions at net-zero cost, December 3, 2020 Report.
[3]The EIB Group Climate Bank Roadmap 2021-2025, November 2020.
[4]10th anniversary of "green bonds" celebrated in Luxembourg, 5/07/2017.
[5]The database is accessible at the following link

Our contribution is twofold:
(i) We identify the EIB loans that should enable carbon neutrality to be achieved by 2050 and analyze their sectoral, spatial and temporal distributions (using a keyword approach).

(ii) We study the macroeconomic determinants of EIB green loans (econometric analysis).

The results of this environmental breakdown show that the majority of the EIB's green investments are concentrated in the transport and energy sectors and overwhelmingly benefit the most developed countries in the EU such as France, Germany and Italy (2100 of the 4375 green investments over the period 1960-2020). Green investments have increased significantly as a portion of the EIB's lending portfolio since the 2000s, up to 25% of its portfolio in 2015. The corresponding econometric analysis suggests that EIB green investments are positively correlated with the GDP per capita and environmental expenditure of beneficiary states. A 1% increase in GDP per capita is associated with a 3.8% increase in EIB green investments and a 1% increase in national environmental expenditure is associated with a 0.5% increase in EIB green investment in the recipient country, suggesting that public investment in this area has a leverage effect. We also develop a logit model where the probability of obtaining a green project is estimated. We show that the probability of obtaining a green loan from the EIB increases with the level of development of the country (measured by the GDP/capita).

The remainder of the chapter is organized as follows: Section 1.2 reviews the literature on EIB loan activity and green investments. Section 1.3 is a qualitative analysis of EIB loans by type of investment (green, brown or neutral). Section 1.4 presents a quantitative analysis of the macroeconomic determinants of EIB lending. Section 1.5 concludes and discusses the economic and political implications of the results of sections 1.3 and 1.4.

1.2 Literature review

Our research question is related to two strands of the literature: (i) analyses of EIB loans and their determinants (Licari, 1969; Fayolle, 2018; Willaert et al., 2010; Clifton et al., 2014a; Clifton et al., 2018; Griffith-Jones and Tyson, 2012; Yuan and Gallagher, 2018) and (ii) the definition and determinants of green investments (Eyraud and Clements, 2013; Yuan and Gallagher, 2018).

1.2.1 Overview of EIB activities

The EIB is the EU's financial institution. Its objective is to implement the EU's economic and social policies by issuing bonds on financial markets. These resources are then made available to "project promoters" in the form of loans and guarantees only. Bank financing (through loans and guarantees) is granted to a wide range of economic actors: private companies, local authorities, associations, public/private partnerships. The EIB's shareholders are exclusively EU member states. The EIB's actions are immediately distinguishable from other forms of EU financing (CAP, ERDF, ESF) in that they come in the form of loans to be repaid rather than grants. According to its statues (TEU, Art.3) The EIB must finance relevant economic projects that fit with the EU's objectives and that cannot be financed by private banks or member states (TFEU 2008, Art.309). EIB loans are provided on a non-profit basis, the relatively advantageous interest rates only allowing the EIB "to meet its obligations, to cover its expenses and to constitute a reserve fund" (EEC Treaty, 1957). These characteristics – low interest rates, long-term lending, and project targeting – allow EIB financing to be studied as an EU fund in its own right [Robinson, 2009]. Studies of EIB activities can be classified into four groups. First, those written by the EIB itself (Kaser, 1984; Willaert et al., 2010), highlighting its role in European integration. The role of the EIB in the integration of member states has since been studied by Clifton et al. [2018], who assess the EIB's lending policies in terms of three historical objectives: (i) development, (ii) integration and (iii) investment. They use GDP per capita as a proxy of countries' level of development, the interest rate differential as a proxy for access to capital, and intra-European trade as a proxy for market integration. They find that EIB lending is negatively correlated with GDP per capita, suggesting that the EIB acts as a development bank. Their results also suggest that the EIB plays a major role in the integration of new member states by investing more in new EU candidate states.

The second group consists of studies of the EIB's activities in different sectors (Tuijnman, 2009; Pinder et al., 1995; Clintworth and Boulougouris, 2018; Griffith-Jones and Tyson, 2012). These articles assess the EIB's lending policies in terms of the EU's sectoral policy objectives, to understand whether EIB investments meet EU education, transport, maritime policy, and industrial objectives, respectively. The third field of investigation covers the EIB's activities outside the EU (12% of its total loan volume) and its role in stimulating economic growth in these countries (Langan, 2014; Griffith-Jones and Tyson, 2012; Yuan and Gallagher, 2018). Langan [2014] has studied the EIB's policies in the context of Africa-EU ties development cooperation while Yuan and Gallagher [2018] focus on the EIB's lending in the energy sector of Central and South American countries. The last group of studies consider EIB loans as potential instruments to boost economic growth in Europe. Since the financial crisis of 2007/2008, the EIB has been used as a counter-cyclical financing instrument (Marzinotto, 2011; Griffith-Jones and Naqvi, 2020), and more recently, the EIB has emerged as a financing tool to tackle the environmental and climate crisis (Kavvadia, 2021b ; Fayolle, 2020; Griffith-Jones and Carreras, 2020).

Among the many case studies performed however, the EIB's environmental standards and the environmental impact of the projects it finances have rarely been considered. Wouters and Hachez [2011] have compared the accountability principles applied by the EIB with the practices of other multilateral lending institutions, focusing on environmental, social and human rights issues. They find that for loan recipients within the EU, the EIB's standards are relatively high and aligned with those of other European institutions. In its external actions however, the standards and principles of the EIB are relatively unclear and non-transparent.

A number of internal EIB studies have also looking into environmental issues. These are technical documents that describe how environmental costs are considered when selecting projects to fund [European Investment Bank, 2013b]. In terms of carbon value, the EIB indicates that it estimates the damage as ranging from EUR 40/tonne to EUR 68/tonne. The EIB's climate action strategy has been described in other internal documents (European Investment Bank, 2013a; European Investment Bank, 2015a; European Investment Bank, 2015b; European Investment Bank, 2020), which highlight the economic and environmental benefits of investing massively in climate change adaptation and mitigation measures to create jobs and increase the resilience of economies to resource scarcity and climate shocks.

1.2.2 Green investments: various definitions

To identify green investments in the EIB's loan portfolio, we use the EIB's own green taxonomy (see table 1.1). This taxonomy is based on the principles of the International Development Finance Club, to which the EIB belongs. An economic activity is classified as global warming mitigating if "it promotes efforts to reduce or limit greenhouse gas (GHG) emissions or enhance GHG sequestration".

Table 1.1: Activities classified as climate finance, European Investment Bank (2015)

Category	Sub-Category
1. Renewable Energy	1.1 Electricity Generation
	1.2 Heat Production or other renewable energy application
	1.3 Measures to facilitate integration of renewable energy into grids
2. Lower-carbon and efficient energy generation	2.1 Transmission and distribution systems
	2.2 Power Plants
3. Energy efficiency	3.1 Energy efficiency in industry in existing facilities
	3.2 Energy efficiency improvements in existing buildings
	3.3 Energy efficiency improvements in the utility and public services
	3.4 Vehicle energy efficiency fleet retrofit
	3.5 Energy efficiency in new buildings
	3.6 Energy audits
4. Agriculture, forestry and land-use	4.1 Agriculture
	4.2 Afforestation and reforestation, and biosphere conservation
	4.3 Livestock
	4.4 Bio fuels
5. Non-energy greenhouse gases reductions	5.1 Fugitive emissions
	5.2 Carbon capture and storage
	5.3 Air conditioning and refrigeration
	5.4 Industrial processes
6. Waste and wastewater	6.1 Waste and wastewater
7. Transport	7.1 Urban transport modal change
	7.2 Transport oriented urban development
	7.3 Inter-urban transport
8. Low-carbon technologies	8.1 Products or equipment
	8.2 R&D
9. Cross-cutting issues	9.1 Support to national, regional or local policy
	9.2 Financing instruments
10. Miscellaneous	10.1 Other activities with net greenhouse gas reduction

Source: European Investment Bank [2015a]; Green investments tracking methodology.

There is no consensus on the definition of green investment [Eyraud and Clements, 2013]. Investment is green [Marinoni et al., 2009] if it aims to protect the environment [Helen, 2019]. However, green investment has also been described as "investment that allows economic activity to be directed towards low carbon alternatives" [Geddes et al., 2020]. In that sense, green investment encompasses more than energy efficiency and renewable energies [Shen and Malik, 2021]. If pollution is considered an inefficiency of the production process rather than a form of waste [Porter and Van der Linde, 1995], green investment can be defined as any investment that improves the overall production process. Thus, along with investments in energy efficiency and renewable energies, those directed towards recycling and waste management, water sanitation, limiting industrial pollution, protecting biodiversity, and finally those aimed at limiting and adapting to climate change all fall under the green investment umbrella [Shen and Malik, 2021].

Some authors have focused on particular types of green investments, such as photovoltaics for Escoffier et al. [2019], and renewable energies for Eyraud and Clements [2013]. Others have focused on particular sectors of the economy. In their study of the urban infrastructure sector for example, Vandermeulen et al. [2011] model the utility of green investments in infrastructure through the positive effect they have on the quality of life of residents. Green investments in pollution reduction (Miao et al., 2018; Guolei, 2018) and financial innovations to facilitate the funding of low carbon projects have also been studied.

In the framework of the European Green Deal and in order to provide financial markets and policy makers with a single classification scheme, the EU called upon an independent group of experts to develop its own taxonomy [EU Technical Expert Group on Sustainable Finance, 2020]. This taxonomy aims to identify economic activities that contribute to the fight against global warming (mitigation) and economic activities that help societies live with global warming (adaptation), while also identifying those that are harmful to the environment and the climate, so called "brown activities". This taxonomy (2020) is more recent than the EIB's (2015), but both are structured around the same two criteria, namely whether an investment (1) contributes to climate change adaptation or (2) contributes to climate change mitigation.

1.2.3 Main determinants of green investments

Green investment allocation can be driven by economic, political and environmental factors.

Regarding the economic determinants of green investments, economic development is known to increase energy consumption and is therefore expected to accelerate investment in green energy [Eyraud and Clements, 2013]. The environmental Kuznets curve suggests that environmental degradation and economic growth obey an inverted U-shaped relationship (Stern, 2004; Panayotou, 1993; Dai et al., 2016). Economic development is usually proxied in the literature by GDP or GDP per capita (Guanglai et al., 2018; Gadenne et al., 2008). Interest rates are considered to be negatively related to levels of investment because the latter are generally financed by bank borrowing (Taylor, 1999; Eyraud and Clements, 2013). This variable is relevant to our analysis since EIB financing is based on loans with interest.

Political factors are important in the allocation of green investments because these are often conditioned by governments' environmental preferences. Gokul [2015] show that greener policies accelerate the deployment of low-carbon technologies because they make the cost of emissions higher. On the other hand, Baker and Ekundayo [2006] argue that the implementation of higher carbon tax rates reduces the amount of R&D spending by companies in low-carbon technologies because of short-term financial constraints. In this study, countries' level of environmental awareness will be proxied by national environmental protection expenditure.

The objective of green investments is to reduce or mitigate environmental degradation and move towards a low carbon economy [Shahbaz et al., 2013]. Countries with high levels of environmental degradation are therefore expected to engage in remediation measures. Green investments are also expected to depend on demographic factors such as population. Countries facing drastic increases in population have energy supply needs that are not necessarily reflected in GDP figures [Baldacci et al., 2008]. Furthermore, the implementation of environmentally-friendly projects requires high levels of knowledge and technical skills in a country's population [Guerrieri et al., 2010].

1.3 EIB Lending (1960-2020): environmental appraisal

This section provides a qualitative assessment of EIB lending. After a brief description of the database (section 1.3.1), we describe the methodology used to identify green EIB investments in section 1.3.2 before presenting the main results in section 1.3.3

1.3.1 EIB Database

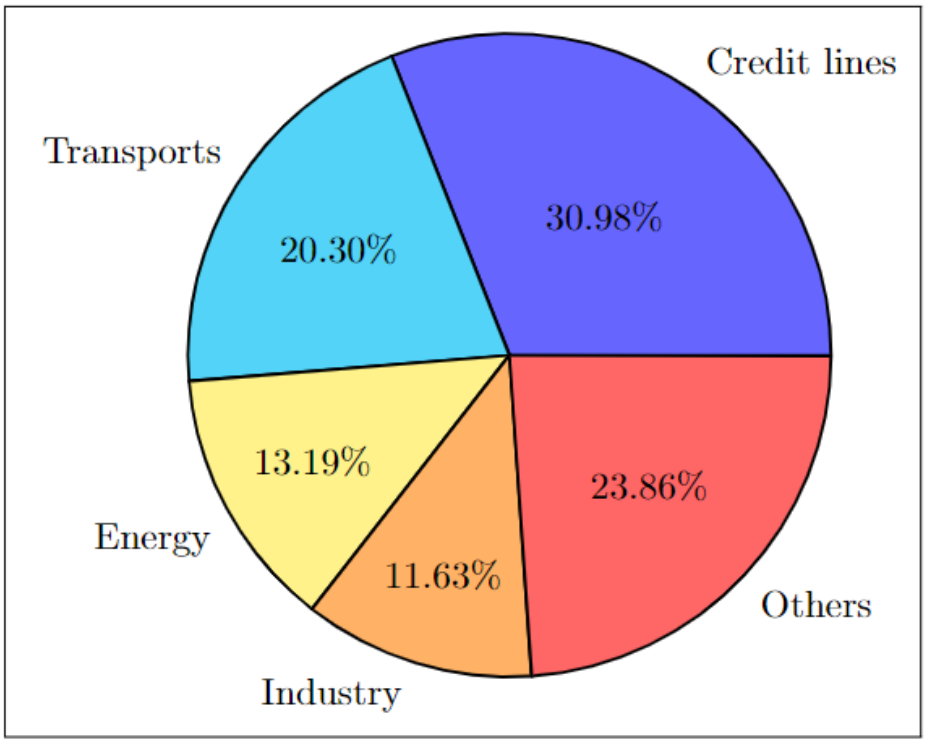
The EIB loan-level database of projects financed by the EIB in the EU from 1960 to 2020 contains records of 17500 projects funded across the 27 EU member states. Various kinds of borrowers (i.e. private companies, local or regional authorities, consortia) are identified and the data on each financed project include its beneficiary, the date of financing, the amount lent, the sector of activity and a brief description of the project. The classification by economic sector[6] in this loan-level database is original and does not correspond to any official classification such as the Statistical Classification of Economic Activities in the European Community (Rev.2,2008), the one used by many other European institutions. Figure 1.1 shows the sectoral breakdown of the EIB's lending portfolio.

The preponderance of transport loans (20% of the total volume of loans granted), can be explained by the establishment of the trans-European transport network, a central element of European transport policy. Although this was already mentioned in the Treaty of Rome (1957), it has only been an area of competence in its own right since the Single Act (1986). The activity of the EIB in transportation has been studied by Pinder et al. [1995] using EU documents and information on more than 700 projects financed by the bank between 1986 and 1992. They show that the EIB's financing coincides poorly with the EU's transportation objectives. They explain this discrepancy as arising from the EIB's mandate and its relative independence from the EU Commission.

The second most funded sector by the EIB is energy (13.19% of the total volume of

[6]The loans granted by the EIB are classified into 13 sectors of the economy: Agriculture, fishing, forestry / Composite infrastructure / Education / Energy / Health / Industry / Lines of credit / Services / Solid waste / Telecommunications / Transportation / Urban Planning / Water, sanitation.

Figure 1.1: Distribution of the EIB lending portfolio (1970-2020)



loans granted). Marty-Gauquie [2004] observed that between 2002 and 2004, renewable energy sources received on the order of 1 billion euros, or 14% of the total loans granted to the energy sector. The EIB invests heavily in European industry (11.63% of the total volume of loans granted) to encourage development and stimulate research. This sector accounts for a quarter of European GDP and more than 30% of the GDP of Ireland, the Czech Republic and Slovakia. Overall therefore, nearly half (45%) of EIB loans are concentrated in three areas: industry, energy and transport, reflecting the weight of these sectors in the EU's economy.

The database used in this study is called "public project repository". In reality, there are underlying[7] data that are not published for legal reasons. The "credit line" sector is an example of the limits of the accessible database. Credit lines are loans signed between a financial intermediary and the EIB. Credit lines projects are new investments or expenditures undertaken by final beneficiaries, carried out over up to three years. They can also include investments in working capital, which should be funded by sub-loans with a minimum 2-year tenor. The EIB provides credit

[7]For works using the full database see Amamou et al. [2020] or Gatti et al. [2022]

lines to financial intermediaries to finance up to 100% of the sub-loan. Agreement from the EIB is required on proposed final beneficiaries based on standard summary project information. The financial intermediary bears the risk on the final beneficiaries. Portfolio performance remains the responsibility of the financial institution and must be reported to the EIB on a regular basis[8]. The following section covers how the green nature of investments was evaluated.

1.3.2 Identification of green EIB investments

EIB investments were evaluated using the eligibility criteria in Table 1.1 [European Investment Bank, 2020] to determine whether they were green, brown and neutral in terms of their environmental friendliness. These criteria were established by the EIB itself (2015) to identify projects to be counted as contributing towards its climate action indicator. The 10 categories can be separated into two groups: (i) climate change mitigation investments, which can be defined as efforts to limit the impact of human societies on the climate; and (ii) climate change adaptation investments, which can be defined as efforts to limit the impact of climate disruption on human societies. From this table, we extracted keywords at the sector level (see table 1.4).

By combining the list of green keywords with the project description we were able to identify the projects that contain one or more of these keywords (see table A.1 and A.2 in the Appendix for a more detailed description of the method). Finally, we categorized the project as green if any of the keywords appeared in the project description.

The methodology for identifying brown investments is relatively similar. However, since there is no brown taxonomy, the list of keywords used does not come from the EIB. For the identification of brown projects, we focused on the most polluting activities in the most polluting sectors, i.e. energy and transport (European Environmental Agency, 2019) in which the EIB has invested. In the transport sector, we have used keywords related to road, sea , and air transport, sectors that are particularly emitting in terms of GHG. In the energy sector, we use keywords related to the collection, distribution, and use of fossil fuels that are particularly emitting in terms of GHG (see table 1.3).

[8]For more information on EIB lines of credit, see: EIB Support to the Financial Sector Lines of Credit to Financial Intermediaries, 11/2017

Table 1.2: List of green keywords

EIB Taxonomy	**Related keywords**
Transport	"rail" ; " railway" ; "tramway" ; "Bus" ; "ferroviaire" ; "metro" ; "public transport" ; "non motorized transport"
Energy	"renewable energy" ; "windfarm" ; "wind turbine" ; "hydropower dam" ; "biomass power" ; "ocean power" ; "solar power"
Energy efficiency	"energy efficiency" ; "energy audits" ; "retrofit"
Agriculture	"afforestation" ; "reforestation" ; "biosphere conservation" ; "carbon pools"; "rehabilitation" ; "fertilizer use reduction" ; "rangeland management"
Waste	"Waste management" ; "methane capture" ; "recycling" ; " waste as inputs"
Non-energy GHG reductions	"coal mine methane capture" ; "storage technology" ; cleaner production"
Education	"climate change research" ; "mitigation resarch"
Cross-cutting issue	"Environmental protection" ; "Climate change" ; "sustainable development" ; " environmental friendly" ; " green economy" ; "national climate plan" ; "Mitigation policies" ; "Climate change adapation" ; "carbon markets"

Table 1.3: List of brown keywords

EIB Taxonomy	**Related keywords**
Transport	"highway" ; "airport" ; "autoroute" ; "motorway" ; "icebreaker" ; "aircraft" ; "parking" ; "automotive" ; "automobile" ; "air transport"
Energy	"gas" ; "oil" ; "coal" ;"Diesel" ; "oil-fired" ; "charbon" ;"fuel" ; "Drilling" ; "refinery"

By combining the list of brown keywords with the project description we were able to identify the projects that contain one or more of these keywords (see table A.3 in the Appendix for a more detailed description of the method). Finally, we categorized the project as brown if any of the keywords appeared in the project description.
The remaining projects (i.e., those that were neither identified as green nor brown) were categorized as "neutral" concerning the environment (see table A.4 in Appendix). These are mostly projects for which we are unable to say if they are green/brown. That doesn't mean they are "neutral" but rather "unidentified"[9].

The results of this environmental breakdown will be presented in terms of three major characteristics: (i) the economic sector of the investment as defined by the EIB, to clarify the EIB's sectoral strategy and identify which sectors have been prioritized in the allocation of green investments, (ii) time, to see if green investments have been trending upwards or downwards in the EIB portfolio, and (iii) geographic distribution, to determine whether green investments are allocated uniformly across the EU.

1.3.2.1 Sectoral breakdown

Using the above described approach, 4374 of the 17750 loans approved by the EIB in the study period (see table 1.4) were identified as green investments. This represents about 25% of all the projects financed by the EIB since 1960 (30% of the total loan amount) and corresponds to the institution's past commitments. A majority of these green investments were made in the transportation, energy and water management sectors.

The predominance of the transportation sector in the EIB's green investment portfolio is a reflection of the importance accorded to establishing a trans-European transport network in EU transport policy. The main focus of these green investments in the transportation sector has been on improving public transport networks in cities and improving railways (see Table A.1 and A.2 in the Appendix for a representative selection of green projects). A small number of loans have also been granted to research and development on new electric car motors. A variety of projects in the energy sector can be labeled as green investments, including the construction of oil pipelines or the transportation of natural gas.

[9]For example: "A loan to finance final beneficiaries within the mid-cap range." Lithuania, 2006 , 5 Millions euros.

Table 1.4: Breakdown of EIB loans by sector

Type of investments			
Sector	**green**	**Neutral**	**Brown**
Agriculture, fishing, forestry	22	70	14
Composite infrastructure	49	135	49
Education	80	415	0
Energy	671	1220	193
Health	58	359	0
Industry	390	1780	417
Lines of credit	1068	3203	978
Services	118	636	31
Solid waste	245	38	0
Telecommunications	24	629	8
Transportation	877	571	1573
Urban planning	190	439	33
Water, sanitation	582	384	0
Total Projects	4374	9464	3712
Total Lending	290 billion euros	325 billion euros	341 billion euros

Reading note: Of the 106 projects in agriculture, fisheries and forestry financed by the EIB, 22 can be considered green according to the EIB taxonomy.

For example, the EIB has financed R&D projects aiming to improve the energy efficiency of gas delivery networks. Regarding renewable energies, the EIB has provided loans for the construction of wind turbines and solar panels. Loans granted to companies to acquire carbon credits from the EU-ETS market as a means to strengthen the EU's climate action are also classified in the energy sector. Under the Kyoto Protocol, some EU member states—mostly those with transitional economies—have surplus carbon quota that can be "greened" and reinvested in mitigation projects. A few development banks are involved in this policy [Tuerk et al., 2010]. The EIB's green investments in the public planning sector focus on the thermal renovation of public and private buildings, in keeping with the EIB's commitment to prioritize the most energy-consuming, high emission and polluting sectors.

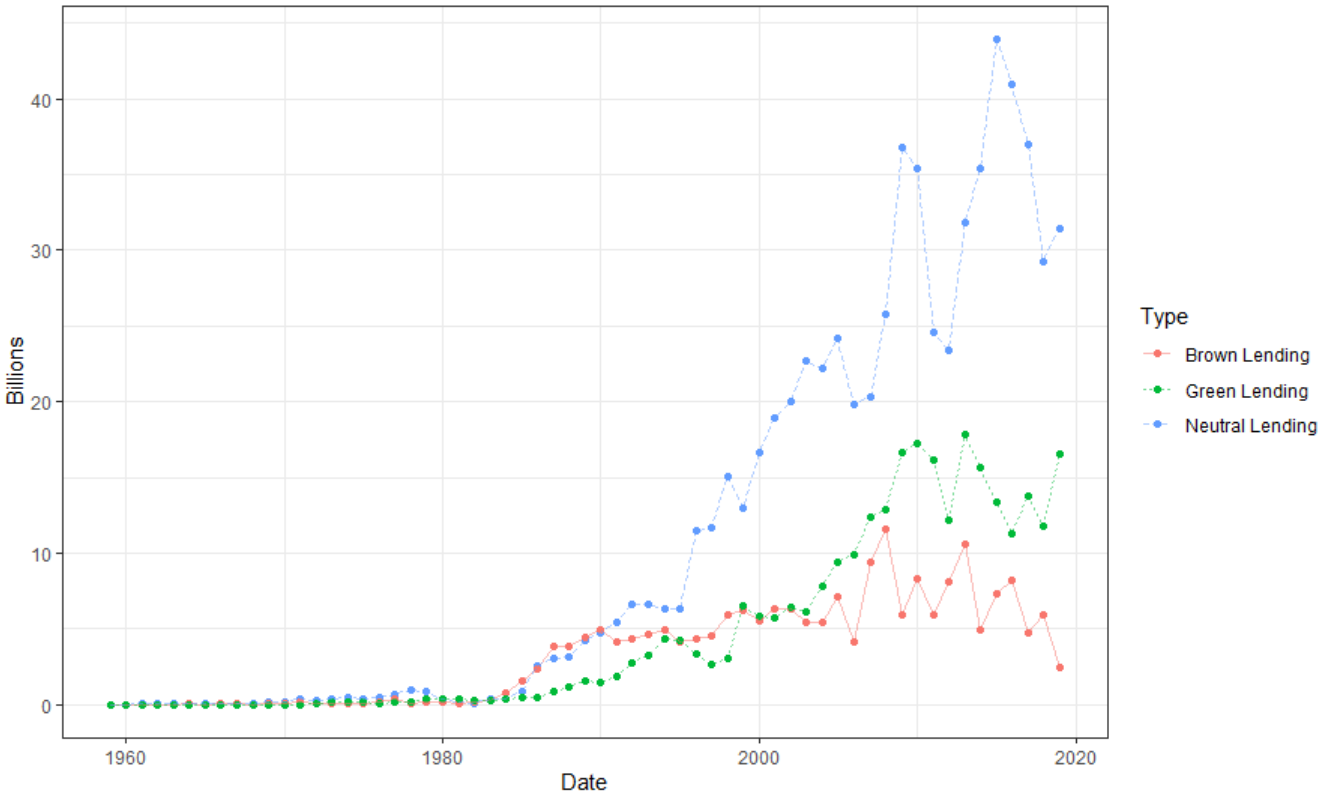
Our methodology classifies 3712 EIB loans as brown investments. These are massively concentrated in the industry, transport and energy sector. They consist in investments in fossil fuel projects, in the improvement of road transport networks or in the expansion of airports[10]. In our approach indeed, a loan that promotes environmentally damaging behavior is classified as brown. By contributing to the improvement of national road networks, the EIB increases the attractiveness of cars over more environmentally friendly modes of transport such as trains and trams. These loans represent around 23% of all EIB intra-EU loans since 1960. Finally, loans classified as neutral with respect to the environment are massively concentrated in the education, health and service sectors.

1.3.2.2 Temporal breakdown

Figure 1.2 shows that the EIB's yearly lending volume has increased significantly since its creation, with a first peak just after the start of the 2007-2008 financial crisis and a second one corresponding to the implementation of the Juncker Plan. Green investments have also been increasing, while investments classified as brown with our approach have tended to decrease. The curves corresponding to green and brown investments cross in the early 2000s. This corresponds to the period in which the EIB officially formalized its environmental strategy at the Goteborg European Council and ratified the EU's sustainable development strategy. Since then, the Bank and other EU bodies have been trying to coordinate their actions in this area. The final decrease in brown investments (2019) corresponds to the end of EIB financing of fossil fuels.

[10]For example, the expansion of Leipzig and Dresden airports, 84 millions euros, Germany, 2002.

Figure 1.2: Evolution of EIB investments in the EU over the period 1970-2020, Author's calculations.



Source: EIB database and Author's calculations.

1.3.2.3 Geographic breakdown

The distribution by member state of EIB green investments (Figure 1.3) is very unequal, with France, Germany, Spain and Italy accounting for around 50% of all green investments (2100 projects out of 4375). This is an interesting result because these countries are not the ones that benefit the most from EIB credits in general. As indicated by [Clifton et al., 2018], the EIB's development objectives encourage it to prioritize investments in less developed economies, to promote economic convergence within the EU. This result can be explained by the increase in environmental awareness suggested by the environmental Kuznets curve above a certain level of economic development. Moreover, the economies that benefit the least from the EIB's green investments are also those (e.g. Poland) that are the furthest behind on energy transition. These are the countries that have little incentive to transition to a greener economy, particularly considering the loss of jobs that would result [Brauers and Pao-Yu, 2020].

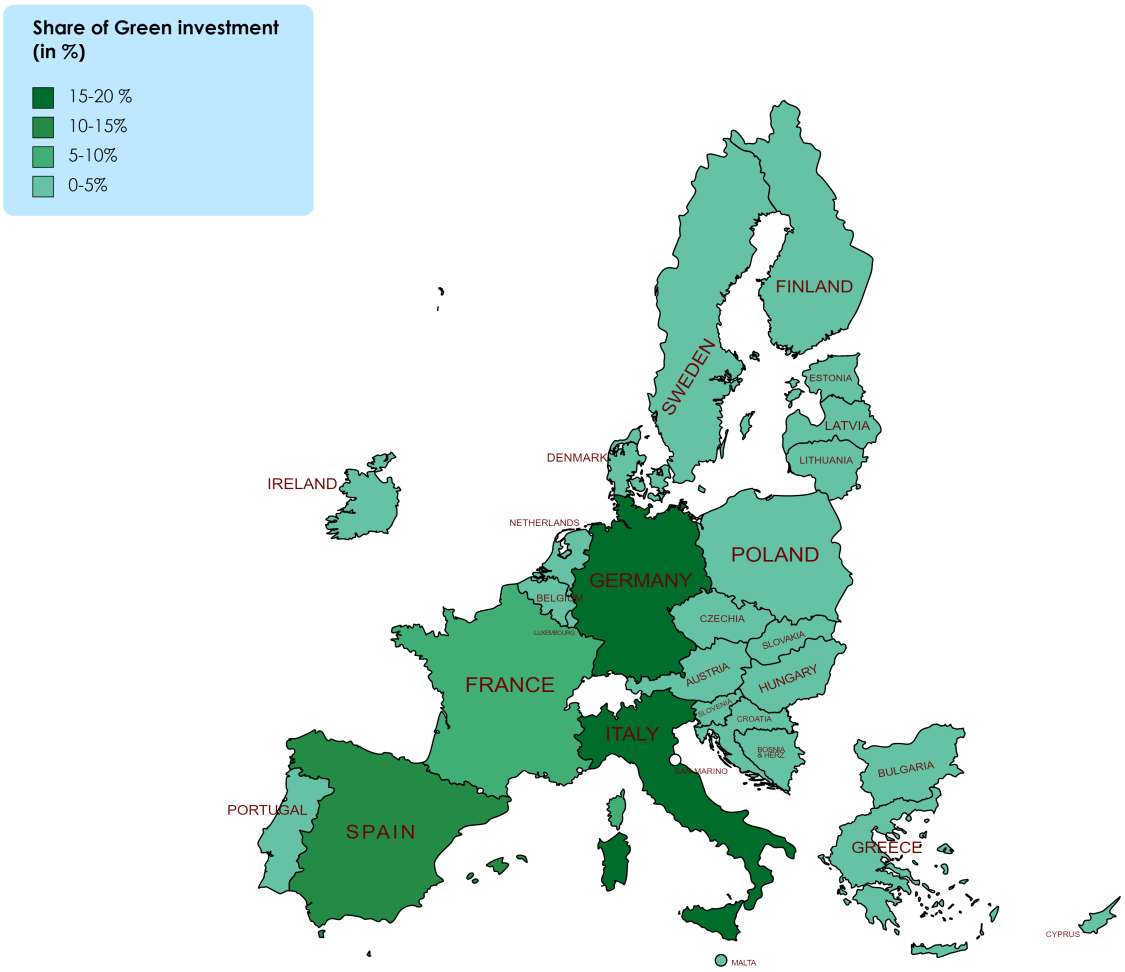


Figure 1.3: National Green Investment Allocation, 1960-2020

1.4 Main determinants of EIB green investments: an empirical investigation

1.4.1 Data and Methodology

The econometric study covers the investments in the EIB database identified as green in the previous section and is based on previous studies of the determinants of development bank investments (Neumayer, 2003; Yuan and Gallagher, 2018; Clifton et al., 2018) and of the determinants of environmentally-friendly investments (Eyraud and Clements, 2013 ; Escoffier et al., 2019). In model (1), we use a panel approach to identify what factors drive the allocation of EIB green investments. The dependent variable of model (1) is the annual amount of green investments by country in billions of euros. The corresponding econometric specification is:

$$GI_{it} = \beta_0 + \beta_1 GDP_{it-1} + \beta_2 r_{it-1} + \beta_3 P_{it-1} + \alpha_1 X_{it-1} + \vartheta_t + \mu_i + \epsilon_{it} \tag{1.1}$$

where GI_{it} denotes the annual amount of green investments in country i at time t, β_0 is a constant, GDP_{it-1} is the annual GDP per capita of country i at time t-1. As Clifton et al. [2018], we use the GDP/capita to approximate the level of development of the country. As EIB loans are only co-financing, we also include the 10-year government bond interest rate as a proxy for the country's access to credit (r_{it-1}) [Eyraud and Clements, 2013]. We use public spending on environmental protection as a policy variable. These expenditures reflect the government's interest in environmental issues [Eyraud and Clements, 2013]. P_{it-1} is the national environmental protection expenditure[11] of country i at time t-1.

X_{it-1} is a set of control variables. More precisely, this variable includes the GHG emissions of the member states, which are a good indicator of the dependence of these states on fossil fuels. ϵ_{it} is the estimation error. Population is also a variable that could have an impact on green investment deployment. Countries with high population growth face increasing energy needs, which could accelerate the deployment of renewable energy [Baldacci et al., 2008]. We also incorporate a binary variable (ETS) representing the effect of the the EU Emissions Trading System[12]. This vari-

[11] state expenditures listed as environmental protection expenditures by Eurostat.

[12] The EU Emissions Trading System was established in 2005 and is the world's first emissions trading system.

able is equal to 1 after 2005 for participating countries and equal to 0 otherwise. As the EU-ETS market aims to put a price on carbon, we expect the introduction of this market to accelerate the deployment of renewable energy [Newell et al., 1999]. To control for the effect of newcomers [Clifton et al., 2018], we use a dummy variable that is equal to 1 in the first five years of a country's eligibility for EIB lending (*New_d)*, and equal to 0 otherwise. Year and country fixed effects are included in the regression models.

The panel is unbalanced because the EU has grown in the period considered from the six founding countries in 1960 to 27 countries in 2020. Table A.5 in Appendix provides descriptive statistics for the variables of interest. We suspect endogeneity in our specification to the extent that the EIB loan is likely to have an impact on the explanatory variables. Indeed, EIB loans can directly impact the GDP/head, as well as the debt level of the beneficiary country. To limit the endogeneity of our model, all the explanatory variables are lagged by one period.

1.4.2 Empirical results and interpretation

The estimated determinants of EIB green investments are presented in Table 1.5, where the different columns summarize the results obtained with alternatives specifications as a robustness check.

Table 1.5: Determinants of EIB green investments at the macroeconomic level

Model	Counterfactual	(1)	(2)	(3)	(4)
Dependent variable	Level	Level	Ratio	Level	Level
	Log(I)	Log(GI)	Log(GI/GDP)	Log(GI)	Number of GI projects
Log(GDP per capita)	-2.945***	3.842***		2.84***	3.7132***
	(1.09)	(2.51)		(2.49)	(1.96)
Debt(% GDP)	-0.01*	0.56	0.45	0.24	-0.24
	(0.02)	(1.19)	(2.5)	(2.98)	(2.4)
Interest rate	0.48	-0.95**	-0.56	-0.09	-0.49**
	(0.02)	(1.56)	(1.97)	(1.64)	(1.18)
Environmental expenditure		0.5**	0.9**	0.09*	0.49**
		(2.57)	(1.59)	(1.49)	(2.73)
Greenhouse gases		0.007	0.08	0.48	-0.15*
		(0.10)	(0.15)	(0.2)	(0.8)
Population	2.78*	0.05*	0.07**	0.08*	0.09*
	(1.89)	(2.6)	(1.9)	(1.8)	(2.42)
New_d			-4.5*		
			(0.1)		
ETS		0.09**			
		(2.25)			
R-sqr	0.53	0.46	0.38	0.40	0.49
Country FE	Yes	Yes	Yes	No	Yes
Year FE	Yes	No	Yes	No	Yes
Observations	316	316	316	316	316

Notes: ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. Robust standard errors are reported in parentheses.

The main macroeconomic determinant of green EIB loans is GDP per capita. Over the period under consideration, the volume of EIB loans, as well as the GDP/capita of the Member States has only increased. To verify that this is not just a co-evolution, we perform a "counterfactual" specification (first column in Table 1.5). In which the

dependent variable is the log of the total amount granted by the EIB to country i at time t irrespective of the green, brown ,or neutral nature of the loans, confirm those of Clifton et al. [2018] that the EIB acts as a development bank, the amounts granted to countries being negatively correlated with their GDP per capita. The EIB acts to promote the economic convergence of European regions in keeping with the EU's cohesion policy.

Considering green investments separately however (columns 1 to 4), the amounts allocated to countries are positively correlated with GDP per capita, indicating that the most developed countries (the EU 15 more or less) obtain a greater share of green investments. A 1% increase in GDP per capita is associated with a 3.84% increase in EIB green investments. France, Germany, Belgium and the Netherlands and are indeed among the largest investors in environmental R&D (Eurostat,2018). This result is also consistent, from a theoretical point of view, with the environmental Kuznets curve [Panayotou, 1993], which suggests that once a certain stage of economic development has been reached, environmental considerations influence households' choices.

This result is in agreement with previous research (Guolei, 2018 ; Eyraud and Clements, 2013 ; Shuai et al., 2018) showing that GDP and GDP per capita are associated with the amounts invested by states in low carbon sectors. Our econometric study also suggests that interest rate increases lead to a decrease in green investments. This result makes sense in that higher interest rates make access to capital more expensive [Eyraud and Clements, 2013]. We find furthermore that a 1% increase in government environmental expenditure is associated with a 0.5% increase in EIB green investments in the recipient country. This suggests that public investment in this area has a leverage effect. The EIB never funds projects in their entirety, describing its support rather as "a guarantee of a rigorous appraisal process that sends a positive signal to other investors". On average, the EIB finances about 33% of the total project cost. This support then acts as quality assurance to attract other public and private investors. This mechanism explain the positive correlation between public expenditure and EIB loans and confirms the role of public policies already highlighted by [Gokul et al., 2015] or [Gokul, 2015].

1.4.3 Alternative specification

The previous section considered total green investment by year and country as the dependent variable. To refine our results, we propose an alternative specification at the project level[13], where the determinants of the likelihood of a project being green are estimated. We used the following logistic regression :

$$\log\left(\frac{p(Y_{ijct}=1)}{1-p(Y_{ijct}=1)}\right) = \alpha + \beta' X_{it} + \mu_i + \gamma_t + \lambda_j + \delta_c + \epsilon_{ijtj} \tag{1.2}$$

Where $p(Y_{itj}=1)$ indicates the probability that project i (i = 1,2...,13835) in sector j (j=1,2..,13) at date t (t=1960,1961 ..,2020) in country c (c=1,2,...,27) is green. The results of this specification are in table 1.6.

Table 1.6: Determinants of EIB green investments at the loan level

Dependent variable:	Green Project
Log (GDP per capita)	0.059***
	(0.018)
Country fixed effect	YES
Sector fixed effect	YES
Year fixed effect	YES
N	13,835

Notes: ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

[13]As a reminder: At the project level, we have the following data: year of the project, amount of the loan, sector of activity, beneficiary country and a brief description of the project. We do not have other information about the project such as the co-financing rate, the estimated duration of the project, the other co-financiers.

As in the macro-level regression, we find a positive and significant sign of a country's level of development as a factor influencing green investment allocation at the project level. Specifically, a 1% change in national GDP leads to a 0.059/100 increase in the probability of obtaining a green investment. This indicates that being in a country with a high level of development increases your probability of investing in environmentally friendly projects. The next section concludes and proposes public policy recommendations based on the results obtained.

1.5 Conclusion

We have explored the unequal allocation of green investments within the EU using a database of EIB loans. Of the 17,750 loans granted to member states between 1960 and 2020, about a quarter were identified as having a favorable environmental impact and were classified as green investments. These loans mainly benefited the transport, energy and solid waste sectors and were awarded more frequently to the most advanced economies in the EU. The corresponding econometric analysis suggests that EIB green investments are positively correlated with GDP per capita and the environmental expenditure of the EU member states. Although our approach allowed us to identify green investments in the EIB's portfolio, this study does not indicate whether EIB financing increases the environmental performance (better carbon capture, lower GHG emissions, improved energy efficiency) of member states. Access to data on ex-post impacts is of paramount importance to assess the real impact of these projects (avoided GHG emissions, impact on biodiversity...). If it truly wishes to become the EU climate bank, the EIB must stop financing all non-green projects by strictly following the new European Green taxonomy. This study was limited to the analysis of the EIB's lending portfolio in the European Union. Future research should be conducted to evaluate the EIB's environmental action outside the EU [14].

Our results point to the two-speed transition of the European Union. A transition started and massively supported by public opinion[15] in Western Europe and a transition that is struggling to start due to a lack of political consensus and relatively

[14]Due to its international mandate, the EIB also finances projects outside the EU. In these countries, the EIB is criticized for its low environmental and social standards by numerous NGOs (Simpere, 2008 ; Wright, 2007).

[15]Special Eurobarometer 513, Climate Change, April 2021.

little support from public opinion in Eastern countries. The members of the *Visegard Group* (Poland, Hungary, Slovakia ,and the Czech Republic) are strongly opposed to the European Green Pact[16] and share their opposition to ambitious energy and climate policies and centralization and state control of energy structures [Szabo and Fabok, 2020]. The European Union must therefore pay particular attention to ensuring that the green transition is carried out in a homogeneously and does not accentuate the structural heterogeneities between the Member States.

The EIB is part of the Network for Greening the Financial System (NGFS). It is a voluntary network of central banks and international financial supervisors that shares best practices and contributes to the development of more sustainable finance[17]. In a recent study Amenc et al. [2021], denounced the widespread greenwashing of ESG (Environmental, Social, and Governance) index funds. They show that Climate criteria represent a maximum of 12% in the elaboration of its new green stock market indices. Methodological transparency on the creation of the indicator and ex-post evaluation of funded projects are major issues to ensure the sustainability of green finance.

[16]EU climate deal falls at summit, four countries wield the axe, Euractiv, 2019.

[17]To align investment portfolios with the Paris Agreements (2015), several indices(Dow Jones Sutainability Index(DJSI), S&P ESG, S&P Global 120 Fossil Fuel Free...) have been developed to help investors redirect their investments towards the most virtuous project

Chapter 2

The Political Economy of green transition: Evidence from EU allocation to French municipalities

Summary of the chapter

How will electoral competition drive the green transition? This chapter examines the factors influencing the allocation of EU green funds to French municipalities using a novel dataset covering 980 municipalities across two multi-annual financial frameworks (2007-2013 and 2014-2020). We identify green projects based on the official taxonomy and explore both the economic and political determinants of these green and other projects. While political economy models highlight the role of political alignment between the mayor and higher levels of government, as well as the significance of municipalities with narrow electoral margins, we find distinct determinants for green projects. Political alignment significantly influences the demand for brown projects, but not for green projects. However, a narrow electoral margin increases the demand for both types of projects, especially green ones. We instrument this effect using the number of appeals filed by municipal opposition in French public courts. Our findings show how green voters and political contestability accelerate the green transition[1].

[1]This chapter comes from a paper co-written with Jules Ducpet and Samuel Ligonnière.

The authors of the paper would like to thank Amélie Barbier-Gauchard for her valuable comments and suggestions. The authors also thank the participants and discussants at the following conferences/workss hops and seminars: the ENS Paris-Saclay seminar, the JRC Summer School (Ispra), EAERE (Leuven), AFSE (Paris), for their various comments and remarks. We thank Lola Kerdiles, Axelle Lucas, and Alexis Rybak for their excellent work as research assistants.

2.1 Introduction

How does political competition affect our chances of successfully achieving the green transition? While sustainable development has been extensively analyzed in the context of bank-firm relationships (Altavilla et al., 2023), bond markets (Flammer, 2021), and household opinions on climate policies (Douenne and Fabre, 2020; Anderson et al., 2023), few researchers have explored its impact on the political process. The democratic electoral process encourages short-term thinking, leading to increased visible spending and pre-election handouts, which, in turn, undermines long-term commitments. We can therefore hypothesize that electoral competition could be initially detrimental to the speed and scope of the green transition.

Besley and Persson [2023] demonstrate that the success of the green transition is far from assured. Their model of electoral competition interacts with shifting citizen values, technological changes between green and brown goods, and the inherent inability of democratic politicians to commit to future policy paths. The success of the green transition depends on the strength of interactions among targeted climate policies, political activism, and the proportion of swing voters among green and brown consumers. They highlight that political forces—particularly electoral competition and lobbying—can significantly influence the pace of this green transition. In electoral competition, policymakers maximize short-term utilitarian welfare, potentially internalizing the externality within a given period and triggering the dynamics of the transition. Proposition 3 and Corollary 3 in Besley and Persson [2023] outline the conditions leading either to a successful green transition or a brown trap. At the heart of the mechanism is the presence of swing voters among brown and green consumers.

The chapter empirically establishes this pro-green dynamic in politically contested areas after elections, testing Besley and Persson [2023] hypothesis . We exploit successive waves of grants provided by the European Structural Funds to French municipalities between 2007 and 2020. We disaggregate the 150,158 requested and approved projects based on the final recipient and we identify whether the project is ecological or not, according to the European Commission's official taxonomy. We combine these data with rich administrative panel data on municipalities during the period. This includes detailed information on local public finance, the structure of the local economy, demographic composition, real estate prices, and income and wealth inequalities, as well as local political characteristics.

A potential identification challenge arises from the supply-side effects of grants from the European Commission, the central government, and regional authorities (intermediate level). This issue becomes particularly relevant when comparing the European Commission's target of 25% green grants with our calculations. Among the 980 largest (in relation to the number of inhabitants) French municipalities, we find that only 21% of public sector grants were allocated to green projects in 2007, and this figure dropped further to 18.9% in 2014. We therefore focus our analysis on these 980 French municipalities with over 10,000 inhabitants, allowing us to examine in detail 58,678 projects, which account for 39% of all projects and 42% of total grants in France. This strategy aims to isolate the demand-side effect from the municipalities, based on the hypothesis that these larger municipalities possess the administrative and technical capacity to respond to European funding calls with proposals that align with the EU's broad objectives [Rodríguez-Pose and Garcilazo, 2015].[2]

French municipalities with more than 10,000 inhabitants represent an ideal laboratory for exploring the links between political competition and climate policies. First, France has a multi-tiered governance structure comprising local, intermediate, and national decision-making levels. This structure, along with clearly defined elections and political parties (Pérignon and Vallée, 2017; Lévêque, 2020), enables researchers to distinguish between political alignment issues across different layers of government and pure political contestability. This setup makes it possible to disentangle the interactions between these two potential mechanisms. Second, the 980 French municipalities exhibit profound heterogeneity across economic, social, and political dimensions, which greatly facilitates identification. Some geographic areas fall within the scope of the EU's economic catch-up initiatives, and the use of financial innovation, as well as reliance on the central government as a lender of last resort, further differentiates these municipalities (Pérignon and Vallée, 2017; Fajeau et al., 2022). Third, this strategy of isolating demand effects by restricting the sample does not eliminate the significant heterogeneity in how municipalities engage with EU

[2]Section 2.3 explains the mechanism for allocating these European funds, distinguishing between the roles of the European Commission, the central government, and the regions (intermediate level). It shows how supply-side effects can potentially exist only at the regional presidency level. The variable of political alignment between the municipality and the regional president further isolates this mechanism. For further details, Dellmuth and Stoffel [2012] show that the allocation of European structural funds grants significant discretion to German local districts, allowing them to balance global EU goals with local political interests. Testa et al. [2012] also highlights the importance of this population threshold in Italian municipalities with regard to green public procurement practices.

projects. Some municipalities have never received EU projects, some have participated in only one funding wave, while others have engaged in both. Additionally, some municipalities focus exclusively on green projects, others on brown, some on both, and some vary their focus across different waves. The final recipients of these projects, whether green or not, are also diverse. The fact that a municipal project can be strictly local, intermediate, or national in scope provides further avenues for identification.

Our first finding shows that intense political competition in recent municipal elections drives mayors to seek European green subsidies for projects initiated shortly after the election. This outcome holds across all specifications and with various choices of control variables that account for economic, social, and local finance dimensions. The narrow electoral margin impacts both green and brown projects but primarily influences green projects. This pro-green dynamic in politically contested areas strengthens further when pro-green political parties, as identified by McAlexander and Urpelainen [2020], nearly succeed in winning despite fierce opposition. In other words, the ecological vote remains impactful, maintaining green political pressure on the mayor, who otherwise tends to align with brown-compatible policies.

Our second key finding concerns the impact of political alignment between fund providers and recipients, specifically on brown projects. We find that sharing the same political color, or even more strongly, the same party affiliation, significantly increases the amount of subsidies allocated to brown projects. This finding is not neutral regarding the shift in values and technological change toward either green or brown outcomes. Any subsidy effort directed towards brown projects can exacerbate the climate trap, as highlighted by Besley and Persson [2023] and Delfgaauw and Swank [2024]. The failure of the green transition can thus stem from voter inattention to intermediate-level elections or those at the central government level.

This contrast in outcomes between political alignment across different levels of government and political competition in an election is not widely discussed in the political economy literature. We explore various mechanisms to rationalize these differences between green and brown subsidies. First, political alignment across different layers of government influences future European subsidies only if the outcomes are visible to citizens. Muraközy and Telegdy [2016] reaches a similar conclusion by distinguishing EU subsidies for construction from those for other purposes in Hungarian municipalities. We distinguish the visibility of projects, particularly by identifying

the ultimate recipient, and whether the project has national, regional, or local significance. A regional president has a stronger incentive to adopt a partisan approach if the project extends beyond the confines of a single municipality. Second, we expand our analysis of green projects by differentiating between adaptation and mitigation of climate change. Adaptation projects, particularly those addressing the aftermath of past climate shocks, are also highly visible. Finally, the third complementary explanation lies in the existing lobbying forces from private interests favoring brown activities, which act as a significant factor in the political climate trap according to Besley and Persson [2023]. Political alignment at the regional level can reinforce itself through lobbying by local political actors, as highlighted by Delatte et al. [2019].

A remaining identification threat arises from the possibility that European subsidies might also influence the probabilities of re-election in future municipal elections, as shown by Muraközy and Telegdy [2016]. To address this, we introduce a new strategy using wave-municipality instruments, specifically the number of political legal challenges brought before public courts at the municipal level in the period preceding the election and before the arrival of the structural funds wave. The use of these instruments reinforces all previous findings, ensuring the causal nature of the results. Major administrative juridications challenges, such as those brought to the Administrative Appeal Courts (*cours administratives d'appel*) and the highest French jurisdiction (*Conseil d'État*), can arise for various reasons, such as disputes over deportations of undocumented immigrants. We therefore focus exclusively on political challenges, strictly related to political considerations, such as disputes over fraudulent elections or the ineligibility of current municipal councilors. These challenges may also involve the legality of building permits or the allocation of subsidies.

These legal challenges serve as a powerful political tool for the opposition (Chapus, 2008), as they can suspend projects, such as construction initiatives. We dissect this instrument by examining those challenges related solely to the previous municipal election and by distinguishing between challenges initiated by the mayor's office and those by the opposition. These instruments are thus strongly tied to the local political competition faced by a mayor, while being a priori unrelated to European subsidy requests. European subsidies cannot be interpreted as purely political gifts, given the required co-financing and the fact that European subsidies account for a

median of 37% of investment costs.

Our chapter highlights the significant impact of political pressure from voters in motivating local policymakers to undertake green projects. Even when parties with limited environmental agendas win, green voting still plays a crucial role. However, political alignment against environmental policies between different political levels hinders the green transition by favoring brown production. Therefore, the political battle must also engage the intermediate political levels.

Section 2.2 presents the literature review. Section 2.3 outlines the institutional framework, data, and associated stylized facts. Section 2.4 presents the main results, and confirms these findings from a causal perspective. Section 2.5 concludes.

2.2 Literature review

2.2.1 Political economy of public funding: alignment and electoral margins

First, we contribute to the political economy literature on the impact of multi-level partisan alignment in tight electoral contexts, building on the foundational models of Lindbeck and Weibull [1993] and Dixit and Londregan [1996], as updated by Arulampalam et al. [2009] and Bracco et al. [2015]. This phenomenon follows a rent-seeking logic, where politicians maximize their power by distributing resources to politically aligned actors. These funds signal both the competence of local officials and the support they receive, helping to boost their chances of reelection. Muraközy and Telegdy [2016] highlight this effect in the context of European subsidies, particularly for public projects visible to voters. Our approach aligns closely with their work, though we differentiate by focusing on green projects versus others. Like them, we distinguish based on the identity of the project sponsor (public or private), but we focus solely on major local public actors to better isolate the demand effect, given that the acceptance rate for these actors is close to 100%. Political alignment shows its influence across various contexts, especially in closely contested elections (Veiga, 2012; Corvalan et al., 2018) and when alignment spans all levels of government (Kemmerling and Bodenstein, 2006; Solé-Ollé and Sorribas-Navarro, 2008; Bouvet and Dall'Erba, 2010; Dellmuth and Stoffel, 2012; Clemens and Veuger, 2021). Beyond partisan alignment, Albouy [2013] shows that coalitions play a significant role

in the geographical distribution of federal funds in the United States. This not only affects the amounts allocated but also the direction of resources, with Democrats channeling funds toward social priorities even when in the minority. This resonates with the broader political focus on ecological transition. Regardless of political alignment, elected officials pursue projects for their local constituencies, often targeting strategic voter groups, such as swing voters (Dahlberg and Johansson, 2002; Johansson, 2003), and engaging in piork-barrel practices (Cadot et al., 2006; Brollo et al., 2013; Carozzi and Repetto, 2016).

2.2.2 Green political economy and electoral competition

Second, we contribute to the growing literature on green political economy, closely aligned with Besley and Persson [2023]. Our work investigates how sustainability challenges reshape political competition for intergovernmental grants. Unlike prior research, we differentiate between two key dynamics for green issues: first, the influence of political alignment with the central government, and second, the role of swing voters in high-uncertainty elections. These dynamics intersect with green public spending, while the literature clearly shows that voter preferences—whether pro- or anti-environment—directly drive public expenditure before elections. As List and Sturm [2006] demonstrates in U.S. states, the impact of environmental policies shifts based on gubernatorial re-election prospects and electoral composition. Political affiliation plays a critical role (Mourao, 2019; McAlexander and Urpelainen, 2020; Schulze, 2021). McAlexander and Urpelainen [2020] highlights that pro-environmental statements on Twitter (X) and green voting in Congress increase before elections, especially among Republicans who narrowly won their previous race. Politicians tactically target swing voters, either through intergovernmental grants (Dahlberg and Johansson, 2002) or by ratifying international environmental agreements (Cazals and Sauquet, 2015). Similarly, Landry [2021] reveals the use of green pork barrel politics in greenhouse gas reduction policies. However, green political economy often leads to ambiguous outcomes in terms of environmental spending efficiency (Stef and Ben Jabeur, 2023; Mourao, 2019). It may discourage local leaders from undertaking critical public investments, such as those aimed at preventing natural disasters (Morvan and Paty, 2024). The relative importance of political factors is also debated in comparison to economic determinants and spillover effects. Nicolas et al. [2025] shows that the adoption of green public procurement in the Czech Republic between 2006 and 2019 depends more on the availability of co-financing

than on ecological policy objectives. Damette and Del Lo [2022] show that public spending at the regional level appears largely unaffected by political considerations. Fabra et al. [2024] complements this analysis by examining the economic effects of renewable energies at the municipal level. However, unlike their analysis, we emphasize the importance of local political dynamics by examining municipalities and how their alignment with higher levels of government influences spending decisions.

2.2.3 Local determinants of European funding

Building on previous analyses of intergovernmental fund requests (Veiga, 2012, Dellmuth and Stoffel, 2012, Bracco et al., 2015, Muraközy and Telegdy, 2016), we include the traditional determinants as local economic fundamentals, public finance, and political economy. These factors can influence both the number of projects and their alignment with green priorities, depending on the level of municipality development. Ecological concerns seem to follow similar determinants, particularly in public projects related to renewable energies (Damette and Del Lo, 2022) and natural disasters (Morvan and Paty, 2024).

General economic factors largely explain the use of these funds, with a portion directed towards regions undergoing economic convergence. Dellmuth and Stoffel [2012] highlights the importance of GDP, unemployment, and urbanization levels. This justifies the inclusion of variables from Piketty and Cagé [2023], such as population and municipality classification—whether small towns, poor or wealthy suburbs, or metropolitan areas. Drawing from Piketty and Cagé [2023]'s extensive data archives, we also account for local economic indicators, including real estate prices, real estate wealth per capita, and the classification of cities by income levels. Additionally, we incorporate demographic variables such as education levels (high school and higher education), population structure by age, gender, and employment type, including unemployment rates and the share of immigrants. Finally, we include income and wealth inequality, using metrics such as average income per capita relative to the national average, real estate capital, homeownership rates, and housing availability in each municipality. Natural disasters can also affect the local economy and the emphasis placed on ecological projects, as noted by Morvan and Paty [2024]. Therefore, we include natural disaster variables in our analysis, drawing from the GASPAR French dataset.

The co-financing from European funds plays a predetermined role within the investment and financing models of public entities. As highlighted by Pérignon and Vallée [2017], Fajeau et al. [2022], and Carlson et al. [2024], local public finances serve as relevant control variables. These include local investment dynamics, central government transfers, and the share of current expenditures in municipal budgets. More specifically, we measure structural rigidity through the weight of personnel costs in operating expenses. On the financing side, the interaction between state transfers, European funds, local taxes, and municipal debt levels is key. We also assess the municipality's self-financing capacity, based on its ability to generate resources. In our analysis, these various elements of local accounting are used as control variables to better understand the influence of European funds on local investment strategies.

Following the models of Arulampalam et al. [2009] and Bracco et al. [2015], we incorporate the results of the 2008 and 2014 municipal elections to assess their impact on the two waves of funding, from 2007 to 2013 and from 2014 to 2020. Specifically, we include variables such as mayoral change (Veiga, 2012), political party shifts, the electoral margin of victory, and the Herfindahl-Hirschman concentration index as used by Pérignon and Vallée [2017]. It considers the squared shares of each electoral group to capture the concentration of results in the first round of the election. Political alignment is also considered, particularly the political affiliation of the regional intermediary responsible for fund allocation. We use the 2004 and 2010 regional elections. The political alignment between the municipal government from 2008 to 2013 and the regional government from 2004 to 2009 will be considered. The same applies for the second period, with the municipal government starting in 2014 and the regional government starting in 2010. To account for geographic proximity to political pressures, we include distances to the capital, Paris, as well as to departmental capitals. Finally, we explore the impact of European cohesion funds. The effective use of EU funds for new energy development remains a critical topic in the literature (Streimikiene et al., 2007; Marques Santos et al., 2022; Santos et al., 2023). Close to our context, Nicolas et al. [2025] links the adoption of green public procurement in the Czech Republic to co-financing from European funds. They also emphasize the role of authorities' experience in green projects, though the effect is weak and they overlook the political and socio-economic context. The heterogeneous effects on economic growth and the catch-up of poorer countries or regions have been widely analyzed (Becker et al., 2010; Pellegrini et al., 2013, among others). Issues such as

the actual utilization of funds and delays linked to governance quality have emerged as key considerations (Blanco-Alcántara et al., 2024). Muraközy and Telegdy [2016] also analyzed the effects of these funds on private firms.

2.3 French institutional setting and data

2.3.1 The French institutional setting: supply versus demand mechanisms.

During the 2007-2013 and 2014-2020 funding cycles, the European Commission set broad objectives, such as enhancing the competitiveness of small and medium-sized enterprises (SMEs), promoting renewable energy, and fostering innovation. These goals allowed member states and their regions significant flexibility in implementation. The Commission provides a general framework and ensures compliance with EU law but does not directly select individual projects. Instead, French regions, which manage these European funds at the national level, approve or reject projects. This setup requires distinguishing between the supply-side effect (European Commission, French Region, French State) and the demand-side effect (municipalities). Although regional and national governments influence the process, they remain constrained by strict European criteria (Dellmuth and Stoffel, 2012).

By comparison, Muraközy and Telegdy [2016] examine 3,154 Hungarian municipalities (excluding Budapest) between 2004 and 2012, reporting a 48-57% success rate for grant applications. Their study, however, does not account for potential variations in acceptance rates across these municipalities, many of which are small and lack administrative capacity. During this period, the median population of a Hungarian municipality was just 1,000, with an average of around 3,100. Notably, only 118 municipalities had populations exceeding 10,000, likely contributing to higher rejection rates due to limited administrative expertise. In contrast to Muraközy and Telegdy [2016] analysis, we narrow our sample by excluding private recipients and municipalities with fewer than 10,000 inhabitants. This approach leaves us with 980 municipalities out of the 35,000 in France, as reported by INSEE (French National Institute of Statistics).

We hypothesize that supply-side effects at the regional level remain relatively limited for larger municipalities. As the primary managers of European funds, regions focus on ensuring that projects comply with operational criteria, and the administrative services of municipalities are well-equipped to meet these standards. For instance, the project evaluation processes documented in the May 2022 minutes of the Bourgogne Franche-Comté Programming Committee show that project approval or rejection hinges on adherence to state aid regulations and public procurement rules. Similarly, Testa et al. [2012] highlight that green public procurement is predominantly managed by larger municipalities, which can rely on both internal and external experts and have sufficiently robust administrative services. Given the expertise of larger municipalities, we expect them to submit projects that meet these compliance standards, minimizing the risk of rejection for technical reasons. However, we cannot entirely rule out a regional supply-side effect, especially since the Regional President plays a key role in the final decision to allocate grants. Our analysis, therefore, considers the political alignment between the municipality and the Regional President to assess the potential influence of this residual supply-side effect.

2.3.2 European structural funds in France: 2007-2020

Table 2.1 presents the 150,158 European projects for France, broken down across the two funding waves. The subsidies remain lower than the investments made, as European policy favors co-financing to prevent any misuse of public funds. Nevertheless, there are some differences between the two waves. The number of projects doubles between the 2007-2013 and 2014-2020 periods, while the total amount of subsidies remains relatively unchanged. The associated investments increase by 3.5 billion € , reflecting a policy shift towards broader dissemination with lower co-financing rates.

Table 2.1: Distribution of EU projects in France by recipient : 2007-2013 and 2024-2020)

	All		Recipients (% Share)		
	Public & Private	Public projects Cities > 10,000 inh.	National	Intermediates	Local
First wave: 2007-2013					
Number of projects	101.142	40.128 (39.7%)	7.058	20.729	12.341 (12.2%)
Amount of subsidies (€ bn)	14.38	5.94 (41.3%)	1.96	2.44	1.55 (10.8%)
Amount of related investments	39.14	15.99 (40.8%)	4.89	6	5.09 (13%)
Second wave: 2014-2020					
Number of projects	49.016	18.550 (37.8%)	3,636	7,613	7,301 (14.9%)
Amount of subsidies (€ bn)	15.61	6.67 (42.7%)	1.53	3.52	1.62 (10.4%)
Amount of related investments	35.64	14.95 (42%)	3.42	7.14	4.39 (12.3%)

Notes: The percentage values indicate the share of projects in our sample relative to the overall projects in France. These projects are those utilized by municipalities with populations over 10,000 inhabitants. The final recipient of these funds, when public, is at the communal, intermediate, or national level. There are three types of intermediate levels in France: regions, departments and consular chambers. For readability, we group these three levels together.

We first separate the 150,158 projects to minimize supply-side effects. We exclude projects where the final recipients are private or public enterprises, as well as municipalities with fewer than 10,000 inhabitants. This leaves us with a sample of 58,678 projects. In this initial analysis, since subsidies account for 41.3% and 42.7% of total funding across the two waves—closely aligning with the share of projects—we observe no immediate signs of bias in co-financing or project size.

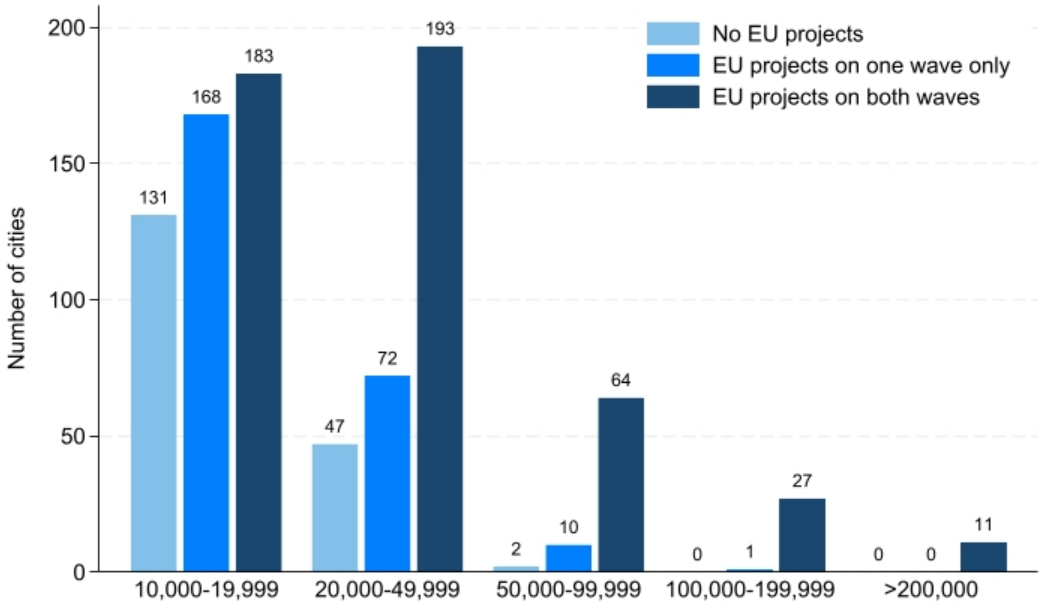
We then distinguish the 58,678 projects by their final recipient. A project can be attributed to a municipality but can be used for a broader or narrower area. In France, this could involve the municipality itself, an intermediate administrative unit called a department, another larger unit called a region, or even the national level. Using text analysis (see Appendix A.1 for detailed methodology), we classified projects related to these municipalities according to whether the final recipient is the municipality itself, an intermediate level, or the national level. This breakdown clarifies the connection between the political concerns of each administrative level and the corresponding project. This issue is particularly relevant for regional projects, where the regional president may align with local public decision-makers, and projects may operate either at the local or regional level. Our baseline focuses on projects where the final recipient is local, while we consider other recipients in a secondary analysis.

This gives us a total of 19,642 projects in our baseline, with total subsidies amounting to €3.17 billion. Comparing the two funding waves reveals no significant bias, despite substantial budgetary variation between the waves. The balance of projects across different recipients remains unchanged.

Table 2.1 highlights the distribution of responsibilities among recipients, showing a relatively stable allocation across both waves. Municipalities play an important role, not only as conduits for larger projects at the intermediate or national levels but also at the local level. Municipalities with more than 10,000 inhabitants consistently account for over 10% of projects, both in terms of project count, subsidies, and associated investment amounts. This indicates that municipalities are also pursuing ambitious projects, comparable in scale to those at higher levels. Within our sample of public projects in municipalities with over 10,000 inhabitants, those specifically targeted at the local level represent around 30% of the total.

The heterogeneity of municipalities underpins our analysis. Figure 2.1 shows how EU-funded projects are not consistently present in each funding wave, depending on the size of the municipalities. We categorize municipalities based on population size to highlight differences among the 980 largest ones. We also distinguish between those that received European funds in both waves and those that benefited in only one. Intermediate administrative levels, such as regional and departmental capitals, could have provided an alternative classification. However, these capitals vary widely in population size, making administrative status less informative. For example, Poitiers, the smallest of the 22 regional capitals, has fewer than 100,000 inhabitants, while Lons-le-Saunier, the smallest of the 96 departmental capitals, has only 17,000. Therefore, we focus on population size to better capture differences among the largest municipalities.

Figure 2.1: Distribution of EU-funded projects by municipality size and funding waves: 2007-2013 and 2024-2020



Notes: The Figure categorizes municipalities by size along the x-axis, using a population threshold of 200,000 inhabitants. It shows the number of cities with or without EU-funded projects within their boundaries for each project wave (2007-2013 for the first wave, 2014-2020 for the second wave). The Figure does not break down the data by recipient type. A detailed breakdown focusing exclusively on local recipients appears in Appendix Figure B.1.

Figure 2.1 highlights the municipality size effect in the allocation of European funds, focusing specifically on the extensive margin. This effect underscores the importance of administrative expertise and capacity, as noted by Testa et al. [2012]. All 11 French cities with populations over 200,000 have projects in both funding waves, and nearly the same applies to cities with populations over 100,000, with the exception of just one. However, the distribution is different for smaller cities: 61.8% of municipalities with populations between 20,000 and 50,000 received EU funds in each wave, while the figure drops to 38% for municipalities with populations between 10,000 and 20,000. In addition, the extensive margin is characterized by volatility, with municipalities entering or exiting the pool of EU fund recipients between waves. This is particularly evident for 27% of municipalities with populations between 10,000 and 20,000, and 23% of those with populations between 20,000 and 50,000, which did not have funds allocated in both periods. The heterogeneity shown in Figure 2.1 clearly demonstrates that the use of these funds is not solely tied to administrative capitals at intermediate levels, such as the 22 regional capitals

or the 96 departmental capitals. Indeed, Figure B.1 in the Appendix shows a nearly identical distribution to Figure 2.1, even though it only includes projects targeting local recipients.

The intensive margin is also relevant in this analysis. Table B.1 in the Appendix provides descriptive statistics, highlighting the significant heterogeneity in the amounts of subsidies and the associated co-financing rates. On average, the 980 French municipalities received €1.6 million per wave. However, the distribution becomes increasingly skewed. The median analysis between waves is consistent with Table 2.1, showing that the 2013-2020 wave had a similar budget but focused on larger projects. Figure B.2 in the Appendix also illustrates the distribution of per capita subsidies, comparing local recipients to intermediate and national-level recipients. We observe significant heterogeneity in per capita subsidies based on municipality size. There are far more outliers among smaller municipalities, but generally, there is an increase in per capita subsidies as municipality size grows. This pattern is not solely driven by subsidies to intermediate or national recipients, as our results clearly distinguish local recipients from others. For purely local projects, the vast majority of European per capita subsidies range between €50 and €100 per wave in cities with populations over 100,000, with declining amounts as population size decreases.

Our analysis thus complements previous studies of European funds at the municipal level in Portuguese (Veiga, 2012) and Hungarian cities (Muraközy and Telegdy, 2016). Veiga and Veiga [2007] suggests population size as an explanatory factor for funds but does not present associated statistics. Similarly, Muraközy and Telegdy [2016] does not break down this heterogeneity by municipality size, though they also consider per capita grant value as a dependent variable. Ultimately, we conclude that there is a kind of "large-municipality bias" in favor of bigger cities, which echoes the "small states bias" observed in the distribution of federal funds (Clemens and Veuger, 2021).

2.3.3 Green use of European structural funds: methodology and stylized facts

One of the main contributions of the chapter is to distinguish the determinants of the green use of European funds. Nicolas et al. [2025] uses a dictionary of 37 green-related terms to classify a project as green or not. We adopt a similar approach, but instead rely on the official taxonomy of the European Union, as shown in Figure A.1 in the Appendix. We applied the EU's green themes for both the 2007-2013 and 2014-2020 periods, building on the work of Ebeling [2022] in chapter 1. Specifically, we analyzed the 58,678 projects in our sample, which includes public projects from municipalities with over 10,000 inhabitants, regardless of whether the final recipient is the municipality itself, an intermediate level, or the national level. We categorized each project based on the final theme provided by the project lead, using the green/non-green classification detailed in table A.1. The list of green themes for each wave is provided in Table A.6. When the theme was not explicitly mentioned in the project announcement, we manually checked and determined whether the project was green or not. The infrequency of such cases did not require the use of text-mining techniques to create an environmental index, as employed by Noailly et al. [2024].

Table 2.2 illustrates the significance of European funds in public green investments. Contrary to what one might expect given the growing ecological awareness, France has reduced its co-financed green investments, both in absolute terms and as a share of total investments. Green investments fell from €4.35 billion between 2007 and 2013 to €3.55 billion between 2014 and 2020, with the share dropping from 27% to 23.7%. While public subsidies for green projects remained stable, and the decline in the number of green projects was less pronounced than the overall decrease in funded projects, the expected green leverage effect did not materialize at the aggregate level.

The second key takeaway from Table 2.2 is the crucial role of the local level in green initiatives. Green projects account for a substantial share of public European subsidies—and related investments—at the municipal level, rising from 36.6% to 42.4%, while this share is 2 to 3 times lower at higher levels of governance. More importantly, the local level is increasingly driving green initiatives. Between 2007 and 2013, it was at the municipal level that green investments grew, both in absolute and relative terms. Currently, over 50% of green projects and subsidies, and more than 63% of

EU-cofinanced green investments, are carried out at the municipal level.

Table 2.2: Distribution of green versus non-green EU projects in France: 2007-2013 and 2024-2020

(%): Share of green projects/Total	Our sample	Recipients		
	Public projects Cities > 10,000 inh.	National	Intermediates	Local
First wave: 2007-2013				
Number of green projects	4,856 (12.1%)	1,160 (16.4%)	1,397 (6.7%)	2,299 (18.7%)
Amount of green subsidies (€ bn)	1.25 (21%)	0.42 (21.5%)	0.26 (10.6%)	0.57 (36.6%)
Amount of related green investments	4.35 (27%)	1.32 (26.9%)	0.83 (13.9%)	2.20 (43.2%)
Second wave: 2014-2020				
Number of green projects	3,417 (18.4%)	815 (22.4%)	793 (10.4%)	1,809 (24.8%)
Amount of green subsidies (€ bn)	1.26 (18.9%)	0.29 (18.8%)	0.28 (8%)	0.69 (42.4%)
Amount of related green investments	3.55 (23.7%)	0.66 (19.2%)	0.64 (9%)	2.25 (51.3%)

Notes: This table presents information related to EU projects classified as green according to the European Commission's typology. The percentage values indicate the share of green projects relative to the total, with the total funds specified in Table 2.1 The final recipient of these funds, when public, is at the communal, intermediate, or national level. There are three types of intermediate levels in France: regions, departments, and consular chambers. For readability, these three levels are grouped together.

The heterogeneity in how French municipalities use European green funds is clearly evident. Table 2.3 presents the distribution of cities by project type and by participation in one or both funding waves. Of the 980 French municipalities, 507 (51.7%) implemented at least one green project, while only 224 (22.8%) participated in both green and non-green projects across both waves.[3] Table 2.3 supports the notion of complementarity between green and non-green projects, given the number of municipalities involved in both types. Significant heterogeneity exists on the extensive margin, and this is mirrored on the intensive margin. Figure B.3 and Table B.3 provide detailed insights into green subsidies. Whether focused on local or regional intermediary projects, the per capita amount of green subsidies is consistently lower than that of non-green subsidies. This disparity may be partially explained by the smaller number of green projects and their potentially smaller average size.

[3]In line with Besley and Persson [2023], one could argue that only green projects should be subsidized, excluding "brown" projects. Under such a scenario, only 65 municipalities would qualify. However, this assumes that all non-green projects are inherently "brown," which we cannot assert without specific data on the energy efficiency of non-green projects outside the current taxonomy.

Table 2.3: Distribution of projects by type and wave

Number of cities	No project	First wave only	Second wave only	Both waves	Total
Only non-green projects	-	124	37	111	272
Only green projects	-	34	23	8	65
Opposite project types across waves	-	-	-	21	21
Both types of projects (one or both waves)	-	143	57	224	424
Total	**-**	**198**	**301**	**117**	**980**

Notes: This table shows the distribution of cities according to the type of projects they received (non-green, green, or both types) and their participation across the first and second waves. The counts represent the number of cities in each category. In cases where cities received different types of projects across waves, they have been grouped together for clarity. Specifically, among the 143 cities that had both types of projects in the first wave, 49 did not receive any funding in the second wave, while 94 received funding for only one type of project in the second wave. More precisely, 82 (12) cities received only non-green (green) projects in the second wave. Similarly, of the 57 cities that had both types of projects in the second wave, 13 did not receive any funding in the first wave, and 44 received funding for only one type of project in the first wave. Specifically, 39 (5) cities received only non-green (green) projects in the first wave.

2.4 Determinants of the use of European structural funds by French municipalities

We first detail the econometric methodology in Section 2.4.1, along with the initial results using OLS estimation in Section 2.4.2. We then focus on the causal relationship by presenting the specification and associated instrument in Section 2.4.3, followed by the corresponding results in Section 2.4.4.

2.4.1 Specification

We aim to understand the various determinants of public economics, political economy, and other economic fundamentals that influence the use of European funds and their green allocation. Our dependent variable, $Y_{i,t}$, represents the amount of funds allocated to municipality i for local recipients during the wave ($t = \{2007 : 2013\}$ or $\{2014 : 2020\}$). This dependent variable can also be disaggregated to focus solely on the green use of the funds. An alternative approach would have been to calculate the ratio of green funds to total funds, but this would have further restricted the sample.

Several choices were possible regarding our model. The first concerns the temporal framework, where we opted for waves rather than individual years. Projects can begin at different points within a given wave, and they can be submitted to the region at any time during the wave. However, project funding can be spread over

several years, based on assumptions that may vary across municipalities and/or regions responsible for processing the applications. Accounting for individual years could introduce bias into the analysis, so we follow Muraközy and Telegdy [2016] by treating t as each political wave. Elections took place in 2008 and 2014, aligning with these two waves.[4]

The second choice concerns the use of a pooled OLS structure rather than a panel model with fixed effects. While the panel structure offers certain advantages, allowing the isolation of within effects, with $T = 2$ et $N = 1960$, fixed effects estimation could lead to biased estimators. A panel structure (municipality, year) would have been necessary, but the interpretation of temporal fixed effects in this context could inadvertently capture political effects related to elections.

The third choice concerns the use of OLS estimators rather than Tobit or Probit models. For example, Muraközy and Telegdy [2016] uses both OLS and Probit to capture the intensive and extensive margins. Given the risks of non-convergence in Probit models with IV and the challenges posed by non-linear equations with IVs, the simple OLS estimator appears more efficient. While it is possible to consider a censored model, as in Dellmuth and Stoffel [2012] or Bouvet and Dall'Erba [2010], there is no indication that the variables are censored from below. These funds are requested and obtained by municipalities with more than 10,000 inhabitants. Table Table B.1 for all projects and Table B.3 for the green use of European funds illustrate the wide dispersion of amounts.

Then we estimate by OLS estimators the following model:

$$Y_{it} = \alpha + \beta' X_{it} + \epsilon_{it} \tag{2.1}$$

where Y_{it} denotes our variable of interest for municipality i and wave $t = (1, 2)$. This variable represents either the total amount of subsidies provided by European funds or, alternatively, the total amount of subsidies specifically allocated to green projects. We transformed all variables into logarithms to estimate a linear equation. In cases where these subsidies are potentially zero, we replace the simple logarithm

[4] Another identification strategy would have been to examine projects before and after the 2008 municipal election, but we lack certainty about the budget announcement policies of French regions. Some regions may have waited for the elections, while others might have taken advantage of them. Given the timing required for budget implementation and with the municipal elections held on March 9 and 16, 2008, it seems reasonable to assume that projects could not have been used to influence the early 2008 election.

with $log(1 + Y)$. α denotes a constant term and ϵ_{it} is the estimation error. We cluster the standard errors at the municipality level, following Brollo et al. [2013]. The following variables were used in our X-vector to test the influence of local politics as well as the influence of the financial situation of municipalities on the green use of structural funds.

Regarding the control variables, we selected the economic variables from the year just before the start of each period to reduce the risk of reverse causality, i.e., from 2006 for $t = 1$ and from 2013 for $t = 2$. For political economy factors, we considered the results of the 2008 municipal election for the first wave and the 2014 election for the second wave. Given the 44 potential control variables across different domains, we applied various LASSO methods to select the most relevant variables. We ran multiple LASSO procedures, both on the dependent variable and by selecting groups of variables by category. The selection process focused on the following political economy variables: the Herfindahl-Hirschman index and political alignment. For local economic determinants, we used real estate prices, the average income per capita relative to the national average, the share of homeowners in the municipality, the share of foreigners, the unemployment rate, as well as a dichotomy between suburbs, poor major cities, and wealthy major cities. Finally, regarding local public finance, we considered the share of local public spending dedicated to investment, the municipality's self-financing capacity, and the share of local taxes in municipal revenues.

2.4.2 Prima facie evidence

We begin by examining the correlation between these control variables and the use of European funds in Table 2.4, and the same relationship for the green use of these funds in Table 2.5. In both tables, column (1) only includes political contestability as a control variable, while column (2) adds the other control terms. Column (3) further includes the other key political economy variable: the political alignment between the region and the municipality. Columns (4) to (6) integrate additional control variables to test the robustness of the model. Column (4) considers the switch of the ruling political party, accounting for party name changes over time. Natural disasters, following the logic of Morvan and Paty [2024], are included in columns (5) and (6), with column (6) also adding the distance to the departmental capital. ‘

Table 2.4 thus considers the total amount of European funds, regardless of their

use. Political variables play a statistically significant role, with the degree of political contestability in close elections and the political alignment between regions and municipalities both positively affecting European funds allocation. Political contestability is captured by the Herfindahl-Hirschman index (HHI), ranging from 0 to 1. The closer the index is to 1, the less electoral competition there is, meaning one party dominates the vote. The statistically significant negative coefficient on the HHI indicates that a closely contested election, where votes are more fragmented, increases the amount of European funds received. This echoes the findings of Johansson [2003], Arulampalam et al. [2009], Bouvet and Dall'Erba [2010], and Dellmuth and Stoffel [2012]. While Muraközy and Telegdy [2016] emphasizes political alignment, their Table 5 adds both linear and quadratic vote differences. The statistical significance of the quadratic term supports our results, showing that beyond a certain level of political dominance, fewer EU funds are allocated. Finally, political alignment between the municipality and the region also positively impacts the receipt of European funds, regardless of the specification used in Table 2.4. This finding aligns with the literature (Solé-Ollé and Sorribas-Navarro, 2008; Veiga, 2012; Bracco et al., 2015; Muraközy and Telegdy, 2016, among others).

Local economic variables also play a role. The share of investment spending in municipal expenditures is negatively related to the use of funds, highlighting the importance of the local public investment model. This suggests that these funds function as a type of catch-up mechanism to balance local investment spending. The economic distribution of funds aimed at addressing economic disparities is also reflected in the economic variables, following Bouvet and Dall'Erba [2010] and Chalmers [2013]. There is a negative relationship between real estate prices and the proportion of homeowners among households, on the one hand, and the use of European funds, on the other. Finally, this underscores the role of population, as emphasized by Veiga [2012] and Corvalan et al. [2018], among others. It shows the significance of regional and departmental capitals, contrasting the relevance of dummies for metropolitan areas, particularly wealthy metropolises. The contrast is evident when compared to suburbs, which are populated by a higher share of foreigners. This is consistent with the findings of Dellmuth and Stoffel [2012] and Muraközy and Telegdy [2016].

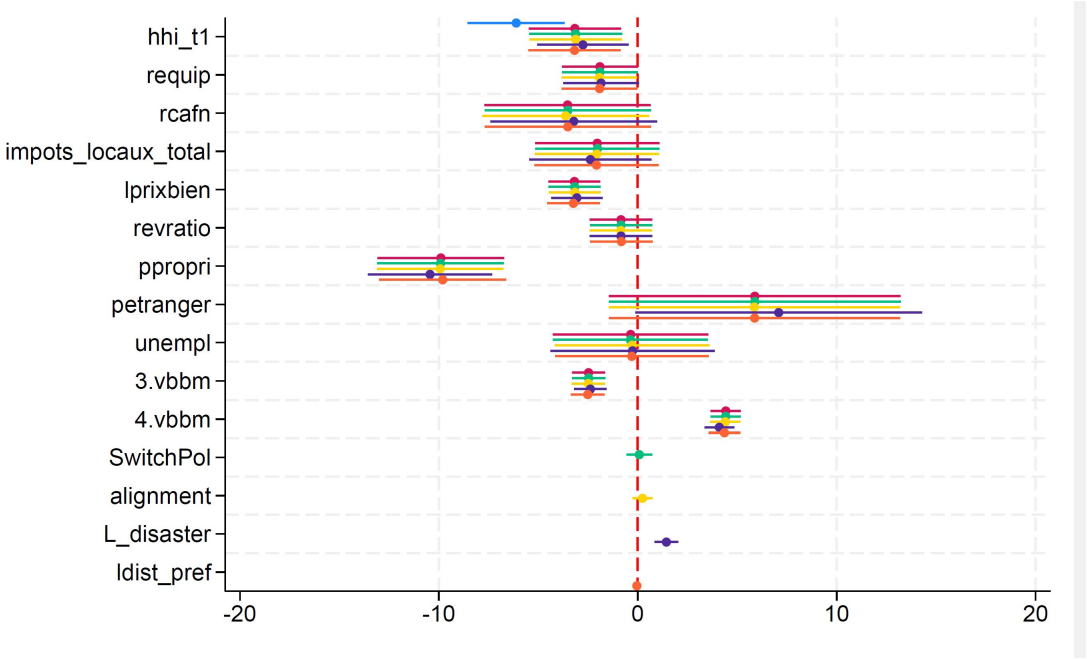
Table 2.4: Determinants of EU funds

	(1)	(2)	(3)	(4)	(5)	(6)
Political variables						
HHI	-6.109***	-3.164***	-3.312***	-3.326***	-2.904**	-2.916**
	(1.241)	(1.179)	(1.163)	(1.172)	(1.152)	(1.153)
Political alignment			0.956***	0.958***	0.954***	0.948***
			(0.307)	(0.307)	(0.303)	(0.304)
Local public finance variables						
Share capital exp.		-1.903**	-2.135**	-2.136**	-2.077**	-2.093**
		(0.966)	(0.972)	(0.973)	(0.975)	(0.976)
Share self-financing		-3.527*	-3.422	-3.427	-3.114	-3.102
		(2.126)	(2.130)	(2.131)	(2.136)	(2.139)
Share local taxes		-2.037	-2.158	-2.162	-2.502	-2.541
		(1.589)	(1.572)	(1.571)	(1.546)	(1.545)
Economic fundamental variables						
Log av. housing price		-3.184***	-3.077***	-3.081***	-2.953***	-3.010***
		(0.663)	(0.661)	(0.665)	(0.654)	(0.663)
Per cap. inc. ratio		-0.842	-0.578	-0.578	-0.580	-0.560
		(0.798)	(0.783)	(0.783)	(0.787)	(0.785)
Share homeowners		-9.898***	-10.136***	-10.129***	-10.679***	-10.577***
		(1.619)	(1.614)	(1.615)	(1.584)	(1.590)
Share foreigners		5.884	6.079	6.078	7.279**	7.273**
		(3.732)	(3.745)	(3.746)	(3.688)	(3.682)
Unemployment rate		-0.359	-0.557	-0.554	-0.459	-0.391
		(1.986)	(1.940)	(1.945)	(2.044)	(2.021)
Suburbs		-2.474***	-2.551***	-2.552***	-2.461***	-2.507***
		(0.424)	(0.423)	(0.423)	(0.416)	(0.421)
Wealthy major city		4.424***	4.181***	4.181***	3.857***	3.782***
		(0.383)	(0.393)	(0.393)	(0.390)	(0.410)
Switch politics				-0.027		
				(0.329)		
Lag natural disaster					1.439***	1.444***
					(0.305)	(0.305)
Log distance prefecture						-0.049
						(0.083)
Obs.	1906	1874	1874	1874	1874	1874
Adj R-squared	.014	.299	.303	.302	.313	.313

Notes: Robust standard errors in parentheses, clustered at the municipality level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 2.4 corresponds to a specific specification, with the dependent variable in $log(1 + Y)$ to account for cases where no European funds were allocated to municipality i in wave t. To quantitatively interpret the four models in Table 2.4, we use a Poisson Pseudo Maximum Likelihood (PPML) model. Figure 2.2 presents, for each line, the various control variables across the four models. While there are indeed differences between the estimates, this approach provides a good basis for comparison. Assuming the *HHI* ranges between 0 and 1, Figure 2.2 shows that a 10% increase in the HHI results in a roughly 40% decrease in the number of funded municipal projects. Compared to a large municipality with over 10,000 inhabitants, being in a suburban area reduces the amount of funds by approximately 2%, while being a wealthy metropolis increases it by 4%. Economic status is also reflected in the proportion of homeowners. With a coefficient of -10 in our PPML models, Figure 2.2 indicates that a 1 percentage point increase in homeownership leads to a roughly 10% decrease in the number of municipal projects funded.

Figure 2.2: PPML estimates for Table 2.4



Notes: The Figure plots the Poisson Pseudo Maximum Likelihood model for the specification in Table 2.4. 3.vbbm corresponds to "suburbs" and 4.vbbm corresponds to "wealthy major municipality".

Table 2.5: Green utilization of EU funds

	(1)	(2)	(3)	(4)	(5)	(6)
Political variables						
HHI	-5.660***	-2.713***	-2.728***	-2.690***	-2.480**	-2.451**
	(1.159)	(1.012)	(1.012)	(1.026)	(1.014)	(1.019)
Political alignment			0.096	0.090	0.095	0.109
			(0.277)	(0.280)	(0.276)	(0.276)
Local public finance variables						
Share capital exp.		-0.988	-1.012	-1.008	-0.976	-0.939
		(0.887)	(0.888)	(0.888)	(0.890)	(0.888)
Share self-financing		-2.844	-2.834	-2.820	-2.647	-2.677
		(1.982)	(1.984)	(1.985)	(1.973)	(1.970)
Share local taxes		-1.757	-1.769	-1.758	-1.977	-1.885
		(1.406)	(1.406)	(1.406)	(1.397)	(1.405)
Economic fundamental variables						
Log av. housing price		-2.825***	-2.815***	-2.804***	-2.739***	-2.604***
		(0.653)	(0.652)	(0.653)	(0.646)	(0.650)
Per cap. inc. ratio		1.243*	1.270**	1.271**	1.268**	1.221*
		(0.639)	(0.646)	(0.646)	(0.636)	(0.635)
Share homeowners		-5.878***	-5.902***	-5.919***	-6.231***	-6.473***
		(1.335)	(1.337)	(1.337)	(1.327)	(1.347)
Share foreigners		-6.680**	-6.661**	-6.657**	-5.933*	-5.920*
		(3.159)	(3.159)	(3.161)	(3.133)	(3.133)
Unemployment rate		2.118	2.098	2.091	2.158	1.998
		(1.682)	(1.685)	(1.683)	(1.738)	(1.789)
Suburbs		-3.259***	-3.267***	-3.264***	-3.212***	-3.102***
		(0.386)	(0.386)	(0.387)	(0.382)	(0.404)
Wealthy major city		7.498***	7.473***	7.473***	7.277***	7.455***
		(0.411)	(0.418)	(0.418)	(0.420)	(0.463)
Switch politics				0.075		
				(0.301)		
Lag natural disaster					0.873***	0.862***
					(0.270)	(0.269)
Log distance prefecture						0.117
						(0.099)
Obs.	1906	1874	1874	1874	1874	1874
Adj R-squared	.014	.332	.331	.331	.335	.336

Notes: Robust standard errors in parentheses, clustered at the municipality level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 2.5 mirrors Table 2.4 but now focuses exclusively on the green use of European funds for projects targeting only municipalities. Certain economic variables are more pronounced, such as the share of homeowners and the categorical variables for suburbs and wealthy major cities. The effects are quantitatively stronger, indicating that green use is likely closely tied to a higher level of development. The share of foreigners becomes negative, clearly indicating their potential role linked to deteriorated economic conditions. This highlights the disparities in the role of foreigners in fund allocation, following the same logic of the differentiated effects found by Muraközy and Telegdy [2016]. They find that the share of foreigners is positively related to funds, but only for private sector requests. More importantly, the political economy factors are altered, with the HHI still playing a major role in fund allocation, whether the funds are green or not. However, political alignment with the region no longer has any effect, which runs counter to traditional mechanisms. In other words, what the current literature captures in terms of political alignment applies only to the non-green use of intergovernmental funds.

2.4.3 Causality issues

We suspect the presence of reverse causality between political contestability and the receipt of European funds. Specifically, the allocation and use of European funds can affect political contestability in either direction. To mitigate this potential bias, we adopt an instrumental variable approach. A valid instrument allows us to estimate the causal effect of an endogenous explanatory variable on the dependent variable if, given the other control variables, it is associated with the endogenous explanatory variable (relevance condition) but not associated with the dependent variable (exclusion restriction). Our instrumental variable strategy employs local characteristics as exogenous drivers of EU funding allocation to instrument for political contestability.

One of our key contributions lies in the proposal of a new causal instrument. We suggest examining appeals made to the highest French legal institutions concerning public matters, specifically the Administrative Appeal Courts. We also use appeals to the *Conseil d'État*, the highest French court, as these appeals reflect the extent to which the petitioner is determined to be heard.

An appeal to these courts is suspensive, temporarily halting the project for a legally defined period. Thus, if one wishes to oppose a mayor's decision, the legal system can be considered a suitable tool (Chapus, 2008).[5] Appeals can be based on various grounds. On the Ariane website[6], we manually select the relevant cases, as simply mentioning the municipality's name or referencing the mayor or a municipal councilor is not sufficient. The municipality should not be cited solely because it is the location of the court handling the dispute, or because the municipality is mentioned only for geographical reference. We also exclude duplicate cases. Most importantly, we focus on disputes that involve local public matters within the authority of the mayor and the municipal council. For example, an appeal to prevent the deportation of a foreign national is not included in the analysis, whereas a challenge to the mayor's authority over the municipal council is. Given the potential exclusion restriction, the number of political appeals is expected to be uncorrelated with the number of projects co-financed by the European Union.

We consider the number of political appeals from January 1, 2001, to the end of March 2008, thus including the municipal elections held from March 11 to 18, 2008, for the first period. For the second period, we use data from April 1, 2008, to March 30, 2014, covering the elections held from March 23 to 30, 2014. These initial appeals are linked to the HHI measure from the 2008 local election, while the appeals from the second period are associated with the HHI from the 2014 election. These appeals reflect how political opposition manifests itself to obstruct the efficiency of the current mayor's public decisions, thereby acting as a local political tool. One might question reverse causality, where the 2001 (or 2008) election could lead to appeals between 2001 and 2008 (or 2008 and 2014). However, the appeals are intended to discredit the mayor's authority and hinder their actions. Winning these appeals, or simply filing them, serves as a political communication strategy for opponents. Therefore, the purpose is not to reward voters who supported them, but rather to gain visibility with the electorate for the next election cycle.

[5] In practice, it is rare for administrative courts to sanction petitioners for abuse of the legal process (*"recours intenté à des fins dilatoires"*), so we can reasonably assume that potential petitioners are free to file these appeals. Judicial practices may vary regionally on this matter, meaning such abuses cannot be used as an alternative instrument.

[6] https://www.conseil-etat.fr/decisions-de-justice/jurisprudence/rechercher-une-decision-arianeweb

We use the number of appeals as an instrument, without considering whether the appeal was won or lost, for several reasons. First, it is sometimes difficult to clearly determine whether an appeal was definitively won or lost, adding an element of arbitrariness. Second, the expected political impact is not so much in the victory of the appeal, but in the temporary suspension of the project and the associated political communication. To validate the importance of this instrument, we distinguish political appeals based on (i) the source of the appeal and (ii) whether it specifically concerns the municipal election or other political issues. Regarding the source of the appeal, we differentiate between appeals originating from the mayor's office and those filed by the local opposition.

Figure 2.3 highlights the importance of this instrument and its various subcategories in relation to political contestability. We graphically represent the number of these appeals against the political contestability measure (HHI) for the corresponding election in the given wave. The top-left graph, labeled A, corresponds to the total number of local political appeals. The top-right graph, labeled B, and the bottom-left graph, labeled C, differentiate the appeals based on their source. The final graph, at the bottom right, labeled D, includes only cases specifically related to the municipal election. In all these cases, the correlation is negative. The number of appeals is negatively related to the HHI, indicating a strong fragmentation of political parties and, consequently, greater political competition. This is particularly evident in case B, where the opposition files the appeal, and in case D, where the election itself is contested.

Figure 2.3: Appeals and political contestability

Notes: 95% confidence intervals.

We thus proceed with the 2SLS estimator, using $Appeals_{it-1}$ as the main instrumental variable. We further break down this instrumental variable into the categories mentioned above, based on (i) all political appeals, (ii) appeals filed by the opposition, (iii) appeals filed by the mayor's office, and (iv) appeals specifically regarding the municipal elections.

Formally, we estimate the following model:

$$\begin{aligned} Y_{it} &= \alpha + \beta' X_{it} + \gamma \hat{HHI}it + \epsilon it \\ HHI_{it} &= \delta + \theta Appeals_{it-1} + \zeta' X_{it} + \eta_{it} \end{aligned} \tag{2.2}$$

where $\hat{HHI}$ corresponds to the political contestability orthogonal to factors related to the use of European public funds. We also consider different outcomes for Y, following the specification of the previous tables, by examining, on the one hand, the total amount of funds and, on the other hand, the amount of funds specifically allocated to green projects.

2.4.4 Main results

Tables 2.6 and 2.7 present the previous model from 2.2, showing the second stage. Table 2.6 separates the total amount of European subsidies regardless of their use, while Table 2.7 focuses solely on the amount allocated to green projects. Both tables maintain the breakdown of the proposed instrument. Column (1) uses the total number of political appeals during the period preceding the election. Column (2) considers only appeals filed by the mayor's office, while column (3) includes only appeals from the opposition. Column (4) focuses exclusively on appeals specifically related to the municipal election.

Both Tables 2.6 and 2.7 demonstrate the strength of this causal instrument. This holds true across the different appeal origins. However, column (4), which represents appeals related to the election, is only statistically significant at the 10% level in the case of green EU funds, and not significant at all for the total EU funds. This can be explained by two main factors. First, there are far fewer election-specific appeals compared to other political appeals. Challenging an election usually involves accusations of fraud or specific actions within the local political landscape. Second, it may also reflect a strong action that is not easily appreciated by voters, as it occurs immediately after the election. Unless it leads to a new vote, it has little effect on political contestability.

Tables 2.6 and 2.7 also highlight the importance of political economy variables. Political contestability remains a significant factor, driving an increase in European funds, with the *HHI* consistently showing a negative and significant coefficient. This holds true for both green funds and general funds. However, political alignment continues

to have a statistically significant positive effect only for the undifferentiated use of funds by municipalities. There is no impact of political alignment on the green use of funds, confirming the results already obtained in subsection 2.4.2.

Both tables reveal few notable differences. The share of local taxes, and thus the heavy reliance on local tax funding, is negatively related to European subsidies, suggesting that municipalities may separate tax-funded projects from those co-financed by the EU. The average real estate price in the municipality and the fact of being a suburb negatively affect the number of European projects awarded.

However, there are disparities between these variables regarding the green use of funds versus undifferentiated use. Being a rich or poor metropolis significantly impacts the green use of funds, indicating that the "greening" of funds is primarily a concern for wealthier municipalities. Similarly, being a suburb or having a high proportion of foreigners in the economy drastically reduces the likelihood of using funds for green projects.

Table 2.6: Second stage - All utilization of EU Funds

	(1)	(2)	(3)	(4)
Dep. Variable	Amount of local projects per city			
IV	All appeals	Appeals by the mayor	Appeals by the opposition	Appeals for the election
HHI	-37.042***	-50.851**	-34.546***	-9.813
	(9.377)	(19.818)	(9.496)	(9.656)
Political alignment	1.360***	1.524***	1.330***	1.036***
	(0.404)	(0.501)	(0.397)	(0.328)
Share capital exp.	-1.748	-1.615	-1.772	-2.011**
	(1.270)	(1.523)	(1.232)	(0.985)
Share self-financing	2.126	4.245	1.743	-2.054
	(3.040)	(4.256)	(2.999)	(2.551)
Share local taxes	-6.488***	-8.101**	-6.197***	-3.309*
	(2.331)	(3.274)	(2.297)	(1.927)
Log av. housing price	-3.167***	-3.254***	-3.152***	-2.996***
	(0.855)	(1.012)	(0.831)	(0.662)
Per cap. inc. ratio	-2.542**	-3.336*	-2.398*	-0.977
	(1.292)	(1.896)	(1.245)	(1.012)
Share homeowners	-8.618***	-7.784***	-8.768***	-10.262***
	(2.066)	(2.673)	(2.009)	(1.679)
Share foreigners	-3.771	-8.241	-2.964	5.042
	(5.270)	(8.271)	(5.169)	(4.916)
Unemployment rate	-3.193	-4.300	-2.993	-1.012
	(3.717)	(4.779)	(3.571)	(2.361)
Suburbs	-1.870***	-1.631**	-1.913***	-2.341***
	(0.534)	(0.688)	(0.522)	(0.444)
Wealthy major city	1.222	0.156	1.415	3.324***
	(0.900)	(1.661)	(0.897)	(0.845)
Lag natural disaster	0.762*	0.488	0.811*	1.302***
	(0.445)	(0.617)	(0.434)	(0.360)
Obs.	1874	1874	1874	1874

Notes: Robust standard errors in parentheses, clustered at the municipality level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 2.7: Second stage - Green utilization of EU Funds

	(1)	(2)	(3)	(4)
Dep. Variable	Amount of green local projects per city			
IV	All appeals	Appeals by the mayor	Appeals by the opposition	Appeals for the election
HHI	-44.026***	-55.698**	-41.916***	-16.545*
	(10.895)	(23.651)	(10.684)	(9.392)
Political alignment	0.589	0.728	0.564	0.262
	(0.430)	(0.549)	(0.419)	(0.310)
Share capital exp.	-0.576	-0.464	-0.596	-0.841
	(1.340)	(1.586)	(1.300)	(0.943)
Share self-financing	3.730	5.522	3.406	-0.488
	(3.364)	(4.855)	(3.298)	(2.547)
Share local taxes	-6.829***	-8.192**	-6.582***	-3.620**
	(2.517)	(3.603)	(2.476)	(1.813)
Log av. housing price	-3.000***	-3.074***	-2.987***	-2.828***
	(0.869)	(1.009)	(0.847)	(0.660)
Per cap. inc. ratio	-1.119	-1.790	-0.998	0.460
	(1.232)	(1.895)	(1.190)	(0.869)
Share homeowners	-3.722*	-3.017	-3.850*	-5.382***
	(2.073)	(2.761)	(2.008)	(1.451)
Share foreigners	-19.380***	-23.158***	-18.697***	-10.486**
	(5.522)	(8.946)	(5.418)	(4.398)
Unemployment rate	-1.171	-2.106	-1.002	1.031
	(3.882)	(4.910)	(3.750)	(2.377)
Suburbs	-2.493***	-2.291***	-2.530***	-2.968***
	(0.566)	(0.729)	(0.554)	(0.431)
Wealthy major city	4.070***	3.170	4.233***	6.192***
	(1.039)	(1.983)	(1.007)	(0.821)
Lag natural disaster	0.048	-0.183	0.090	0.594*
	(0.448)	(0.645)	(0.439)	(0.339)
Obs.	1874	1874	1874	1874

Notes: Robust standard errors in parentheses, clustered at the municipality level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

2.4.5 Robustness

We show that our results are robust to a variety of tests. Table C.1 shows how our results are affected by accounting for the win margin or the residual HHI when considering election results to gauge contestability within the opposition. We take the share of all political opponents, except the winner, recalculate the weighted shares, and then apply the same HHI procedure. Table C.2 shows how our results are not sensitive to using the total financed public investment rather than focusing solely on the amount of the European subsidy. Columns (3) and (4) expand the recipients to include all beneficiaries, not just municipalities, while columns (5) and (6) consider only national and subnational recipients, excluding municipalities. Finally, columns (7) and (8) take into account the European funding rate. Political alignment only plays a role in cases where the region could potentially contribute additional funds to the European ones. The use of these funds may thus limit the region's deployment of its own public resources. Lastly, Table C.3 reuses the PPML model, as in Figure 2.2, by multiplying the alternative dependent variables. The share of green funding in European funds shows no significant relationship with political economy variables, likely due to the sharp decrease in observations for this variable.

2.5 Conclusion

We have examined the uneven distribution of EU structural funds among French municipalities using a database of EU structural funds in France spanning from 2007 to 2020. We identified funds which are likely to have a positive impact on the environment, according to their thematic focus and were categorized as "green investments," which were primarily allocated to the transportation, biodiversity, and building sectors. Our findings indicate that the political economy of municipalities play a significant role in the allocation of structural funds and their utilization for green purposes.

First, we find that the green use of these funds is far from being a priority for public agents at the municipal, intermediary, or state levels. Municipalities remain the main drivers of green projects, although it is unclear whether this is due to a lack of political will or other factors. The specific competencies of municipalities may also favor the green use of these European funds. Nonetheless, we primarily build on the political economy literature regarding intergovernmental subsidies, which em-

phasizes political alignment across different levels of government and intense political competition during elections as triggers for these funds.

Second, we highlight that only intense political competition, rather than political alignment, drives the green use of these funds. This underscores the significance of political competition across various levels and suggests that electoral rivalry may push local policymakers to adopt greener projects, even against their initial preferences. Finally, this analysis could be extended to the role of local lobbying, whether from "brown" or "green" interest groups, in shaping the use of European funds. The impact of lobbying has been theorized by Besley and Persson [2023], offering another testable prediction. The analysis could also be extended to firms applying for European subsidies, exploring potential reciprocal favoritism between private firms and municipalities, as discussed by Delatte et al. [2019].

While our methodology allowed us to identify green investments in the EU structural funds database for French municipalities, we cannot assess the extent to which these investments have improved their environmental performance. Specifically, we are unable to determine whether they have led to increased carbon capture, reduced greenhouse gas emissions, or improved energy efficiency. Access to ex-post impact data is essential to accurately evaluate the effectiveness of these projects, including their potential to mitigate emissions and enhance biodiversity. Future research should therefore focus on ex-post assessments to measure the environmental impact of European structural funds.

Chapter 3

ECB's Climate Speeches and Market Reactions

Summary of the chapter

This chapter study the impact of the European Central Bank's (ECB) climate related speeches on European stock markets. Using the database of 2594 speeches between 1997 and 2022 of the European Central Bank, we employ advanced textual analysis techniques, including keyword identification and topic modeling, to isolate speeches related to climate change. We then conduct an event study to estimate the differences in abnormal returns of a large panel of listed companies in response to the European Central Bank's speeches on climate change. Our analysis reveals that the ECB's communication on climate issues has intensified significantly since 2015. Using topic modelling methods, we classify climate speeches into two main themes: (i) green finance and economic policies, and (ii) climate-related risks The event study shows that financial markets tend to reallocate portfolios towards greener ones in the days following the ECB's climate speeches. Our results show that following a climatic speech by the ECB, green financial markets are benefiting from positive abnormal returns by around 1 percentage point. More specifically, we find that climate speeches dealing with green monetary policy and other economic policy instruments have a larger effect on green stock prices than speeches dealing with different types of climate risk[1].

[1]The author is grateful to Amélie Barbier-Gauchard, Christophe Godlewski, Pierre Lesuisse, Samuel Ligonnière, and Corentin Roussel for their helpful comments and suggestions. The author would also like to thank the participants and discussants at the following conferences/workshops and seminars: Environmental Economics (Orleans), EconomiX, FAERE Conference
This Chapter is published as a BETA Working Paper:

3.1 Introduction

On July 4, 2022, the European Central Bank (ECB) announced that it would integrate environmental criteria into its asset purchase policy (Quantitative Easing or QE). The introduction of environmental criteria in the conduct of monetary policy sends a strong signal to all financial markets and contrasts with the ECB's old pillar of sectoral "neutrality". The July 4, 2022 announcement follows the ECB's major strategic review presented by its president, Christine Lagarde, which promised to "integrate climate change considerations into monetary policy". From October 2022, the financial institution of the Euro Area will shift its bond portfolio to companies with "good climate performance". The stated objective is to reduce the financial risk related to climate change in the Euro system's balance sheet and to support the ecological transition of the economy.

Central banks increasingly recognize climate change as a source of financial risk (Carney, 2015; Network for Greening the Financial System, 2019). Climate change and its environmental damages are indeed, likely to have direct consequences on price stability due to their impact on food and energy prices [Gallic and Vermandel, 2020]. Since the Bank of England Governor's speech, many economists have been calling for central banks to "green" their monetary policy. Thus, a dedicated field of literature proposes mechanisms to integrate climate change-related financial risks into the conduct of monetary policy by central banks. Whether through the implementation of green quantitative easing (Dafermos et al., 2017, Campiglio, 2016), or through the integration of climate risks into micro and macro prudential supervision [Boneva et al., 2022]). But one aspect of central bank action regarding climate change is still relatively new in the literature on central bank climate action: communication.

The literature has focused on identifying the climate discourse of central banks, using various methods such as dictionary approaches or topic modelling techniques (Arseneau et al., 2022 ; Arseneau et al., 2022). The results show that central banks with an explicit mandate to fight climate change engage more regularly in climate discourse [Arseneau and Mitsuhiro, 2023]. The results also show that central banks deal with several climate change-related themes : risk, sustainable development, green finance (Campiglio et al., 2023 ; Arseneau et al., 2022) Companies with good environmental performance are positively affected by these discourses (Neszveda and Siket, 2023 ; Campiglio et al., 2023). Campiglio et al. [2023] tests the climate speeches impact of over a hundred central banks on data from American companies.

Regarding the ECB's climate speeches in particular, Neszveda and Siket [2023] are developing a green sentiment index to measure the climate intensity of ECB speeches. They examine whether the ECB's green speeches cause a significant divergence in stock returns depending on how companies perform in terms of emissions reduction. They find that the green tone of the ECB positively (negatively) affects the most (least) eco-friendly firms based on their emissions However, the autors do not distinguish between the different types of climate discourse (green finance and policies, climate-related risks), which may have different effects. An in-depth analysis of the ECB's climate speeches is interesting for at least two reasons. Firstly, the ECB has made the most speeches over the period 1997-2021 [Arseneau et al., 2022]. Secondly, it stands out from the FED for its pro-active policy in the fight against climate change [DiLeo et al., 2023].

In this chapter, we provide a European perspective on the impact of central bank climate speeches using stock market indices covering the EU as a whole and focusing on ECB speeches. To identify climate-related speeches given by the ECB, we use a keyword approach as well as topic modelling models to identify narratives characterized by distinct lexicons. To evaluate the impact of climate-related speeches by the ECB on European financial markets using an event study, we will use a diverse set of stock indices that capture a broad spectrum of the market. The selected indices for this study include a mix of benchmark and green indices, each providing insights into different segments of the european stock market.

Our findings indicate that the European Central Bank (ECB) has increasingly addressed climate change in its communications since 2015, coinciding with the Paris Agreement. Out of the 2,652 speeches analyzed from 1997 to 2022, 132 focused on climate change, with three-quarters of these delivered after 2015. The textual analysis, utilizing topic modeling, further reveals that the ECB discusses various dimensions of climate change, including climate risks and the future of monetary policy in this context. We categorize climate-related speeches into two primary groups: (i) those aimed at guiding stakeholders to adapt to upcoming public policy changes and their implications, and (ii) those providing insights into the economic state regarding climate-related risks (both physical and transition risks) and the opportunities arising from climate change.

The event study we propose, try to discern market reactions surrounding ECB climate speeches, particularly focusing on green stock market indices. We observed abnormal returns within these indices during the post-speech event window implied a market inclination towards green portfolios, with sustained effects beyond the immediate post-event period. Overall, all climate-related speeches result in positive CARs (Cumulative abnormal returns), indicating a general market inclination towards green assets following the ECB's communication. Green finance and policies speeches, which focus on specific financial instruments and policies supporting sustainability, lead to significant increases in CARs, suggesting that investors respond positively to these targeted messages. In contrast, climate-related risks speeches produce more moderate CARs.

The results of this study have important implications for the ECB communication strategy and its role in sustainable finance. Positive market reactions to climate-related speeches, particularly those on green finance and policies, indicate that ECB messages are perceived as important by investors. This suggests that the ECB can use its communication strategy to influence market behavior and support the shift to sustainable investments.

The remainder of the chapter is organized as follows: Section 3.2 reviews the literature on central banking communication and climate change. Section 3.3 presents the methodology to identify climate speeches. Section 3.4 presents the econometric strategy of our event study. Section 3.5 presents the main results. Section 6 concludes and discusses the policy implications of the results.

3.2 Literature review

Our research question is at the crossroad of two strands of the literature: (i) analysis of central bank communications regarding climate change and (ii) impact of environmental policies events, news, announcement on financial market.

3.2.1 Central bank communication

Central bank communication is a tool for transmitting central bank actions to the real economy. Beyond this aspect, the communication of central banks is also a determinant of the public's perception of the institution itself.

Exploring the communication strategies of central banks is compelling for a couple of significant reasons. Firstly, such strategies are increasingly acknowledged as crucial in shaping macro-financial dynamics (Blinder et al., 2008 ; Haldane and McMahon, 2018). Through public statements and announcements, which are meticulously analyzed by the financial markets, central banks guide expectations about future economic conditions, influencing asset prices considerably (Altavilla et al., 2019; Ehrmann and Talmi, 2020). Over the years, their role in macroeconomic and financial dynamics has become more pronounced, intensifying economies' reliance on their policy announcements (Issing, 2005). Secondly, the communication of central bankers plays a pivotal role in establishing their legitimacy and bolstering their accountability—an important balance to their independence from political bodies [Moschella et al., 2020].

The study of the impact of central banks communication on the economy and finance has been extensive and varied. For instance, Guthrie and Wright [2000] examined the use of central bank statements instead of open market operations to implement monetary policy in New Zealand. Additionally, several studies, such as Demiralp and Jorda [2004], Ehrmann and Fratzscher [2004] and Haan and Jansen [2006], have used dummy variables to classify days based on the presence or absence of central bank communication. Haan and Jansen [2006] also looked at the effect of central bankers' comments on interest rates, inflation, and economic growth in the Eurozone. Gerlach [2007] also discussed the impact of interest rate-related statements made by the ECB, using a subjective dummy classification of the statement.

With respect to climate communication of central banks, Arseneau et al. [2022] use language processing techniques by analyzing a corpus of 17,000 central bank speeches to identify climate-related speeches. Their study concludes that (i) global warming-related communications have been growing exponentially in recent years, (ii) Central banks are communicating on a variety of sub-themes related to global warming: impact of climate on the economy, implications for price stability, sustainable finance... (iii) Central banks tend to use speculative language regarding global warming, language that indicates uncertainty. Arseneau and Mitsuhiro [2023] investigate the influence of central bank mandates on communication about climate change, using a comprehensive dataset of central bank speeches. The analysis reveals that central banks with explicit sustainability objectives frequently address climate change directly within the scope of these objectives. In contrast, central banks with

indirect or no sustainability objectives discuss these issues within the broader context of their traditional mandates, such as financial and price stability. Deyris [2023] focuses on the ECB's communication, in addition to using speeches to identify climate issues, he also looks at exchanges with the European Parliament and conducts semi-structured interviews. Neszveda and Siket [2023] develops a green sentiment index. Using extra-financial data from French, German and Italian companies, they show that climate-related speech has a positive (negative) impact on the most (least) eco-friendly companies. Campiglio et al. [2023] investigates the role of central banks in the climate change discourse through their public communication strategies. The authors analyze a novel dataset of 32,359 speeches from 131 central banks spanning from 1986 to 2021. By applying natural language processing techniques, they identify three key narratives related to climate change: sustainable development, green finance, and climate-related financial risks. The study finds that central bank communication on climate issues is largely influenced by institutional factors rather than by a country's exposure to climate risks. Additionally, the paper demonstrates that more frequent and intense climate-related communication by central banks positively impacts the stock performance of firms with better environmental scores.

3.2.2 Market reactions to climate-related policy announcements, news and events

The event study method was first introduced by Ball and Brown [1968] and Fama et al. [1969] as a way to analyze the impact of emergencies on financial markets. It is based on the assumption that any effects will be quickly reflected in changes in prices shortly after the event [Liu et al., 2020]. This method has been commonly used to study the effect of environmental measures on stock prices, with an emphasis on market reactions to environmental behaviors and policies (Klassen and McLaughlin, 1996 ; Jacobs et al., 2010). Recent research has also focused on market responses to the implementation of environmental policies (Chen et al., 2021; Li et al., 2021; He and Liu, 2018) and has found that capital markets tend to react differently to different types of policies. Environmental regulations have been found to have a negative impact on market returns, particularly in industries that are sensitive to environmental issues [Albrizio et al., 2017] as they are perceived as a cost burden and a threat to competitiveness [Stucki, 2019] due to the increased costs of meeting compliance standards [Clarkson et al., 2004] and the additional expenses of environmental supervision [Shen et al., 2017]. If investors are not optimistic about a

company's investment prospects, they are more likely to sell their stock [Baker et al., 2012]. When local governments issue corresponding policies and measures to enforce environmental regulations after a central government policy is implemented, it can affect productivity and force firms to use resources for non-productive purposes [Christainsen and Haveman, 1981] leading to stock price declines in industries that are sensitive to environmental issues [Zhao et al., 2018] as investors seek to avoid potential negative risks [Wang et al., 2019]. Following the devastating 2011 earthquake in Japan, German Chancellor Angela Markel was the first to commit to the suspension of several nuclear reactors that led to a spike in carbon prices[2] . Financial markets are therefore able to anticipate future changes in energy prices as a result of political speeches and incorporate these future decisions into their portfolio. Krueger et al. [2020] contend that investors might adjust their portfolio allocations away from industries with a high environmental impact toward sectors that are more environmentally sustainable due to climate risk factors. Lin and Zhao [2023] assesses the impact of the Carbon Border Adjustment Mechanism (CBAM) announcements on Chinese financial markets. Their main estimation findings suggest that the CBAM event had a negative impact on both steel rebar and aluminum futures.

By integrating these two strands of literature, this chapter investigates how ECB communication related to climate change, influence financial market reactions. The literature on central bank communication (e.g., Blinder et al., 2008; Haldane and McMahon, 2018; Altavilla et al., 2019; Ehrmann and Talmi, 2020) demonstrates that central bank statements and announcements play a crucial role in shaping market expectations and, consequently, in driving asset prices. Conversely, the literature on market reactions to environmental policies and events (Ball and Brown, 1968; Fama et al., 1969; Chen et al., 2021; Krueger et al., 2020) highlights how environmental announcements and events can lead to significant and immediate impacts on stock prices. This chapter intersects these fields by examining how climate-related communications from the ECB can act as signals of forthcoming environmental policy and new risks, thereby influencing investor behavior and asset prices.

[2]https://www.businessgreen.com/news/2033960/carbon-price-spikes-japan-nuclear-crisis

3.3 ECB climate speeches: identification and analysis

The first sub-section presents the ECB speech database, discusses the various options for identifying climate speeches and presents the chosen methodology. The second sub-section consists of a descriptive analysis of the speeches identified as dealing with climate change.

3.3.1 Identification of ECB climate speeches

On its website, the ECB provides a database of all speeches made by ECB officials between 1997 and 2022[3]. The ECB provides information on the date of the speech, the speaker, the title of the speech, the subtitle of the speech (generally the place and context of the speech) and the full content of the speech. After filtering out the speeches (speeches without content) we end up with 2,594 speeches between 1997 and 2022. Table D.1 in the appendix provides the complete database structure.

We are therefore only studying official ECB communication, and not other aspects of ECB communication (social networks, media transcripts, press conferences). Reading the speeches database gives us an idea of the diversity of ECB communications. These range from opening speeches at a research conference, to a lecture at an economics master's degree, to a meeting with a member state finance ministry. A glance at the titles of the papers reveals that the ECB communicates on a wide variety of subjects. The ECB can discuss artificial intelligence, the digital euro, inflation, the history of the euro and new macroeconomic theories. As the ECB communicates only in English, it is impossible to distinguish between speeches addressed "to the markets" and those addressed "to the people" [Moschella et al., 2020]. Figure 3.1 shows the evolution of ECB communications over time. There is a general upward trend in communication, with peaks observed during the financial crises (2007-2008).

We define a climate-related speech as a speech given by an official (by the Presidents, Vice-Presidents and Board Member) of the ECB that discusses the impact of climate change on the economy and/or the financial system but also the risks and opportunities generated by global warming adaptation and mitigation policies as well as the

[3]Some of the oldest speeches predate the existence of the ECB and were given by the president of the European Monetary Institute.

potential climate action of the central bank (i.e. the actions it could implement as part of its mandate to fight climate change in its own way). As described by Arseneau et al. [2022] there are three approaches in text analysis to classify text with respect to a topic.

The first is unsupervised topic models. When the researcher is not familiar with the topics present in the corpus, unsupervised topic models can be an effective way to organize a large amount of text into a more manageable set of categories, known as dimension reduction. One commonly used topic model is Latent Dirichlet Allocation (LDA), introduced by Blei et al. [2003], which has a simple structure and can be easily applied for dimension reduction. However, it may not be suitable for identifying text related to a specific and relatively new topic like climate change. These methods seek to discern the principal themes within a text corpus by examining the combined likelihood of word occurrences. However, topic modeling may not be suitable for our objective. Given its unsupervised nature, there is no assurance that the topic of climate will be recognized as one of the themes.

As an alternative, supervised machine learning techniques such as text regression or the Naive Bayes Classifier can be used. These methods are appropriate when the researcher knows the topics of interest and has a small sample of texts related to them. However, in this case, there is no initial set of speeches that have been identified as climate-related to use as a training set [Arseneau et al., 2022]. Indeed, due to the sparse presence of the target topic within the collection of speeches, adequately training the algorithm would require manually labeling a substantial volume of speeches. Considering the average length of texts in our corpus, we do not view this as a viable approach.

Another approach is the dictionary approach, which involves using a pre-established dictionary or set of keywords to classify texts into known categories. This approach is best when there is a strong and reliable belief that a certain topic is present in the text but information to identify it is limited. This approach is promising for identifying climate-related speeches. This technique requires researchers to create or use an existing list of relevant keywords or sentences, search for them in the corpus, and establish a threshold for a speech to be considered relevant.

As our research question relates more to the impact of climate speeches than to the improvement of methods for identifying climate speeches, we rely largely on combinations of pre-existing dictionaries. One from the World Bank [2018] related to the environment in general and those of Arseneau et al. [2022] and Campiglio et al. [2023] dedicated to identifying climate speeches in central bank communications. We have grouped them together to produce a dictionary of 200 expressions relating to climate change. Expressions are preferred to individual keywords, as they help avoid false positives. The keyword "climate" is often associated with the expressions business climate or climate of confidence, which do not reflect the climate change theme. We carry out several tests, removing expressions that have no occurrences and removing false positives. Our process has removed more than a hundred expressions, and although conservative, this method allows us to avoid false positives. Table 3.1 shows the 83 final expressions used and their occurrences in the speeches.

Table 3.1: Dictonnary of climate-related expressions and counting by occurrence in the 2594 ECB speeches (1997-2022)

Expression		
abrupt transition (2)	carbon emission (42)	carbon emissions (41)
carbon price (28)	carbon prices (15)	carbon pricing (13)
carbon tax (17)	carbon taxes (8)	climate action (15)
climate change (520)	climate crisis (36)	climate data (5)
climate event (3)	climate events (3)	climate exposure (3)
climate exposures (2)	climate finance (2)	climate goals (7)
climate hazard (1)	climate hazards (1)	climate impact (2)
climate policies (20)	climate policy (8)	climate protection (3)
climate related (2)	climate risk (135)	climate risks (95)
climate scenario (10)	climate scenarios (8)	climate science (1)
climate shock (1)	climate shocks (1)	climate stress test (36)
climate stress tests (3)	decarbonise (5)	disorderly transition (6)
environmental risk (110)	environmental risks (99)	global warming (27)
green bond (80)	green bonds (62)	green economy (3)
green finance (30)	green investment (20)	green investments (10)
green swan (16)	green swans (6)	green technologies (16)
green technology (1)	green transition (129)	green transitions (1)
greener (43)	greenhouse (38)	greening (19)
low carbon (2)	physical risk (36)	physical risks (29)
stranded asset (8)	stranded assets (8)	sustainable finance (33)
transition risk (51)	transition risks (43)	

3.3.2 Analysis of ECB climate speeches

Starting from the initial database of 2594 speeches, our keyword approach allowed us to identify 132 speeches related to global warming (see table 3.2). Table D.2 in the appendix gives an overview of the speeches identified as relating to climate change.

Table 3.2: Disassociation of climate-related and non climate-related speeches, 1997-2022

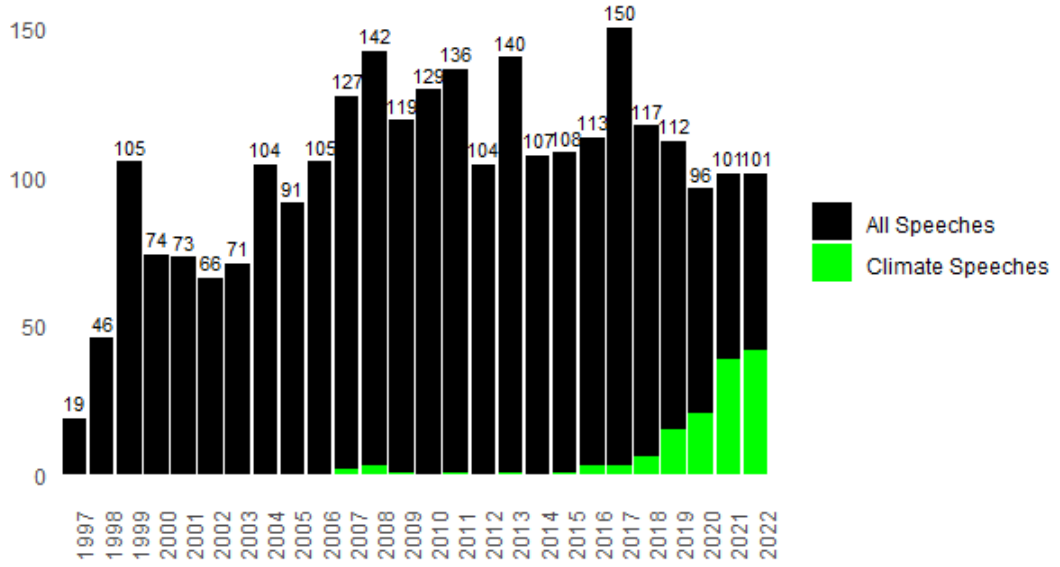
	Number of Speeches
Non Climate-related speeches	2462
Climate-related speeches	132
All speeches	2594

It can be seen that the ECB has been communicating on this subject for a long time, having already mentioned it in 2007. On the other hand, there has been an exponential increase in communication on this subject since 2015, coinciding with the Paris agreements (2015). Since then, the ECB has not stopped communicating on this subject, peaking in 2022 with over 40 speeches dealing with climate.

Climate speeches reveals a strong concern for various aspects of climate and the environment. The most frequent expression is *climate change* with 520 occurrences. Climate risks also feature prominently, with terms such as *climate risk*, *physical risk* and *transition risks*. Transitions towards greener practices are highlighted with *green transition*, *decarbonise* or *climate scenarios*. Financial tools related to green transition are also frequently used, notably *green bonds* and *sustainable finance*. Figure D.1 in appendix shows the cloud of words most frequently used in ECB climate speeches. We can already see that these speeches don't seem to stray too far from traditional central bank communication, with the prevalence of the terms *inflation*, *interest rates*, *markets* and *expectations*. To verify that the intensification of climate change-related speeches is not simply the result of an intensification of central bank communication, figure 3.1 shows the ratios of climate-related rhetoric. It can be seen that the proportion of climate-related speeches has risen steadily, and that in almost 40% of speeches in 2021, the ECB mentioned climate change.

Simple identification of the ECB's climate speeches is not enough. We seek to understand what exactly the ECB is talking about when it comes to climate change. Table D.2 in appendix provides a sample of the 132 speeches identified as dealing

Figure 3.1: Trends in the intensity and nature of ECB communications, 1997-2022



with climate change by our keyword methodology. It is interesting to note that beyond the common theme of climate change, the speeches are extremely varied.

Finally, we could classify climate-related speech into two broad categories: (i) those that seek to have agents integrate the changes in monetary policy that will take place over the next few years with the aim of integrating climate change , and discuss their implications (*Climate Change and Central Banks,Christine Lagarde, 2021.*), and (ii) those that seek to provide agents with information on the state of the economy regarding risks (physical and transitional) and opportunities generated by climate change (*Speaking notes on climate-related risks,* Luis de Guindos, 2019). The first category of speeches is linked to the anchoring of expectations. Forward guidance [Bernanke and Sack, 2004] is a tool used by central banks to influence the expectations of economic agents by communicating the central bank's intentions regarding future monetary policy. The second category of speech directly echoes the notion of central bank transparency. A central bank's transparency can be defined as the fact that it communicates the information at its disposal to other economic agents [Barbier-Gauchard et al., 2018].

To understand the different types of climate speech in more detail, we run a topic model on these 134 speeches (see table 3.3). As briefly mentioned earlier, topic models are unsupervised algorithms designed to identify hidden topics within a corpus.

They treat each document as a 'bag of words' and classify them based on the co-occurrence probabilities of terms. The underlying idea is that if two words frequently appear together, they are likely thematically related. After categorizing words into latent topics, the model can represent each document as a mixture of these topics, revealing its underlying themes. This approach enables the analysis of how overall topical interests have evolved over time and across different contexts. We use the latest version of the Latent Dirichlet Allocation (LDA) algorithm developed by Blei et al. [2003]. The beta values in LDA topic modeling represent the probability that a word is associated with a particular topic. The higher the beta value, the more important the word is for that topic.

These results should be compared with those of Arseneau et al. [2022] and Campiglio et al. [2023] which also seek to identify the different themes addressed in the climate speeches of central banks. Arseneau et al. [2022] identify ten topics: financial stability; macroprudential policy; Climate Impact/Transition; Supervision and Regulation; Financial System; Sustainable Finance; Financial Innovation; Asset Allocation; Monetary Policy; and Central Bank Mandate. Campiglio et al. [2023] identify three topics: sustainable development, green finance and climate-related risks. The explanation for our different topics can be found in the fact that they use the speeches of 131 central banks over the period 1986-2021. They therefore capture a greater variety of speeches. In addition, the ECB has distinguished itself from other major central banks [DiLeo et al., 2023] by its declared intention to be a major player in climate policies.

Table 3.3: Top 15 Terms in each topic for the 132 ECB climate speeches (2006-2022)

Green finance and policies	β	**Climate-related risks**	β
monetary policy	0.0267390	climate change	0.0224933
green bonds	0.0214702	climate related	0.0123096
carbon pricing	0.0088131	stress test	0.0085954
central banks	0.0086776	central banks	0.0075883
price stability	0.0081686	monetary policy	0.0064675
climate change	0.0064798	crypto assets	0.0060846
inflation expectations	0.0058662	financial stability	0.0057707
greening	0.0056648	transition risk	0.0056670
green transition	0.0047442	environmental risks	0.0050705
green monetary policy	0.0046350	related risks	0.0048895
fiscal policy	0.0042621	climate risks	0.0046023
green finance	0.0037698	physical risk	0.0045883
governing council	0.0033753	risk management	0.0043214

Beyond the textual analysis, i.e. the words and sub-themes addressed by the ECB when it talks about climate change, it is also interesting to see the tone of the speeches. This is what sentiment analysis is all about. For this study, we use the *SentimentR* package [Rinker, 2022], previously validated in energy and climate research by Santi [2020] and Ikoro et al. [2018] on the 132 climate speeches. This tool accurately computes text polarity sentiment to adjust the impact of polarized words. Sentiment values for each speech is determined using the P/N ratio, derived from the count of positive (P) and negative (N) sentences identified through polarity assessment.

Table 3.4: Top 10 emotions by sentences in ECB climate speeches (2006-2022)

Emotion	Counting by sentence
trust	25,318
anticipation	14,486
fear	10,442
joy	5,996
sadness	5,541
anger	4,420
surprise	3,290
disgust	1,727
trust_negated	670
anticipation_negated	376

Table 3.4 lists the top ten emotions identified within the ECB climate speeches. The emotion count represents the number of sentences expressing each specific emotion within the ECB climate speeches. Since multiple sentences within a single speech can represent the same or different emotions, the total count can exceed the number of speeches analyzed The sentiment analysis identified 'trust' as the most common emotion in these communications, with 25,318 occurrences. The presence of 'anticipation' and 'fear' in the speeches aligns with the findings of Lucca and Trebbi [2009], who highlighted the impact of the emotional tone of central bank communications on financial markets. The use of 'anticipation' may help prepare markets for future policy changes. The expression of 'fear' could indicate the seriousness of climate change challenges, signaling to market participants the potential for significant measures to address these issues.

Furthermore, the occurrence of negated emotions such as 'trust/negated' and 'anticipation/negated', though less frequent, is notably significant. This aspect of ECB's communication might be indicative of a deliberate strategy to maintain a balance between providing clear guidance and preserving the necessary flexibility to adapt

to evolving economic conditions and uncertainties associated with climate change [Arseneau et al., 2022].

The analysis suggests that the majority of the ECB's climate-related speeches are constructed to generate predominantly positive emotions, particularly trust. This strategic focus on building trust is likely aimed at stabilizing market expectations and fostering a sense of confidence in the ECB's approach to climate challenges. By doing so, the ECB not only reinforces its commitment to addressing climate risks but also influences market anticipation, potentially guiding investor behavior in a manner that aligns with the broader goals of financial stability and sustainable economic transition.

3.4 Impact of ECB's climate speeches on financial market

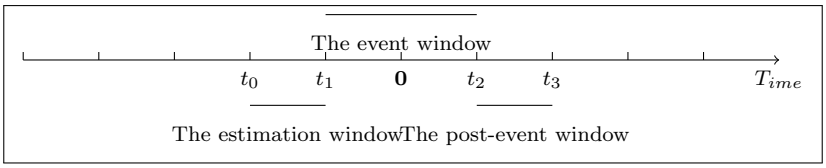
This section constitutes the empirical contribution of this work. In section 4.1, we presents the theoretical foundations of the event study methodology. In section 4.2, we present the application of event study to our research question.

3.4.1 Event study - theoretical approach

The event study method was first introduced by Ball and Brown [1968] and Fama et al. [1969] as a way to analyze the impact of emergencies on financial markets. It is based on the assumption that any effects will be quickly reflected in changes in prices shortly after the event [Liu et al., 2020]. Figure 3.2 represent the timeline of the event study. It's based on three different windows. The interval $t_1 - t_0$ corresponds to the estimation window which gives us the information required to calculate the normal returns (before the event date). The interval $t_2 - t_1$ is the event window, and the interval $t_3 - t_2$ corresponds to the post event window which is used to estimate the abnormal returns after the event.

In order to measure the normal returns, we must first determine an estimator. Once chosen, it will allow us to calculate the expected and abnormal daily returns. The returns of the estimation period, i.e., the period before the event date, are used to calculate the abnormal returns (ARs). We follow the methodology of Dyckman et al.

Figure 3.2: Data structure of the event study



[1984], reused since by Selmi et al. [2022] which shows that the statistical market model gives better results.

The return on stock i at time t is determined solely by the market return at time t in the market model. We use the market model (equation 1) to calculate the expected returns $E(R_{i,t})$. α is the intercept and β is the slope. R_{mt} is defined as the rate of return of the benchmark index on day t.

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \tag{3.1}$$

$AR_{i,t}$ is the abnormal return of index i on day t. $R_{i,t}$ is the current return of index i at day t; $E(R_{i,t})$ is the normal return of index i at day t.

$$AAR_t = \sum_{i=0}^{N} AR_{i,t} \tag{3.2}$$

AAR_t is the average abnormal return at day t, N is the number of events included in the index. These AARs are then used to determine the cumulative average abnormal return (CAAR). We sum up all the AR from T1; T2 i.e starting and ending day of the event window to obtain the cumulative average abnormal return CAAR.

$$CAAR_t = \sum_{j=T1}^{T2} AAR_{t,j} \tag{3.3}$$

We now test if CAAR is statistically different from 0. We then calculate its t-statistic and compare it to its critical value.

$$t = \sqrt{\frac{(T2 - T1 + 1)\sum_{i=1}^{N} \sigma^2}{N^2}} \tag{3.4}$$

3.4.2 Financial data

With regard to our financial data, we need daily returns over the period of interest. To carry out the event study, we also need to have different stock market prices to analyze: green stock market prices and general stock market indices to use as benchmarks. Indeed, to be sure of the causal effect of the speeches, we need global stock market indices that will not be significantly affected by the ECB's climate-related communication. We collected data on the daily returns of several stock prices, which are summarized in Table D.3 in appendix. Table D.4 in the appendix gives descriptive statistics on the stock market returns of these different indices. The DAX, Eurostock50, and FCHI indices represent major companies in Germany, the Eurozone, and France, respectively. The DAX includes 40 major German companies, the Eurostock50 represents Eurozone supersector leaders, and the FCHI tracks the 40 largest French stocks. The S&P Europe 350 index includes 350 leading companies from developed European markets.

These 4 indices will be our benchmarks for our event study. In other words, we'll measure the difference in returns between our "green" indices and those 4 indices, which illustrate the general volatility of stock prices in Europe.

For the green stock market indices, we have selected 3 that we feel are consistent with our analysis, 2 European indices and one worldwide index to see if the ECB's communication is likely to have an impact beyond the eurozone. The Dow Jones Sustainability Europe Index (DJSEI), the Dow Jones Sustainability World Index (DJSWI) and the S&P Europe 350 ESG Index (SPEUROPE350ESG). The DJSEI and the DJSWI track companies with superior sustainability performance in Europe and globally, while the SPEUROPE350ESG targets companies with strong environmental, social, and governance practices.

The indices were selected to capture both general market trends and specific reactions within green sectors, providing a comprehensive view of market responses. We're going to apply the event study described above, using iteratively the different green stock market indices with the different benchmark indices. We will also vary the event window for the robustness of our results.

In addition, we'll run several types of regression based on climatic speeches. More specifically, we will first carry out the event study for all climate speeches. Then, we will take two sub-samples representing respectively (i) discourses dealing with the

future of monetary policy in the context of climate change and (ii) discourses dealing with different types of climate risks . This distinction will enable us to identify which of the ECB's climate-related speeches have the greatest impact on financial markets.

3.5 Results

This section presents the main results of our event study. First, we present the impact of all climate-related events on the cumulative average abnormal returns of green stock indices. Then, in a more detailed analysis, we evaluate the individual impact of each sub-topic speeches that we have identified via our topic model, i.e. (i) green finance and policies, (ii) climate risks.

3.5.1 Impact of ECB climate-related speeches

The graphs 3.3 and 3.4 illustrate the cumulative abnormal returns (CAR) surrounding all ECB climate-related speeches across three distinct indices: DJSEI, DJSWI, and S&P EUROPE 350 ESG (with EuroStock50 and FCHI as benchmark).

The analysis reveals a consistent trend of positive abnormal returns following these speeches, indicating a favorable market response to the ECB's communication on climate-related issues. Notably, the CAR for the DJSEI increases by approximately 0.5% to 1% in the days following the speeches, with this positive trend persisting throughout the event window. This increase suggests that the market not only reacts immediately but continues to adjust its portfolio allocations in favor of greener assets over time. Our results are similar to those of Ardia et al. [2023] and which showed that green firms outperform brown firms when media coverage of climate change increases. Neszveda and Siket [2023] found similar results based on French, German and Italian firms following ECB climate speeches.

This outperformance underscores the targeted impact of the ECB's communication on green investments, as the broader market indices do not exhibit significant abnormal returns. These findings suggest that investors view the ECB's climate-related speeches as credible signals of the institution's commitment to integrating climate considerations into its monetary policy framework, leading to a reallocation of capital towards sustainable investments. The prevalence of 'trust' and other positive emotions in the sentiment analysis suggests that markets perceive ECB climate communication as credible and stabilizing, which aligns with the positive CARs observed

in green indices. The ECB is therefore suggesting that investing in green stocks is the right strategy for investors, as they will be supported by the ECB and national/european environmental policies.

Figure 3.3: Impact of climate speeches on the Dow Jones Sustainability Europe index

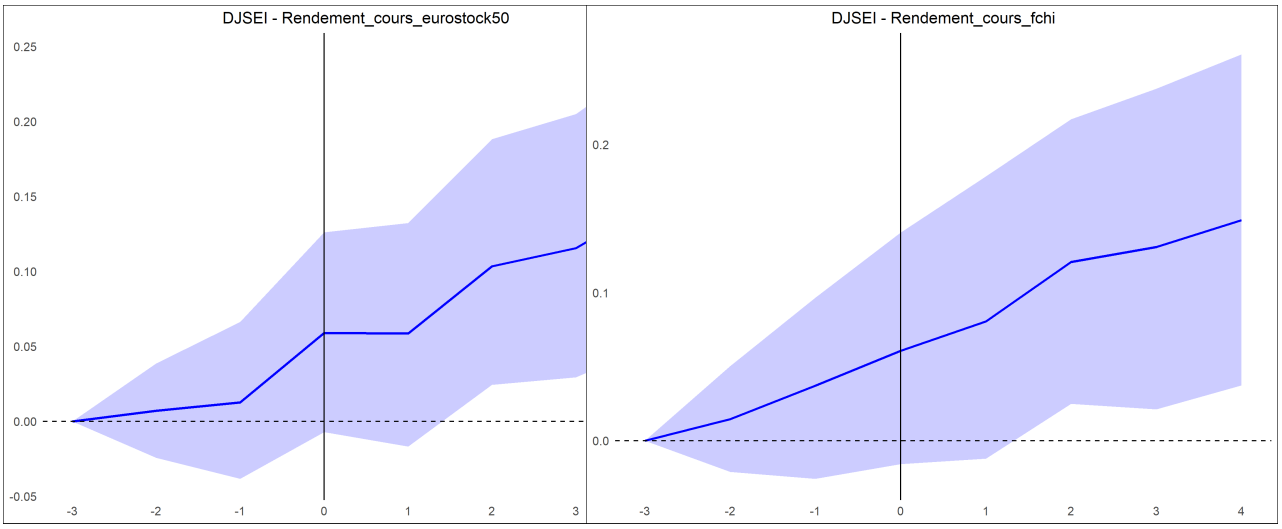
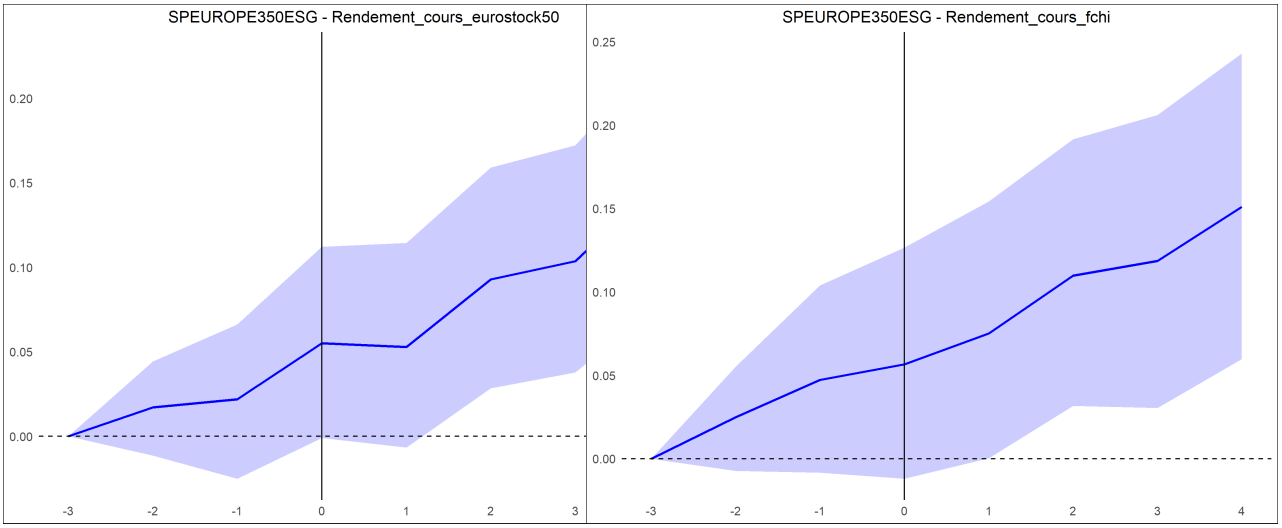


Figure 3.4: Impact of climate speeches on the S&P350 ESG



3.5.2 Impact of green finance and policies speeches vs climate-related risks speeches

Once we have seen that the ECB's climate speeches have a significant effect on the financial markets, it is also interesting to distinguish this impact according to the content of the speech. To do this, we construct two subsamples of our climate speeches based on the results of topic modelling. We thus classify the speeches into two categories, one relating to green finance and policies and the other to climate-related risks. The results are shown in Figures 3.5, 3.6 and 3.7. The graph on the left shows the cumulative abnormal returns of the various green indices following speeches on the theme: green finance and policies. The graph on the right shows the cumulative abnormal returns of the various green indices following speeches relating to the theme: climate-related risks.

ECB speeches on "green finance and policies" have a clear impact on financial markets. These speeches, which cover topics such as green bonds and sustainable finance initiatives, result in positive cumulative abnormal returns (CARs) for green indices like DJSEI and DJSWI. For instance, the CAR for DJSEI shows an immediate increase of up to 1% following these speeches, with this positive trend continuing throughout the event window. This suggests that investors view these speeches as signals of the ECB's commitment to supporting green financial instruments, leading to a measurable market response.

ECB climate-related risks speeches generate a more moderate market response compared to Green Finance and policies speeches. While CARs remain positive, the magnitude is generally lower. These speeches often discuss the challenges and uncertainties of climate change, such as transition and physical risks, leading investors to respond with caution. Despite the more measured response, the positive CARs suggest that investors recognize the importance of these risks and may be reallocating capital towards sectors better positioned to manage them. This indicates that the ECB's communication on climate-related risks is considered relevant, though it prompts a more cautious adjustment in market behavior.

Figure 3.5: Impact of Green finance and policies speeches (left) vs Climate-related risks speeches (right) on S&PESG

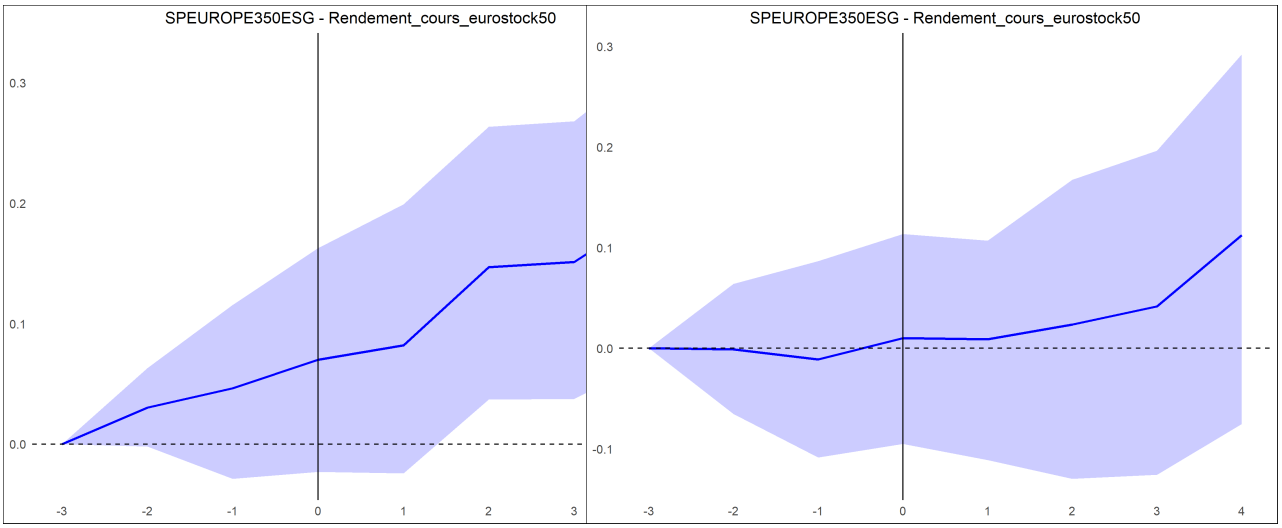


Figure 3.6: Impact of green finance and policies speeches (left) vs Climate-related risks speeches (right) on DJSWI

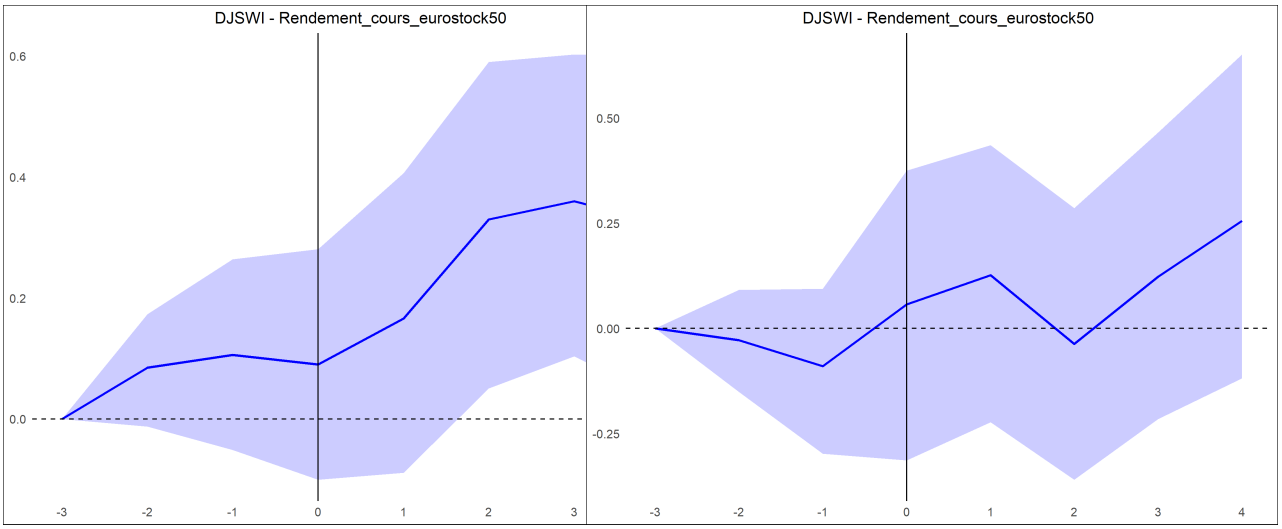
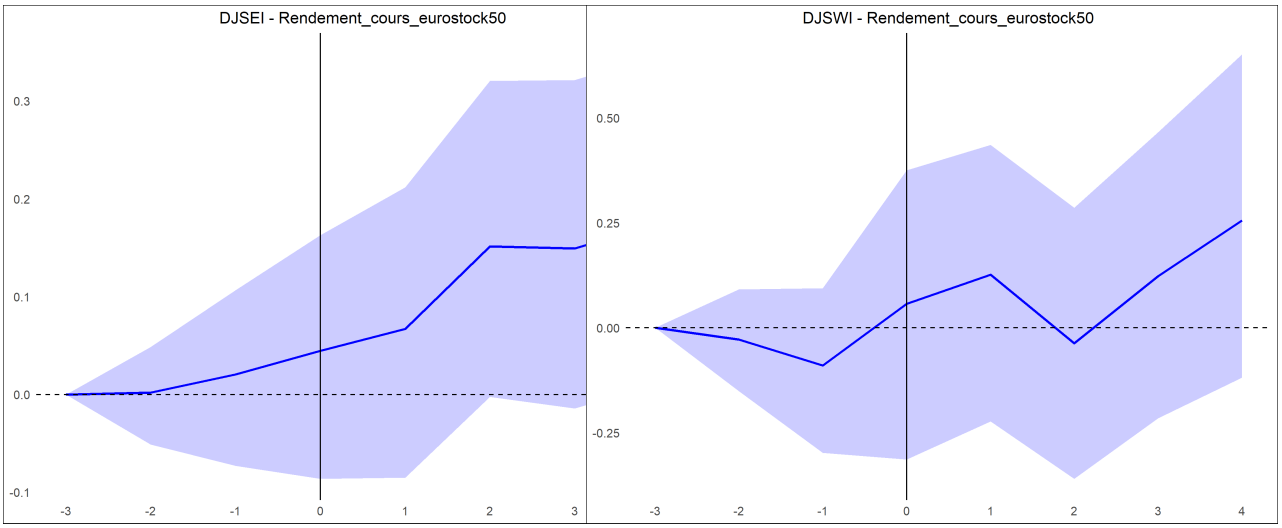


Figure 3.7: Impact of green finance and policies speeches (left) vs climate-related risks speeches (right) on DJSEI



The fact that markets react more strongly to speeches related to future monetary policy, compared to speeches providing information about climate risks, suggests that investors place greater weight on communications that directly influence financial instruments and regulatory environments. This can indicate that markets are more responsive to actionable guidance or policy signals that could affect the valuation of assets, such as the implementation of green bonds or sustainable finance initiatives. This may also indicate that financial markets have already integrated the various risks associated with climate change via other transmission channels (ESG criteria, news), and that in listening to central bank speeches they are only seeking information linked to the conduct of future monetary policy.

3.6 Conclusion

Central banks have increasingly become key participants in the public debate on climate change and the low-carbon transition, a shift largely driven by the recognition that climate change poses significant risks to financial stability and economic resilience (Campiglio et al., 2018 ; Network for Greening the Financial System, 2019 ; Awazu et al., 2020). The ECB is characterized by its pro-active approach to the fight against climate change, and also by the fact that it takes a different stance from the FED in this area [DiLeo et al., 2023].

We applied text analysis tools to a corpus of 2594 speeches made by the ECB between 1997 and 2022 in order to identify speeches related to climate change. Once identified, we analyzed the extent to which these speeches address a particular sub-theme related to climate change. We then used an event study methodology to identify the effect of these speeches on the financial markets.

Out of the 2,594 speeches analyzed, 132 focused on climate change, with three-quarters of these speeches delivered after 2015, the year the Paris Agreement was signed. The increase in these speeches peaks in 2021, where nearly one in two speeches addresses climate change issues. Finally, with the use of topic modelling techniques, we were able to classify climate-related speeches into two broad categories: (i) those that aim to help agents integrate the forthcoming changes in public policy and discuss their implications, and (ii) those that aim to provide agents with information on the state of the economy concerning the risks (both physical and transitional) and opportunities generated by climate change.

Sentiment analysis of speeches reveals that the ECB seeks to instill confidence and anchor agents' expectations (emotions that stand out most in sentiment analysis). The prevalence of 'trust' in the sentiment analysis suggests that markets perceive ECB climate communication as credible and stabilizing, which aligns with the positive CARs observed in green indices

The analysis of ECB climate-related speeches, shows distinct market reactions as reflected in cumulative abnormal returns (CARs) across different green indices. Overall, all climate-related speeches result in positive CARs, indicating a general market inclination towards green assets following the ECB's communication. Green Finance and policies speeches, which focus on specific financial instruments and policies sup-

porting sustainability, lead to significant increases in CARs, suggesting that investors respond positively to these targeted messages. In contrast, Climate-related Risks speeches produce more moderate CARs, reflecting a cautious market response to the uncertainties associated with climate risks. This may also indicate that financial markets have already integrated the various risks associated with climate change via other transmission channels (ESG criteria, news), and that in listening to central bank speeches they are only seeking information linked to the conduct of future monetary policy.

The results of this study have important implications for the ECB communications strategy and its role in sustainable finance. Positive market reactions to climate-related speeches, particularly those on green finance and polices, indicate that ECB messages are perceived as important by investors. This suggests that the ECB can use its communication strategy to influence market behavior and support the shift to sustainable investments. Enhancing the accuracy of firm greenness measures is essential for financial markets to appropriately price equities, particularly as central banks adopt green promotional strategies. By increasing the frequency and clarity of its climate communications, the ECB can strengthen its ability to direct capital flows towards green assets. This approach could also serve as a benchmark for other central banks, highlighting the role of targeted communication in managing climate-related financial risks. As environmental factors are increasingly integrated into financial decisions, the ECB communication efforts could help align financial markets with broader climate objectives and promote financial stability within the European Union.

General Conclusion

This thesis proposes an empirical investigation of European climate change actions, focusing on the financing of this transition by three main actors. It examines both direct financing of the transition by the EIB and structural funds and indirect financing via ECB communication.

More specifically, it provides answers to the following questions: Can the EIB transform itself into a climate bank without abandoning its initial objectives? What are the characteristics of French municipalities that decide to finance green projects using European structural funds? Can the ECB use its communications to encourage financial markets to reallocate their portfolios in favor of more environmentally-friendly companies? By investigating these questions using an empirical approach, the thesis aims to shed some light on the public policy decisions to be implemented at European level to finance the fight against climate change.

Contributions

Chapter 1 shows the existence of a positive link between economic development and green projects financed by EIB loans. By distinguishing green projects from neutral and brown projects within the EIB's loan portfolio over the period 1960-2020, we show that countries with the highest GDP per capita are the countries that apply for and receive the most EIB financing, in contrast to the total loan envelope, which is more geared towards the developing regions of the EU [Clifton et al., 2018].

Chapter 2 shows the existence of a clear link between obtaining European funding to finance a climate-responsible project and the political contestability of the commune. By distinguishing between green projects and projects financed by structural funds for French communes, we show that communes run by mayors whose political legitimacy is contested tend to make significant use of European structural funds to finance environmental projects.

Chapter 3 presents empirical results on financial market reactions to ECB Governing Council communications on climate change. Using textual analysis to identify speeches dealing with various aspects of climate change (risk, policy, impact), we show that "green" indices benefit from abnormal positive returns in the days surrounding the intervetion. Our results suggest a reallocation of portfolios in favor of green companies following the European monetary authority's climate change speeches, prompting the ECB to step up its communication on this subject in order to guide the expectations of financial market agents.

Policy implications

The results highlighted in this thesis can be used to draw up a number of policy recommendations addressed to the European institutions. Firstly, this thesis raises the question of the integration of environmental objectives within European institutions whose primary objective is not to finance the ecological transition.

The EIB, which aims to become the EU's Climate Bank by 2025, needs to question its ability to maintain its role as a catalyst for sustainable development. As shown in [Clifton et al., 2018], the EIB is fulfilling its role as a convergence financier by investing more in the EU's least developed countries, but chapter 1 suggests that when EIB loans are distinguished by their environmental impact, it is the most developed countries that benefit most from green loans. Our findings highlight the dual-speed transition within the European Union. In Western Europe, this transition is well underway and heavily backed by public opinion[4]. Conversely, in Eastern European countries, the transition is struggling to gain momentum due to a lack of political consensus and comparatively low public support. The Visegrad Group members (Poland, Hungary, Slovakia, and the Czech Republic) are particularly resis-

[4]Special Eurobarometer 513, Climate Change, April 2021.

tant to the European Green Pact[5] and oppose ambitious energy and climate policies, as well as the centralization and state control of energy infrastructures [Szabo and Fabok, 2020]. Therefore, the European Union must ensure that the green transition is implemented uniformly to avoid exacerbating existing structural disparities among Member States.

One of the specific features of the Structural Funds and EIB loans is the selection of projects financed. Indeed, for a project promoter to obtain financing from the EIB or the Structural Funds, an application must be submitted. As a result, the projects financed depend more on the supply of available projects than on the projects that the EIB and the Structural Funds would ideally like to finance. Economic literature has shown that administrative capacity is a major determinant of the economic impact of the Structural Funds (Huliaras and Petropoulos, 2016 ; Rodríguez-Pose and Garcilazo, 2015).

To evaluate the effects of a public policy, economic analysis must compare the situation of economic agents after the implementation of this policy to the situation of these same agents without the economic policy, known as a counterfactual scenario. The windfall effect can be defined as *"the actions of economic agents that would have occurred even in the absence of the public policy"*. Generally mentioned in labor economics studies [Moczall, 2014], the windfall effect is defined as "hires in the target group that would have taken place even without the program" [Calmfors, 1994]. Meunier and Ponssard [2018] apply the theory of the windfall effect to subsidies for clean technologies.They suggest that a public investment mechanism to support research for companies results in subsidies that these companies do not need to be profitable. They then propose a contingent subsidy mechanism aimed at minimizing the perverse effects of subsidies. Similar to Aglietta and Espagne [2015], I propose that investment projects whose potential gains from avoided emissions needs to be certified by a competent body, which will helps to limit windfall effects, i.e., to limit public funding of projects whose low-carbon impact is not proven and which are profitable without the need for public funds.

Economic literature has shown that financial markets are sensitive to various ECB communications [Blinder et al., 2008, Haldane and McMahon, 2018, Guthrie and Wright, 2000]. In chapter 3, I show how financial markets react to the ECB's com-

[5]EU climate deal falls at summit, four countries wield the axe, Euractiv, 2019.

munication on climate change. More specifically, I show that financial markets tend to reallocate portfolios in favor of more climate-friendly portfolios in the days surrounding an ECB climate speech. This suggests that the ECB must continue to communicate on these issues, whether through the publication of climatic stress tests [European Central Bank, 2022a] or the production and dissemination[6] of climate change data and indicators .

Limits and future extensions

The above policy implications and recommendations need to be analyzed in the light of the specific limits of each chapter. We discuss some of these limitations and propose ideas for addressing them.

In **chapter 1**, I propose to evaluate the determinants at national level of the allocation of green investments by the EIB. The database used comes from the EIB itself, and does not allow for a more precise geolocation of projects. In reality, each project fits into a local framework and is therefore determined by political, economic and social factors linked to the territory to which it belongs. I partially address this limitation by restricting my field of study to France in chapter 2, but the location of projects financed by the EIB merits particular investigation.

In **chapter 2**, I propose to identify the characteristics of French communes that use European structural funds to finance climate-friendly projects. For reasons of data accessibility and time, this study focuses on French communes. In reality, the allocation of structural funds is managed by the regions at European level. It is therefore highly likely that my results may varies if I consider other european regions and that a study of the allocation of European funds in other European regions could lead to different conclusions. The literature has indeed shown that the effectiveness of the Structural Funds depends largely on the political and administrative organization of the recipient countries (Le Gallo et al., 2011 ; Crescenzi and Giua, 2014). A plausible limitation of this study relates to our hypothesis concerning the supply versus demand of funds by the regions. This hypothesis stems from interactions with regional authorities. However, if the analysis is extended to communes with fewer than 10,000 inhabitants or to firms, obtaining precise acceptance rates, as outlined

[6]Press release : ECB publishes new climate-related statistical indicators to narrow climate data gap, 24 January 2023

in Muraközy and Telegdy [2016], will become necessary.

One avenue for future research would be to analyze the extent to which funding from European players (EIB or European Structural funds) has been coordinated with local policies and legislation. For example, Zepa and Hoffmann [2023] examines how policy mixes unfold across different governance levels within the European Union, focusing on Latvia's transition to sustainable energy. The study finds significant friction points in policy coherence between national and local levels, often due to EU-level strategies not being substantiated with appropriate national policy instruments. Additionally, the lack of political commitment at the national level perpetuates these issues, undermining the comprehensiveness and credibility of the policy mix.

In **chapter 1 and 2**, we suggest the positive environmental impact of funded projects using the project description (ex-ante). A possible field of research could be the evaluation of the direct impact of these projects on an ex-post basis. Using the geolocation of projects, my current research project is to look at the impact these projects have had on several economic criteria (growth and employment) and environmental criteria (pollution and biodiversity). As these are generally large-scale infrastructure projects, they are likely to have a local impact, on air pollution for example [Ou et al., 2024]. The European Commission's efforts to obtain a database Bachtrögler et al. [2021] for each project, harmonized at European level and including project geolocation, are a step in this direction.

In **chapter 3**, I propose to assess the reactions of financial markets following the ECB's speeches on climate change. The first limitation stems from the fact that I'm only interested in stock prices aggregated into indices such as the Dow Jones Sustainabilty Europe Index or the S&P. It would be relevant to assess the impact of these speeches on stock market returns at the firm level as Campiglio et al. [2023] do for American firms, in order to identify which sectors and firms are most impacted (positively and negatively) by this type of discourse. The second limitation arises from the fact that I am only interested in the speeches made by members of the ECB Executive Board. In reality, central bank communication goes far beyond official speeches, and includes all communication via social networks [Masciandaro et al., 2024], as well as press conferences [Angino and Robitu, 2023] and media coverage [Bennani, 2020]. It would therefore be interesting to assess the differentiated impact of this type of climate communication on financial markets.

To identify climate change speeches, I use a keyword approach. This is just one method of textual analysis; the literature also uses topic modelling techniques [Arseneau et al., 2022, Arseneau and Mitsuhiro, 2023] It would be interesting to use other techniques to check whether we are indeed identifying the same speeches, and if not, to verify the impact of these speeches on the financial markets.

The interest of this study lies in the dual dimension of European policies: the purely economic dimension and the environmental dimension. Recent work on climate risk and its systemic aspect [Dell et al., 2012, Gallic and Vermandel, 2020], illustrates the impossibility of addressing these two aspects separately. They must actually be addressed simultaneously by both economists and policymakers. Ostrom [1990] contribution on the governance of commons invites us to move beyond the dichotomy of environment as a public or private good. Currently, there is no legal definition of environmental commons [Misonne, 2018]. However, one of the characteristics of the "commons" is the existence of a voluntary organization, a "proto-government" [Dardot and Laval, 2017]. This organization, by virtue of its legitimacy, is able to establish management rules for this good, which promotes its respect and development. Through this thesis, we show that the EU could be this legitimate organization that sets the rules for managing certain common goods that belong to the European community. The European Green Deal is opening the way for academic research into the means and conditions of financing the reconstruction of Europe's post-Covid-19 economy.

Conclusion générale

Cette thèse propose une investigation empirique des actions européennes en matière de changement climatique, en se concentrant sur le financement de cette transition par trois acteurs principaux. Elle examine à la fois le financement direct de la transition par la BEI et les fonds structurels, ainsi que le financement indirect via la communication de la BCE.

Plus précisément, elle répond aux questions suivantes : La BEI peut-elle se transformer en une banque climatique sans abandonner ses objectifs initiaux ? Quelles sont les caractéristiques des communes françaises qui décident de financer des projets verts à l'aide des fonds structurels européens ? La BCE peut-elle utiliser ses communications pour encourager les marchés financiers à réallouer leurs portefeuilles en faveur d'entreprises plus respectueuses de l'environnement ? En explorant ces questions par une approche empirique, la thèse vise à éclairer les décisions de politique publique à mettre en œuvre au niveau européen pour financer la lutte contre le changement climatique.

Contributions

Le **chapitre 1** montre l'existence d'un lien positif entre le développement économique et les projets verts financés par les prêts de la BEI. En distinguant les projets verts des projets neutres et bruns au sein du portefeuille de prêts de la BEI sur la période 1960-2020, nous montrons que les pays avec le PIB par habitant le plus élevé sont ceux qui sollicitent et reçoivent le plus de financements de la BEI, contrairement à l'enveloppe totale des prêts, qui est davantage orientée vers les régions en développement de l'UE [Clifton et al., 2018].

Le **chapitre 2** montre l'existence d'un lien clair entre l'obtention de financements européens pour financer un projet respectueux du climat et la contestabilité politique de la commune. En distinguant les projets verts des projets financés par les fonds structurels pour les communes françaises, nous montrons que les communes dirigées par des maires dont la légitimité politique est contestée tendent à utiliser de manière significative les fonds structurels européens pour financer des projets environnementaux.

Le **chapitre 3** présente des résultats empiriques sur les réactions des marchés financiers aux communications du Conseil des gouverneurs de la BCE concernant le changement climatique. En utilisant l'analyse textuelle pour identifier les discours traitant des divers aspects du changement climatique (risques, politiques, impacts), nous montrons que les indices verts bénéficient de rendements anormaux positifs dans les jours entourant l'intervention. Nos résultats suggèrent une réallocation des portefeuilles en faveur des entreprises vertes à la suite des discours de la BCE sur le changement climatique, incitant ainsi la BCE à intensifier sa communication sur ce sujet afin de guider les attentes des acteurs des marchés financiers.

Implications politiques

Les résultats mis en avant dans cette thèse permettent de formuler un certain nombre de recommandations politiques à l'adresse des institutions européennes. Premièrement, cette thèse soulève la question de l'intégration des objectifs environnementaux au sein des institutions européennes dont l'objectif principal n'est pas de financer la transition écologique.

La BEI, qui vise à devenir la Banque climatique de l'UE d'ici 2025, doit s'interroger sur sa capacité à maintenir son rôle de catalyseur du développement durable. Comme le montre Clifton et al. [2018], la BEI remplit son rôle de financeur de la convergence en investissant davantage dans les pays les moins développés de l'UE, mais le chapitre 1 suggère que lorsqu'on distingue les prêts de la BEI selon leur impact environnemental, ce sont les pays les plus développés qui bénéficient le plus des prêts verts. Nos résultats mettent en évidence une transition à deux vitesses au sein de l'Union européenne. En Europe occidentale, cette transition est bien engagée et fortement soutenue par l'opinion publique[7]. À l'inverse, dans les pays d'Europe de l'Est, la

[7]Eurobaromètre spécial 513, Changement climatique, avril 2021.

transition peine à prendre de l'ampleur en raison d'un manque de consensus politique et d'un soutien public relativement faible. Les membres du groupe de Visegrád (Pologne, Hongrie, Slovaquie et République tchèque) sont particulièrement réticents au Pacte vert européen[8] et s'opposent aux politiques énergétiques et climatiques ambitieuses, ainsi qu'à la centralisation et au contrôle étatique des infrastructures énergétiques [Szabo and Fabok, 2020]. Par conséquent, l'Union européenne doit veiller à ce que la transition verte soit mise en œuvre de manière uniforme afin d'éviter d'exacerber les disparités structurelles existantes entre les États membres.
L'une des spécificités des Fonds structurels et des prêts de la BEI réside dans la sélection des projets financés. En effet, pour qu'un promoteur de projet obtienne un financement de la BEI ou des Fonds structurels, une demande doit être soumise. En conséquence, les projets financés dépendent davantage de l'offre de projets disponibles que des projets que la BEI et les Fonds structurels souhaiteraient idéalement financer. La littérature économique a montré que la capacité administrative est un déterminant majeur de l'impact économique des Fonds structurels (Huliaras and Petropoulos, 2016 ; Rodríguez-Pose and Garcilazo, 2015).

Pour évaluer les effets d'une politique publique, l'analyse économique doit comparer la situation des agents économiques après la mise en œuvre de cette politique à la situation de ces mêmes agents en l'absence de la politique économique, ce que l'on appelle un scénario contrefactuel. L'effet d'aubaine peut être défini comme *les actions des agents économiques qui auraient eu lieu même en l'absence de la politique publique*. Généralement mentionné dans les études en économie du travail [Moczall, 2014], l'effet d'aubaine est défini comme "les embauches dans le groupe cible qui auraient eu lieu même sans le programme" [Calmfors, 1994]. Meunier and Ponssard [2018] appliquent la théorie de l'effet d'aubaine aux subventions pour les technologies propres. Ils suggèrent qu'un mécanisme d'investissement public visant à soutenir la recherche pour les entreprises aboutit à des subventions dont ces entreprises n'ont pas besoin pour être rentables. Ils proposent ensuite un mécanisme de subvention conditionnelle visant à minimiser les effets pervers des subventions. Similairement à Aglietta and Espagne [2015], je propose que les projets d'investissement dont les gains potentiels liés aux émissions évitées doivent être certifiés par un organisme compétent, ce qui permettrait de limiter les effets d'aubaine, c'est-à-dire de limiter le financement public de projets dont l'impact bas-carbone n'est pas prouvé et qui sont rentables sans l'apport de fonds publics.

[8] L'accord climatique de l'UE échoue au sommet, quatre pays bloquent, Euractiv, 2019.

La littérature économique a montré que les marchés financiers sont sensibles à diverses communications de la BCE [Blinder et al., 2008, Haldane and McMahon, 2018, Guthrie and Wright, 2000]. Dans le chapitre 3, je montre comment les marchés financiers réagissent aux communications de la BCE sur le changement climatique. Plus précisément, je démontre que les marchés financiers tendent à réallouer les portefeuilles en faveur de portefeuilles plus respectueux du climat dans les jours entourant un discours climatique de la BCE. Cela suggère que la BCE doit continuer à communiquer sur ces questions, que ce soit par la publication de tests de résistance climatique [European Central Bank, 2022a] ou par la production et la diffusion[9] de données et d'indicateurs sur le changement climatique.

Limites et extensions futures

Les implications politiques et recommandations ci-dessus doivent être analysées à la lumière des limites spécifiques de chaque chapitre. Nous discutons de certaines de ces limitations et proposons des idées pour y remédier.

Dans **le chapitre 1**, je propose d'évaluer les déterminants, au niveau national, de l'allocation des investissements verts par la BEI. La base de données utilisée provient de la BEI elle-même et ne permet pas une géolocalisation plus précise des projets. En réalité, chaque projet s'inscrit dans un cadre local et est donc déterminé par des facteurs politiques, économiques et sociaux liés au territoire auquel il appartient. Je traite partiellement cette limitation en restreignant mon champ d'étude à la France dans le chapitre 2, mais la localisation des projets financés par la BEI mérite une investigation particulière.

Dans **le chapitre 2**, je propose d'identifier les caractéristiques des communes françaises qui utilisent les fonds structurels européens pour financer des projets respectueux du climat. Pour des raisons d'accessibilité des données et de temps, cette étude se concentre sur les communes françaises. En réalité, l'allocation des fonds structurels est gérée par les régions au niveau européen. Il est donc très probable que mes résultats varient si je considère d'autres régions européennes et qu'une étude de l'allocation des fonds européens dans d'autres régions européennes pourrait conduire à des conclusions différentes. La littérature a en effet montré que l'efficacité des fonds structurels

[9] Communiqué de presse : La BCE publie de nouveaux indicateurs statistiques liés au climat pour combler le déficit de données climatiques, 24 janvier 2023

dépend largement de l'organisation politique et administrative des pays bénéficiaires (Le Gallo et al., 2011 ; Crescenzi and Giua, 2014). Une limite plausible de cette étude concerne notre hypothèse sur l'offre versus la demande de financements par les régions. Cette hypothèse découle de nos interactions avec les autorités régionales. Cependant, si l'analyse est étendue aux communes de moins de 10 000 habitants ou aux entreprises, il sera nécessaire d'obtenir des taux d'acceptation précis, comme cela est souligné dans les travaux de [Muraközy and Telegdy, 2016].

Une piste pour de futures recherches serait d'analyser dans quelle mesure les financements des acteurs européens (BEI ou Fonds structurels européens) ont été coordonnés avec les politiques et législations locales. Par exemple, Zepa and Hoffmann [2023] examine comment les combinaisons de politiques se déploient à différents niveaux de gouvernance au sein de l'Union européenne, en se concentrant sur la transition de la Lettonie vers une énergie durable. L'étude révèle des points de friction significatifs en termes de cohérence des politiques entre les niveaux national et local, souvent dus au fait que les stratégies au niveau de l'UE ne sont pas étayées par des instruments de politique nationale appropriés. De plus, le manque d'engagement politique au niveau national perpétue ces problèmes, sapant la portée et la crédibilité de la combinaison de politiques.

Dans les **chapitres 1 et 2**, nous suggérons l'impact environnemental positif des projets financés en utilisant la description du projet (ex ante). Un champ de recherche possible pourrait être l'évaluation de l'impact direct de ces projets sur une base ex-post. Mon projet de recherche actuel est de mesurer l'impact de ces projets sur plusieurs critères économiques (croissance et emploi) et environnementaux (pollution et biodiversité). Comme il s'agit généralement de projets d'infrastructure à grande échelle, ils sont susceptibles d'avoir un impact local, sur la pollution de l'air par exemple [Ou et al., 2024]. Les efforts de la Commission européenne pour obtenir une base de données [Bachtrögler et al., 2021] pour chaque projet, harmonisée au niveau européen et incluant la géolocalisation des projets, vont dans ce sens.

Dans le **chapitre 3**, je propose d'évaluer les réactions des marchés financiers suite aux discours de la BCE sur le changement climatique. La première limitation provient du fait que je m'intéresse uniquement aux prix des actions agrégés en indices tels que le Dow Jones Sustainability Europe Index ou le S&P. Il serait pertinent d'évaluer l'impact de ces discours sur les rendements boursiers au niveau des entreprises comme le font Campiglio et al. [2023] pour les entreprises américaines, afin d'identifier quels

secteurs et quelles entreprises sont les plus impactés (positivement et négativement) par ce type de discours. La deuxième limitation provient du fait que je m'intéresse uniquement aux discours prononcés par les membres du Directoire de la BCE. En réalité, la communication des banques centrales va bien au-delà des discours officiels et comprend toute la communication via les réseaux sociaux [Masciandaro et al., 2024], ainsi que les conférences de presse [Angino and Robitu, 2023] et la couverture médiatique [Bennani, 2020]. Il serait donc intéressant d'évaluer l'impact différencié de ce type de communication climatique sur les marchés financiers.

Pour identifier les discours sur le changement climatique, j'utilise une approche par mots-clés. Il s'agit d'une méthode d'analyse textuelle parmi d'autres ; la littérature utilise également des techniques de topic modeling [Arseneau et al., 2022, Arseneau and Mitsuhiro, 2023]. Il serait intéressant d'utiliser d'autres techniques pour vérifier si nous identifions effectivement les mêmes discours, et dans le cas contraire, de vérifier l'impact de ces discours sur les marchés financiers.

L'intérêt de cette étude réside dans la double dimension des politiques européennes: la dimension purement économique et la dimension environnementale. Les travaux récents sur le risque climatique et son aspect systémique [Dell et al., 2012, Gallic and Vermandel, 2020] illustrent l'impossibilité de traiter ces deux aspects séparément. Ils doivent en fait être abordés simultanément par les économistes et les décideurs politiques. La contribution de Ostrom [1990] sur la gouvernance des biens communs nous invite à dépasser la dichotomie de l'environnement en tant que bien public ou privé. À l'heure actuelle, il n'existe pas de définition juridique des biens communs environnementaux [Misonne, 2018]. Cependant, l'une des caractéristiques des "communs" est l'existence d'une organisation volontaire, un "proto-gouvernement" [Dardot and Laval, 2017]. Cette organisation, en vertu de sa légitimité, est capable d'établir des règles de gestion pour ce bien, ce qui favorise son respect et son développement. À travers cette thèse, nous montrons que l'UE pourrait être cette organisation légitime qui établit les règles de gestion de certains biens communs appartenant à la communauté européenne. Le Pacte Vert Européen ouvre la voie à la recherche académique sur les moyens et les conditions de financement de la reconstruction de l'économie post-Covid-19 en Europe.

Appendix

Chapter 1

Tables A.1 , A.2, A.3 and A.4 ecorrespond respectively to a selection of green, brown and neutral projects drawn from the EIB project database. They appear as they are coded in the database with the beneficiary country, the sector, the amount of the project, the date of financing and a brief description of the project. The project description column is the column that allowed us to identify projects as green, brown or neutral. Specifically, the words in bold are the words that allowed us to identify these projects. Table A.5 contains descriptive statistics on the variables used in the econometrics section.

Table A.1: Methodology for tracking green projects (Part 1)

Sector	**Country**	**Project description**	**Amount***	**Year**
Energy	Romania	Financing of the investment programme of Enel Green Power Romania for the development construction and operation of three onshore **wind farms**** for a total installed capacity of some 260 MW	200M	2013
Composite infrastructure	Germany	Framework Loan to support public municipal infrastructure focusing on urban renewal, including cultural heritage, housing and **energy efficiency**	200M	2013
Health	Austria	A multiple beneficiary intermediated loan to finance projects in Austria carried out by public and private sector promoters in education, health care, environment, **energy efficiency** and research & development	5M	2016
Telecom	Spain	Installation of optical fibre cables along Spain's main **railway** axes and several railway modernisation schemes	56M	2001
Transports	Spain	A new 15 km **tramway** in the Barcelona metropolitan area	136M	2001
Lines of credit	Hungary	Financing SME projects in the field of **environmental protection**, **energy savings**, infrastructure (including health, education and urban renewal), industry, services and tourism in Hungary.	50M	2003
Agriculture	Spain	The project includes **reforestation** and implementation of more effective measures to prevent forest fires, mitigation of soil erosion and regeneration of natural habitat	25M	2009

M stands for millions of euros. **The words displayed in **bold** in the project description column are those that allowed us to define this project as a green investment.

Table A.2: Methodology for tracking green projects (Part 2)

Sector	**Country**	**Project description**	**Amount***	**Year**
Industry	Finland	**Environmental protection** and modernisation of the Imatra mill complex	160M	2000
Education	Germany	Extension and refurbishment of the university campus in Hamburg to merge several academic institutes in a common facility to boost **research on climate change**	85M	2018
Urban planning	Slovakia	A multi-sector municipal framework loan to support eligible investment schemes in the City of Presov mainly in the areas of **public transport**, education, recreation, social cares	8M	2016
Services	Romania	Financing the 2nd phase of Bucharest Sector 1's thermal rehabilitation programme for improving **energy efficiency** in 406 residential buildings located in Bucharest Sector 1	22M	2015
Solid waste	Finland	Construction of **waste-to-energy** CHP plant in Brista, Sweden, and implementation of a digital remote metering infrastructure on the low voltage level	36M	2011
Water	Spain	Financing of investments in the rehabilitation of coastal areas, recovery of areas affected by forest fires and other investments targeted at **environmental protection**	64M	2014

M stands for millions of euros. **The words displayed in **bold** in the project description column are those that allowed us to define this project as a green investment.

Table A.3: Methodology for tracking brown projects

Sector	**Country**	**Project description**	**Amount***	**Year**
Agriculture	France	Logging **roads**** in the Julian Pre-Alps and the Natisone Valley	1M	1989
Composite infrastructure	Slovakia	Establishment of an industrial supplier park for the Peugeot **automobile** (PSA) production plant located close to the city of Trnava	17M	2005
Transports	Spain	62 km shadow-toll **motorway** concession between the cities of Pamplona and Logro	175M	2002
Health	Sweden	Design, construction, financing, and operation of the New Karolinska University Hospital Solna, a patient hotel and **parking** garage	298M	2010
Industry	France	Purchase and conversion of four Airbus A-300-600 **aircraft** into supercarriers	112M	1993
Energy	Germany	Development, construction and operation of a 750 MW advanced hard **coal**-Power Plant in the assisted-2 area Duisburg-Walsum, North-Rhine Westphalia (NRW)	53M	2007
Lines of credit	Germany	The project concerns a sector-dedicated i2i global loan, with a risk-sharing window under SFF to support small and medium-sized RDI projects in the **automotive** supply industry	50M	2007
Telecom	France	Construction of a European-wide computerized direct access system for **air transport** and tourism	46M	1990
Services	Spain	Investments in the regional **road** network and rehabilitation of historic buildings	13M	1999
Urban planning	Italy	Urban infrastructure (**parking**, elevators, construction and improvement of **roads**) in Belluno (Veneto)	2M	1994

*M stands for millions of euros. **The words displayed in **bold** in the project description column are those that allowed us to define this project as a brown investment.

Table A.4: Examples of neutral projects

Country	**Sector**	**Year**	**Amount***	**Project**
Lithuania	Lines of credit	2006	5M	A loan to finance final beneficiaries within the mid-cap range.
Portugal	Services	2001	5M	Construction and operation of three wholesale markets in Portugal
Finland	Education	2004	25M	Improving education facilities throughout Finland
France	Industry	2016	25M	The proposed operation would support Valneva's ongoing R&D efforts, and potentially enable the company to accelerate the development of its lead product candidates.
Greece	Transports	2015	25M	Co-financing of priority investments in the Hellenic Republic under the 2007-2013 National Strategic Reference Framework (NSRF).
Italy	Urban infrastructure	2001	25M	Various small-scale urban infrastructure schemes in the Municipality of Salerno
Germany	Composite Infrastructure	1998	25M	Bank-intermediated project-financing of an industrial park in Saarlouis (Saarland)
Spain	Energy	2019	800M	Framework loan to support the Spanish Autonomous Community of Valencia in the implementation of selected investments under ERDF, ESF and EAFRD.
Czech Republic	Industry	2007	369M	Development of light industrial, logistics and business parks.

*M stands for millions of euros.

Table A.5: Descriptive statistics for key variables

Variable	**Obs**	**Mean**	**Std.Dev**	**Min**	**Max**	**Source**
GDP per capita	623	22104	16104	804.5	115761	Eurostat
Interest rates	623	5.849	2.122	-0.250	24.1	Eurostat
Ln (total EIB Lending)	623	46553	69214.62	0	382057	EIB
EIB GI projects	4375	162	234	2	880	Author's calculation
Population	623	25361544	23570511	406	82534	Eurostat
Government debt	423	62.97	30.99671	4.60	178.90	Eurostat
Environmental protection expenditure	423	756.4	926.1472	1.3	6163	Eurostat
Greenhouse gases emissions	623	330.47	245.6592	1.96	1387.92	Shift project Data portal
Energy Intensity	623	0.00015	0.000	0.00005	0.00071	Shift project Data portal
Carbon Intensity	623	0.43	0.50	0.08	2.84	Shift project Data portal
Human Capital	539	2.956	0.3137255	1.551	3.688	World Bank

Table A.6: Green structural funds programmes in scope

2007-2013	2014-2020
Aid to SMEs for the promotion of environmentally friendly products and production schemes	Energy efficiency and demonstration projects in SMEs and accompanying measures
Rail investments mainly for home/work travel TER	Support for environmentally friendly production processes and resource efficiency in SMEs
Rail investments mainly for rail freight	Productive investment in large enterprises linked to a low-carbon economy
Rail investments mainly for intercity passengers: studies and land acquisitions LGV; other mainline passenger investments; studies and land acquisition LGV	Development and promotion of enterprises specializing in the provision of services contributing to the low-carbon economy and climate change resilience (incl. support for such services)
Multi-modal transport: combined transport; TEN-T	Multimodal transport
Intelligent transport systems	Bicycle and pedestrian paths
Promotion of clean urban public transport	Infrastructure and promotion of clean urban transport (including equipment and rolling stock)
Bicycle paths	Energy efficiency: retrofits of public infrastructure; demonstration projects and support actions; renovations of existing housing stock
Urban/rural rehabilitation: integrated projects; major urban planning operations; restructuring of priority districts; other	Intelligent low and medium voltage energy distribution systems (including smart grids and ICT systems)
Rehabilitation of industrial sites and contaminated land	Rehabilitation of industrial sites and contaminated land
Energy efficiency, cogeneration, energy management	Electricity: storage and transmission
Renewable energies: wind energy; solar energy; biomass energy; hydroelectric, geothermal, and other	Renewable energy: solar; biomass energy; other (incl. hydro, geothermal, and marine); integration
Household and industrial waste management	Promotion of energy efficiency in large companies
Drinking water: protection of the resource and control of non-point source pollution; quantitative management of the resource and reservoirs; other	Household waste management (including reduction, separation, and recycling measures)
Wastewater treatment: sanitation	High-efficiency cogeneration and district heating
Air quality	Commercial, industrial, or hazardous waste management
Integrated pollution prevention and control	Environmental measures to reduce and/or avoid greenhouse gas emissions
Risk prevention: development and implementation of plans and actions to prevent and manage natural and technological risks	Water management and drinking water conservation (including watershed management, water supply, etc.)
Climate change adaptation and mitigation: territorial climate plans	Climate change adaptation measures, prevention, and management of climate-related risks such as erosion, fire, floods
Biodiversity promotion and nature protection: Natura 2000; restoration, maintenance, and management of aquatic environments; other	Protection and enhancement of biodiversity, nature conservation, and green infrastructure
Other actions to preserve the environment and prevent risks: Agenda 21, other	Protection, restoration, and sustainable use of Natura 2000 sites
Natural assets: protection and preservation; promotion	

Chapter 2

Identifying public and green projects

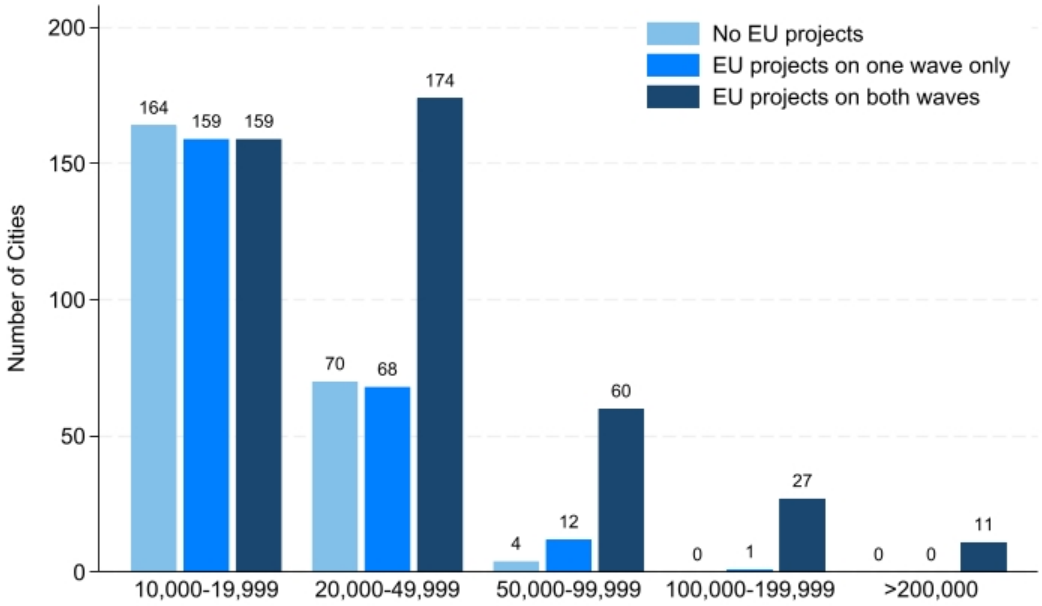
EIB taxonomy	Our taxonomy	Short description
Renewable energy	Energy	Renewable energies
Lower carbon energy		Lower carbon energies
Energy efficiency		Energy efficiency
	Urban	Rehabilitation of brownfields
		Sustainable neighbourhood redevelopment
	Building	Termic rehabilitation
		Neutral or low carbon construction
	Air	Other investments promoting air quality
Non energy GHG reductions		
Agriculture, forestry, land use	Biodiversity	Protection and restoration of the fauna and flora
		Including rivers, lakes, mountains
	Agriculture	Agricultural and fishing practices
		lowering environmental externalities
	Forest	Reforestation
		Sustainable forest management
	Land	Other investment promoting land quality
Waste and wastewater	Waste	Waste management and reduction
	Water	Management of water reserves and water systems
	Risk	Prevention of climatic risks
Miscellaneous		Include flooding, erosion
Transport	Transport	Public transport
		Multimodal transport
		Bicycle path
Low carbon technologies	R&D	Research and development of new technologies
		and materials with environmental applications
Cross cutting issues	Cross cutting issues	Climate, air and energy plan
		Support for actors on sustainable development issues
	Awareness	Awareness of the general public, students or tourists

Figure A.1: European green taxonomy

Data Description

Other stylized facts on our sample

Figure B.1: Distribution of EU-funded projects by municipality size and funding waves - Only local recipients

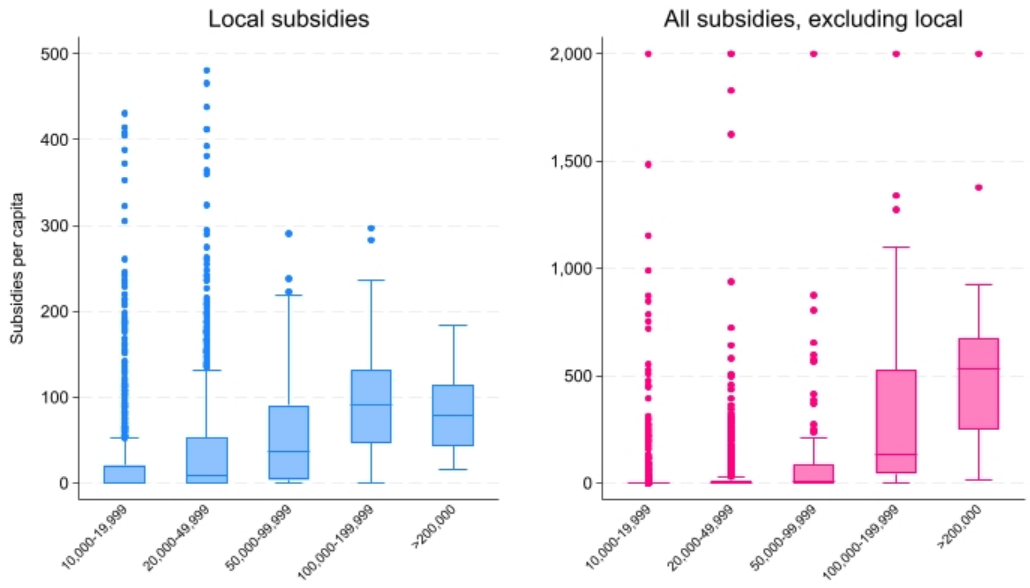


Notes: The Figure categorizes municipalities by size along the x-axis, using a population threshold of 200,000 inhabitants to include all regional capitals. It shows the number of cities with or without local EU-funded projects within their boundaries for each project wave (2007-2013 for the first wave, 2014-2020 for the second wave). The main difference between Figure 2.1 in the paper and this figure is the choice of recipients. Figure 2.1 in the paper includes all projects, whereas this figure focuses exclusively on local recipients.

Table B.1: Summary Statistics for our Sample: Municipalities with Population over 10,000

	Mean	SD	Min	Median	Max	N
2007-2013						
EU Funding focused on local recipients						
EU Funds (€ k)	1,579.64	4,178.27	0.00	116.41	36,100.59	980
Investments (€ k)	5,194.02	15,701.55	0.00	372.11	290,055.70	980
EU funding rate (%)	34.90	13.45	0.28	33.16	100.00	644
Politics						
HHI	0.45	0.14	0.17	0.42	1.00	954
Residual HHI	0.66	0.26	0.18	0.58	1.00	930
Win margin	0.22	0.21	-0.52	0.19	1.00	951
Local finances						
Share capital exp.	0.66	0.16	0.06	0.69	1.00	979
Share self-financing	0.05	0.08	-0.47	0.05	0.45	979
Share local taxes	0.37	0.10	0.09	0.36	0.74	979
Additional variables						
Av. housing price	185.34	73.95	58.27	171.59	656.49	972
Per cap. inc. ratio	1.00	0.29	0.48	0.93	3.83	980
Share homeowners	0.51	0.13	0.14	0.51	0.88	977
Share foreigners	0.07	0.06	0.00	0.06	0.36	971
Unemployment rate	0.13	0.04	0.04	0.12	0.29	980
Distance prefecture	67.69	63.28	0.00	46.18	297.88	972
2014-2020						
EU Funding focused on local recipients						
EU Funds (€ k)	1,648.33	4,532.15	0.00	38.69	42,933.10	980
Investments (€ k)	4,478.06	12,221.02	0.00	101.47	101,386.19	980
EU funding rate (%)	42.72	15.78	3.55	44.37	100.00	528
Politics						
HHI	0.42	0.13	0.16	0.40	1.00	952
Residual HHI	0.59	0.25	0.15	0.52	1.00	884
Win margin	0.24	0.19	-0.18	0.22	1.00	900
Local finances						
Share capital exp.	0.73	0.14	0.20	0.75	1.00	980
Share self-financing	0.07	0.07	-0.46	0.06	0.40	980
Share local taxes	0.41	0.10	0.10	0.40	0.76	980
Additional variables						
Av. housing price	192.45	83.63	58.19	175.55	800.96	972
Per cap. inc. ratio	0.98	0.28	0.45	0.92	3.35	980
Share homeowners	0.51	0.13	0.14	0.51	0.88	977
Share foreigners	0.08	0.06	0.00	0.07	0.38	968
Unemployment rate	0.15	0.08	0.05	0.15	2.00	980
Distance prefecture	67.69	63.28	0.00	46.18	297.88	972

Figure B.2: Subsidies per capita by municipality size and by recipient



Notes: The Figure categorizes municipalities by size along the x-axis, using a population threshold of 200,000 inhabitants to include all regional capitals. The boxplots display the per capita amounts of EU subsidies received. The left-hand side represents amounts for local recipients, while the right-hand side shows amounts for other recipients on a larger scale. Intermediate-level and national recipients often receive larger subsidies, which explains (1) the difference in scale between the two graphs and (2) the truncation beyond €2,000 per capita for five outlier cases. These outliers involve subsidies ranging from €2,000 to €5,000 per capita and have been truncated to enhance readability.

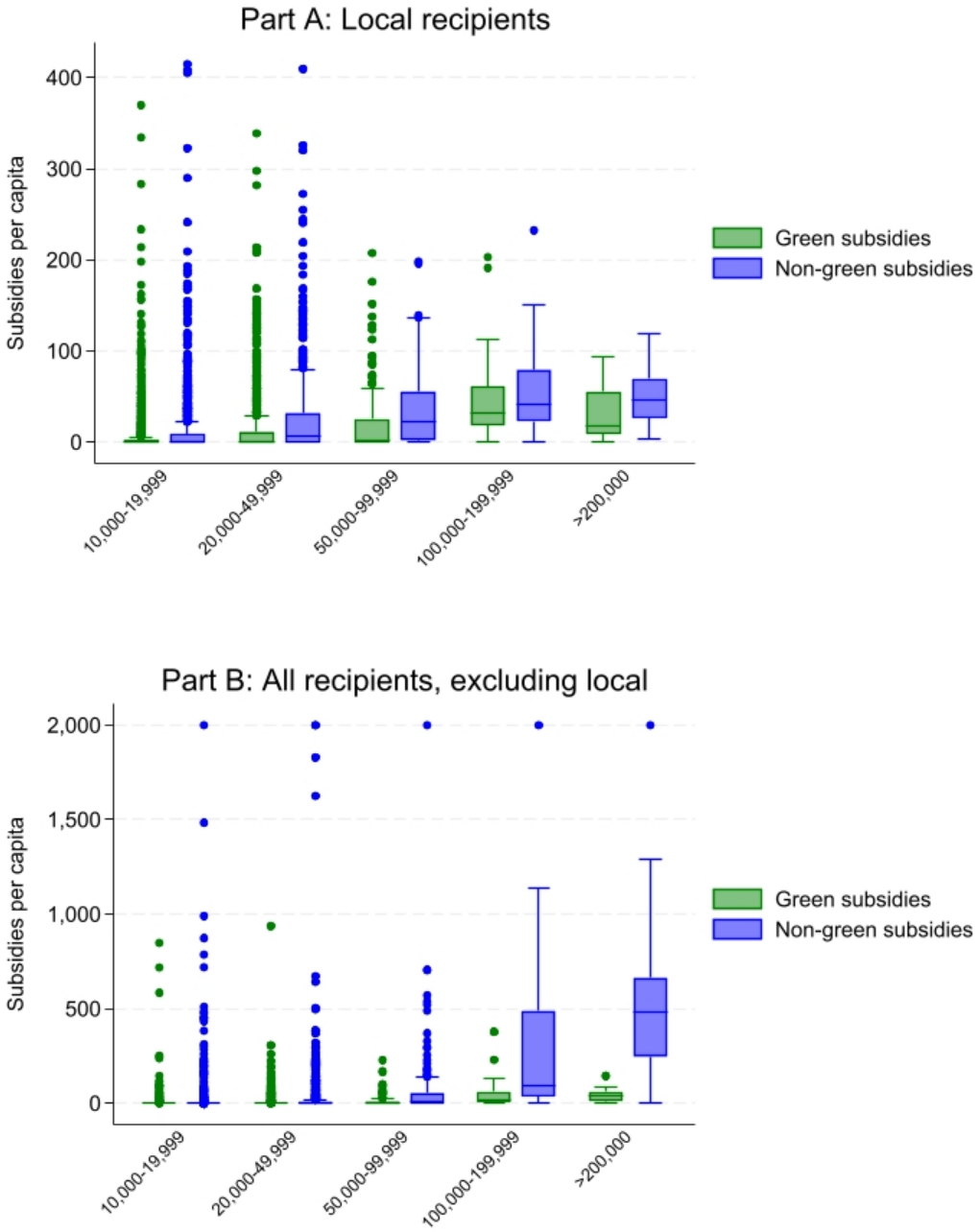
Other stylized facts on green projects

Table B.2: Distribution of projects by type and wave - Only local recipients

Number of cities	No project	First wave only	Second wave only	Both waves	Total
Only non-green projects	-	105	42	103	250
Only green projects	-	40	23	9	72
Opposite project types across waves	-	-	-	22	22
Both types of projects (one or both waves)	-	137	54	184	375
Total	261	282	119	318	980

Notes: This table presents the distribution of cities based on the types of projects they received (non-green, green, or both types) and their participation across the first and second waves. The counts reflect the number of cities in each category. In cases where cities received different types of projects across waves, these have been grouped together for clarity. Specifically, among the 137 cities that exclusively received both types of projects in the first wave, 46 did not receive any funding in the second wave, while 91 received only one type of project in the second wave. More precisely, 77 (14) cities received only non-green (green) projects in the second wave. Similarly, of the 54 cities that exclusively received both types of projects in the second wave, 10 did not receive any funding in the first wave, while 44 received only one type of project in the first wave. Further decomposition shows that 38 (6) cities received only non-green (green) projects in the first wave. The primary difference between Table 2 in the paper and this table is the selection of recipients. Table 2 includes all projects, whereas this table focuses exclusively on local recipients.

Figure B.3: Green and non-green subsidies per capita by municipality size and type of recipient



Notes: The figures classify municipalities by size along the x-axis, using a population threshold of 200,000 inhabitants to include all regional capitals. The boxplots show per capita amounts of EU subsidies, with two distinctions. Part A shows subsidies for local recipients, and Part B displays subsidies for other recipients. The second distinction divides subsidies into green and non-green categories, based on the official European classification. Some projects for non-local recipients receive unusually large subsidies, ranging between €2,000 and €5,000 per capita. For clarity, we truncate these outliers at €2,000 per capita, following the same approach as in Figure B.2.

Table B.3: Summary Statistics for our Sample: Municipalities with Population over 10,000

	Mean	SD	Min	Median	Max	N
2007-2013						
Green EU Funding focused on local recipients						
Green EU Funds	577.59	1,850.29	0.00	0.00	19,811.73	980
Green Investments	2,242.19	10,379.19	0.00	0.00	266,307.65	980
Green EU funding rate	31.21	13.05	1.18	30.00	76.18	386
Green share in EU funds	31.42	36.33	0.00	14.42	100.00	644
Green Categories						
Mitigation EU Funds	622.57	5,030.07	0.00	0.00	144,296.09	980
Mitigation Investments	2,432.44	17,817.62	0.00	0.00	437,921.81	980
Adaptation EU Funds	230.64	1,040.00	0.00	0.00	13,624.35	980
Adaptation Investments	702.62	3,445.95	0.00	0.00	63,986.89	980
Other EU Funding						
Other EU Funds	1,002.05	2,782.96	0.00	52.81	30,098.07	980
Other Investments	2,951.83	8,247.34	0.00	175.42	93,612.99	980
Other EU funding rate	36.90	14.27	0.28	36.75	100.00	579
2014-2020						
Green EU Funding focused on local recipients						
Green EU Funds	699.02	2,195.99	0.00	0.00	22,747.23	980
Green Investments	2,299.48	7,247.32	0.00	0.00	75,301.25	980
Green EU funding rate	34.89	14.03	2.98	33.39	80.00	296
Green share in EU funds	33.58	37.69	0.00	16.04	100.00	528
Green Categories						
Mitigation EU Funds	776.08	3,039.46	0.00	0.00	37,886.80	980
Mitigation Investments	2,357.55	8,324.84	0.00	0.00	81,965.50	980
Adaptation EU Funds	259.28	1,169.51	0.00	0.00	23,360.33	980
Adaptation Investments	682.89	3,019.18	0.00	0.00	50,993.36	980
Other EU Funding						
Other EU Funds	949.31	2,919.15	0.00	0.00	36,829.29	980
Other Investments	2,178.58	6,638.57	0.00	0.00	85,549.70	980
Other EU funding rate	47.25	16.26	5.00	48.66	100.00	470

Robustness

Table C.1: Robustness: Alternative political contestability

	(1)	(2)	(3)	(4)
Win margin	-3.114***		-1.149	
	(0.823)		(0.765)	
Residual HHI		-3.215***		-1.666***
		(0.653)		(0.574)
Political alignment			0.933***	0.872***
			(0.312)	(0.309)
Share capital exp.			-1.945*	-2.160**
			(0.992)	(0.999)
Share self-financing			-3.457	-3.740*
			(2.164)	(2.134)
Share local taxes			-2.173	-1.660
			(1.577)	(1.555)
Log av. housing price			-2.930***	-3.097***
			(0.667)	(0.663)
Per cap. inc. ratio			-0.560	-0.760
			(0.784)	(0.789)
Share homeowners			-10.298***	-10.013***
			(1.597)	(1.604)
Share foreigners			8.687**	7.432**
			(3.709)	(3.665)
Unemployment rate			0.021	-0.106
			(1.912)	(1.909)
Suburbs			-2.394***	-2.506***
			(0.428)	(0.427)
Wealthy major city			4.202***	3.835***
			(0.393)	(0.402)
Lag natural disaster			1.454***	1.385***
			(0.308)	(0.310)
Obs.	1851	1814	1820	1783
Adj R-squared	8.1e-03	.015	.305	.317

Notes: Robust standard errors in parentheses, clustered at the municipality level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table C.2: Robustness: Alternative Dependent Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Local Investment		Local Subsidy Recipients		Other Recipients		EU Funding Rate	
HHI	-6.447*** (1.333)	-3.061** (1.241)	-6.323*** (1.247)	-2.971*** (1.141)	-8.910*** (1.189)	-4.821*** (1.076)	2.607 (3.980)	-0.675 (3.812)
Political Alignment		0.964*** (0.325)		0.737** (0.307)		0.055 (0.306)		3.196*** (0.956)
Share Capital Expenditure		-2.304** (1.050)		-2.049** (1.013)		-3.778*** (1.005)		6.191** (2.883)
Share Self-Financing		-3.183 (2.307)		-2.737 (2.215)		2.046 (2.047)		-13.013* (6.694)
Share Local Taxes		-2.891* (1.659)		-2.884* (1.651)		-0.215 (1.728)		10.001* (5.388)
Log Avg. Housing Price		-3.329*** (0.701)		-3.015*** (0.665)		-2.647*** (0.746)		9.510*** (2.133)
Per Capita Income Ratio		-0.434 (0.836)		0.532 (0.833)		2.815*** (1.005)		-17.071*** (4.954)
Share Homeowners		-11.451*** (1.704)		-13.792*** (1.656)		-17.016*** (1.767)		6.128 (5.544)
Share Foreigners		7.719* (3.939)		3.937 (3.664)		-7.332** (3.517)		-8.932 (9.262)
Unemployment Rate		-1.076 (2.397)		-2.336 (2.724)		-4.799 (5.163)		13.378 (11.957)
Suburbs		-2.673*** (0.446)		-1.684*** (0.411)		-0.297 (0.402)		2.625** (1.237)
Wealthy Major City		4.021*** (0.417)		4.140*** (0.393)		8.052*** (0.564)		-2.882* (1.584)
Lagged Natural Disaster		1.527*** (0.328)		1.448*** (0.313)		1.231*** (0.316)		0.624 (0.933)
Observations	1906	1874	1906	1874	1906	1874	1125	1112
Adjusted R-squared	0.014	0.31	0.015	0.28	0.031	0.29	-0.0004	0.076

Table C.3: Robustness: Alternative Model PPML

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	EU Funds	Green EU Funds	Other EU Funds	Investments	All Recipients	Other Recipients	EU Funding Rate	Green Share in EU Funds
HHI	-1.434*** (0.436)	-2.009*** (0.611)	-1.160** (0.467)	-1.278*** (0.442)	-1.977** (0.785)	-2.224** (1.100)	-0.021 (0.096)	-0.320 (0.322)
Political Alignment	0.124 (0.092)	0.027 (0.101)	0.195* (0.109)	0.042 (0.106)	0.227 (0.173)	0.296 (0.227)	0.081*** (0.024)	-0.067 (0.074)
Share Capital Expenditure	-0.421 (0.265)	-0.069 (0.373)	-0.602** (0.306)	-0.592** (0.253)	-0.081 (0.501)	0.180 (0.667)	0.163** (0.075)	0.154 (0.245)
Share Self-Financing	-1.086* (0.642)	-1.274 (0.858)	-0.993 (0.796)	-1.076* (0.645)	-0.131 (1.221)	0.155 (1.579)	-0.340* (0.174)	0.108 (0.571)
Share Local Taxes	0.255 (0.529)	0.807 (0.650)	-0.095 (0.647)	-0.093 (0.571)	1.085 (1.008)	1.583 (1.344)	0.269* (0.138)	0.505 (0.407)
Log Avg. Housing Price	0.258 (0.216)	-0.003 (0.289)	0.405* (0.235)	0.007 (0.219)	0.961** (0.458)	1.225** (0.595)	0.253*** (0.056)	-0.145 (0.150)
Per Capita Income Ratio	-0.774** (0.346)	-0.344 (0.492)	-0.939** (0.368)	-0.332 (0.347)	0.036 (0.462)	-0.021 (0.562)	-0.471*** (0.132)	0.253 (0.282)
Share Homeowners	-4.744*** (0.541)	-4.654*** (0.593)	-4.781*** (0.614)	-4.833*** (0.591)	-8.480*** (0.851)	-10.224*** (1.170)	0.165 (0.140)	0.769* (0.425)
Share Foreigners	-2.093 (1.497)	-5.175*** (1.486)	-0.732 (1.613)	-3.243** (1.551)	-3.540 (2.328)	-3.844 (3.218)	-0.254 (0.232)	-3.950*** (1.033)
Unemployment Rate	0.590** (0.246)	0.669*** (0.228)	0.544* (0.312)	0.289 (0.248)	-1.931 (1.995)	-6.433** (2.598)	0.296 (0.222)	0.424** (0.187)
Suburbs	-0.767*** (0.153)	-1.342*** (0.218)	-0.527*** (0.155)	-0.890*** (0.139)	-0.485** (0.220)	-0.283 (0.298)	0.065** (0.032)	-0.399*** (0.113)
Wealthy Major City	1.601*** (0.133)	1.735*** (0.166)	1.527*** (0.151)	1.681*** (0.157)	2.178*** (0.178)	2.610*** (0.252)	-0.077* (0.044)	0.384*** (0.085)
Lagged Natural Disaster	0.277** (0.109)	0.173 (0.121)	0.340*** (0.131)	0.168 (0.144)	0.053 (0.195)	-0.078 (0.259)	0.017 (0.024)	-0.028 (0.075)
Observations	1874	1874	1874	1874	1874	1874	1112	1112

Chapter 3

ECB speeches database

The complete database contains 2594 speeches by the presidents, vice-presidents and member boards of the European Central Bank from 02/07/1997 to 31/08/2023.The ECB has built a database[10] for researchers working on central bank communication. This database is updated every month and is structured as follows :

Table D.1: Structure of the ECB speech database

Date	The original publication date of the speech on the ECB website.
Speakers	Only ECB Executive Board members' speeches are included. If a speech, or part of a speech, is given by a speaker who is not an Executive Board member, his/her name is not listed.
Title	The title of the speech
Subtitle	The subtitle of the speech. Usually in the format "Type by speaker, role, at occasion".
Contents	The contents of the speech are given in full including footnotes.

[10]The database is available at the following link: https://www.ecb.europa.eu/press/key/html/downloads.en.html

ECB climate speeches

Figure D.1: Word clouds for climate-related speeches

Table D.2: Sample of speeches identified as climate speeches

Date	Speaker	Title
2022-12-01	Frank Elderson	The European Climate Law and the European Central Bank
2022-03-17	Isabel Schnabel	A new age of energy : climateflation and greenflation
2021-10-12	Christine Lagarde	The contribution of finance to combating climate change
2021-07-11	Christine Lagarde	Climate Change and Central Banks
2021-06-29	Christine Lagarde	Financing a green and digital recovery
2019-11-21	Luis de Guindos	Implications of the transition to a low-carbon economy for the euro area
2019-05-23	Luis de Guindos	Speaking notes on climate-related risks

Financial data

Table D.3: Descriptions of key stock indices

Index	**Description**	**Type**
DAX	Includes 40 major German blue chip companies.	Benchmark
Eurostock50	Provides a blue-chip representation of Eurozone Supersector leaders	Benchmark
FCHI	Tracks the 40 largest French stocks	Benchmark
SPEUROPE350	The S&P Europe 350 indexes 350 leading blue-chip companies from developed European markets	Benchmark
DJSEI	Dow Jones Sustainability Europe Index, tracks leading sustainability-driven companies in Europe	Green
DJSWI	The Dow Jones Sustainability World Index follows global leaders in sustainability practices	Green
SPEUROPE350ESG	The S&P Europe 350 ESG Index focuses on companies with strong environmental, social, and governance practices	Green

All these indices in the form of daily returns are taken from the DOW Jones and Yahoo Finance websites. They cover the period 2000-2022.

Table D.4: Descriptive Statistics of Stock Prices and Returns

Variable	**N**	**Mean**	**Standar error**	**Min**	**25%**	**Mediane**	**75%**	**Max**
ReturnsDAX	3265	0.01	1.06	-11.32	-0.38	0.01	0.41	9.65
Returns_DJSEI	3265	0.00	0.82	-11.04	-0.25	0.02	0.30	7.66
Returns_djswi	3265	0.01	0.87	-27.08	-0.21	0.03	0.29	7.63
Returns_eurostock50	3265	0.01	0.99	-15.56	-0.30	0.02	0.37	9.24
Returns_fchi	3265	0.01	1.00	-20.95	-0.30	0.03	0.36	8.39
Returns_spE350	3265	0.01	0.82	-11.55	-0.25	0.03	0.31	8.49
Returns_spE350esg	3265	0.01	0.86	-14.73	-0.25	0.03	0.30	8.40

Bibliography

Aglietta, M. and Espagne, E. (2015). Financing energy and low-carbon investment: public guarantees and the ECB. *CEPII Policy Brief*, 06.

Albouy, D. (2013). Partisan representation in congress and the geographic distribution of federal funds. *Review of Economics and Statistics*, 95(1):127–141.

Albrizio, S., Kozluk, T., and Zipperer, V. (2017). Environmental policies and productivity growth: Evidence across industries and firms. *Journal of Environmental Economics and Management*, 81:209–226.

Altavilla, C., Boucinha, M., Pagano, M., and Polo, A. (2023). Climate risk, bank lending and monetary policy. *Bank Lending and Monetary Policy (October 18, 2023)*.

Altavilla, C., Brugnolini, L., Gürkaynak, R. S., Motto, R., and Ragusa, G. (2019). Measuring euro area monetary policy. *Journal of Monetary Economics*, 108:162–179. cit. on pp. 130, 132.

Amamou, R., Gereben, A., and Wolski, M. (2020). Making a difference: Assessing the impact of the EIB's funding to SMES. *EIB Working Paper*, 04.

Amenc, N., Goltz, f., and Liu, V. (2021). Doing good or feeling good? detecting greenwashing in climate investing. *Scientific Beta "Advanced ESG and Climate Investing" Research Chair*.

Anderson, S., Marinescu, I., and Shor, B. (2023). Can pigou at the polls stop us melting the poles? *Journal of the Association of Environmental and Resource Economists*, 10(4):903–945.

Angino, S. and Robitu, R. (2023). One question at a time! a text mining analysis of the ecb q&a session.

Ardia, D., Bluteau, K., Boudt, K., and Inghelbrecht, K. (2023). Climate change concerns and the performance of green vs. brown stocks. *Management Science*, 69(12):7607–7632.

Arseneau, D. M., Drexler, A., and Osada, M. (2022). Central bank communication about climate change. *Finance and Economics Discussion Se- ries 2022-031. Washington: Board of Governors of the Federal Reserve System*.

Arseneau, D. M. and Mitsuhiro, O. (2023). Central bank mandates and communication about climate change: Evidence from a large dataset of central bank speeches. *Bank of Japan Working Paper Series*, No.23-E-14.

Arulampalam, W., Dasgupta, S., Dhillon, A., and Dutta, B. (2009). Electoral goals and center-state transfers: A theoretical model and empirical evidence from india. *Journal of Development Economics*, 88(1):103–119.

Awazu, P. B.-M. D.-L., SAMAMA-Romain, P. D. S.-F., et al. (2020). The green swan-central banking and financial stability in the age of climate change.

Bachtrögler, J., Arnold, E., Doussineau, M., and Reschenhofer, P. (2021). *UPDATE: Dataset of projects co-funded by the ERDF during the multi-annual financial framework 2014-2020*. Number JRC125008. Publications Office of the European Union, Luxembourg.

Baker, E. and Ekundayo, S. (2006). Profit-maximizing R&D in response to a random carbon tax. *Resource and Energy Economics*, 28(2):160–180.

Baker, M., Wurgler, J., and Yuan, Y. (2012). Global, local, and contagious investor sentiment. *Journal of Financial Economics*, 104(2):272–287.

Baldacci, E., Clements, B., Gupta, S., and Cui, Q. (2008). Social spending, human capital, and growth in developing countries. *World Development*, 36(8):1317–1341.

Ball, R. and Brown, P. (1968). An empirical evaluation of accounting income numbers. *Journal of Accounting Research*, 6(2):159–178.

Barbier-Gauchard, A., Sidiropoulos, M., and Varoudakis, A. (2018). *La gouvernance économique de la zone euro. Réalités et perspectives*. LMD Economie. De Boeck Supérieur.

Becker, S. O., Egger, P. H., and Von Ehrlich, M. (2010). Going nuts: The effect of eu structural funds on regional performance. *Journal of Public Economics*, 94(9-10):578–590.

Bennani, H. (2020). Central bank communication in the media and investor sentiment. *Journal of Economic Behavior & Organization*, 176:431–444.

Bernanke, B, R. V. and Sack, B. (2004). Monetary policy alternatives at the zero bound: An empirical assessment. *Federal Reserve Board WP*.

Besley, T. and Persson, T. (2023). The political economics of green transitions. *The Quarterly Journal of Economics*, 138(3):1863–1906.

Beyer, A. and Schreiner, L. (2024). The impact of ECB Banking Supervision on climate risk and sustainable finance. Working Paper Series 2952, European Central Bank.

Blanco-Alcántara, D., Gallud Cano, J., and Lopez-de Silanes, F. (2024). Determinants of the use of European Structural and Investment Funds. *The European Journal of Finance*, 30(4):430–455.

Blei, D. M., Ng, A. Y., and Jordan, M. I. (2003). Latent dirichlet allocation. *Journal of Machine Learning Research*, 3(null):993–1022.

Blinder, A. S., Ehrmann, M., Fratzscher, M., De Haan, J., and Jansen, D.-J. (2008). Central bank communication and monetary policy: A survey of theory and evidence. *Journal of Economic Literature*, 46(4):910–45.

Bolton, P., Despres, M., Da Silva, L. A. P., Samama, F., and Svartzman, R. (2020). The green swan. *BIS Books*.

Boneva, L., Ferrucci, G., and Mongelli, F. P. (2022). Climate change and central banks: what role for monetary policy? *Climate Policy*, 22(6):770–787.

Boungou, W. and Dufau, B. (2024). Eu ets phase iv and industrial performance. *Economics Letters*, 236:111596.

Bouvet, F. and Dall'Erba, S. (2010). European regional structural funds: How large is the influence of politics on the allocation process? *JCMS: Journal of Common Market Studies*, 48(3):501–528.

Bracco, E., Lockwood, B., Porcelli, F., and Redoano, M. (2015). Intergovernmental grants as signals and the alignment effect: Theory and evidence. *Journal of Public Economics*, 123:78–91.

Brauers, H. and Pao-Yu, O. (2020). The political economy of coal in poland: Drivers and barriers for a shift away from fossil fuels. *Energy Policy*, 144:111621.

Brollo, F., Nannicini, T., Perotti, R., and Tabellini, G. (2013). The political resource curse. *American Economic Review*, 103(5):1759–1796.

Cadot, O., Röller, L.-H., and Stephan, A. (2006). Contribution to productivity or pork barrel? the two faces of infrastructure investment. *Journal of public Economics*, 90(6-7):1133–1153.

Calmfors, L. (1994). Active labour market policy and unemployment - a framework for the analysis of crucial design features. *OECD Economic Studies*, (22):7–47.

Campiglio, E. (2016). Beyond carbon pricing: The role of banking and monetary policy in financing the transition to a low-carbon economy. *Ecological Economics*, 121(C):220–230.

Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G., and Tanaka, M. (2018). Climate change challenges for central banks and financial regulators. *Nature climate change*, 8(6):462–468.

Campiglio, E., Deyris, J., Romelli, D., and Scalisi, G. (2023). Warning words in a warming world: Central bank communication and climate change. Global Research Alliance for Sustainable Finance and Investment.

Carlson, M., Giammarino, R., and Heinkel, R. (2024). Municipal capital structure.

Carney, M. (2015). Breaking the tragedy of the horizon-climate change and financial stability. *Speech form the Governor of the Bank of England, Lloyd's of London*.

Carozzi, F. and Repetto, L. (2016). Sending the pork home: Birth town bias in transfers to italian municipalities. *Journal of Public Economics*, 134:42–52.

Cazals, A. and Sauquet, A. (2015). How do elections affect international cooperation? evidence from environmental treaty participation. *Public Choice*, 162:263–285.

Chalmers, A. W. (2013). Regional authority, transnational lobbying and the allocation of structural funds in the e uropean u nion. *JCMS: Journal of Common Market Studies*, 51(5):815–831.

Chapus, R. (2008). *Droit du contentieux administratif*. Montchrestien, Paris, 12e éd. edition.

Chen, C., Pan, D., Huang, Z., and Bleischwitz, R. (2021). Engaging central banks in climate change? The mix of monetary and climate policy. *Energy Economics*, 103(C).

Christainsen, G. B. and Haveman, R. H. (1981). The contribution of environmental regulations to the slowdown in productivity growth. *Journal of Environmental Economics and Management*, 8(4):381–390.

Clarkson, P. M., Li, Y., and Richardson, G. D. (2004). The Market Valuation of Environmental Capital Expenditures by Pulp and Paper Companies. *The Accounting Review*, 79(2):329–353.

Clemens, J. and Veuger, S. (2021). Politics and the distribution of federal funds: Evidence from federal legislation in response to covid-19. *Journal of Public Economics*, 204:104554.

Clifton, J., Díaz-Fuentes, D., Howarth, D., and Kavvadia, H. (2020). The role of the european investment bank in times of covid-19. *SSRN Electronic Journal*.

Clifton, J., Diaz-Fuentes, D., and Lara Gomez, A. (2018). The European Investment Bank : Development, Integration, Investment? *Journal of Common Market Studies*, 56,4:733–750.

Clifton, J., Diaz-Fuentes, D., and Revuelta, J. (2014a). Financing utilities : How the role of the European Investment Bank shifted from regional development to making markets. *Utilities Policy*, 29:63–71.

Clifton, J., Díaz-Fuentes, D., and Revuelta, J. (2014b). Financing utilities: How the role of the european investment bank shifted from regional development to making markets. *Utilities Policy*, 29:63–71.

Clintworth, M. and Boulougouris, E. (2018). Combining multicriteria decision analysis and cost–benefit analysis in the assessment of maritime projects financed by the European Investment Bank. *Maritime Economics Logistics*, 20(1):29–47.

Cook, J., Nuccitelli, D., Green, S., Richardson, M., Winkler, B., Painting, R., Way, R., Jacobs, P., and Skuce, A. (2013). Quantifying the consensus on anthropogenic global warming in the scientific literature. *Environmental Research Letters*, 8(2):024024.

Corvalan, A., Cox, P., and Osorio, R. (2018). Indirect political budget cycles: Evidence from chilean municipalities. *Journal of Development Economics*, 133:1–14.

Crescenzi, R. and Giua, M. (2014). How does the net impact of the eu cohesion policy differ across countries. In *RSA Conference Challenges for the New Cohesion Policy in*, volume 2020.

Dafermos, Y., Nikolaidi, M., and Galanis, G. (2017). A stock-flow-fund ecological macroeconomic model. *Ecological Economics*, 131:191–207.

Dahlberg, M. and Johansson, E. (2002). On the vote-purchasing behavior of incumbent governments. *American Political Science Review*, 96(1):27–40.

Dai, H., Xie, X., Xie, Y., Liu, J., and Masui, T. (2016). Green growth: The economic impacts of large-scale renewable energy development in china. *Applied Energy*, 162:435–449.

Damette, O. and Del Lo, G. (2022). Renewable energy drivers in france: a spatial econometric perspective. *Regional Studies*, 56(10):1633–1654.

Dardot, P. and Laval, C. (2017). *Commons: For a Revolution in the 21st Century*. Zed Books.

Delatte, A. L., Matray, A., and Pinardon-Touati, N. (2019). Political quid pro quo in financial markets. *Available at SSRN 3429836*.

Delfgaauw, J. and Swank, O. (2024). The political climate trap. *Journal of Environmental Economics and Management*, 124:102935.

Dell, M., Jones, B. F., and Olken, B. A. (2012). Temperature shocks and economic growth: Evidence from the last half century. *American Economic Journal: Macroeconomics*, 4(3):66–95.

Dellmuth, L. M. and Stoffel, M. F. (2012). Distributive politics and intergovernmental transfers: The local allocation of european union structural funds. *European Union Politics*, 13(3):413–433.

Demiralp, S. and Jorda, O. (2004). The response of term rates to fed announcements. *Journal of Money, Credit and Banking*, 36(3):387–405.

Deyris, J. (2023). Too green to be true? forging a climate consensus at the european central bank. *New Political Economy*, 28(5):713–730.

DiLeo, M., Rudebusch, G. D., and van, J. (2023). Why the fed and ecb parted ways on climate change. Hutchins Center Working Paper 88, Hutchins Center on Fiscal and Monetary Policy, Washington, D.C.

Dixit, A. and Londregan, J. (1996). The determinants of success of special interests in redistributive politics. *the Journal of Politics*, 58(4):1132–1155.

Douenne, T. and Fabre, A. (2020). French attitudes on climate change, carbon taxation and other climate policies. *Ecological Economics*, 169:106496.

Dupont, C., Moore, B., Boasson, E. L., Gravey, V., Jordan, A., Kivimaa, P., Kulovesi, K., Kuzemko, C., Oberthür, S., Panchuk, D., et al. (2024). Three decades of eu climate policy: Racing toward climate neutrality? *Wiley Interdisciplinary Reviews: Climate Change*, 15(1):e863.

Dyckman, T., Philbrick, D., and Stephan, J. (1984). A comparison of event study methodologies using daily stock returns: A simulation approach. *Journal of Accounting Research*, 22:1–30.

Ebeling, A. (2022). European investment bank loan appraisal, the eu climate bank? *International Economics*, 172:203–216.

Ebeling, H. (1964). *Der Begriff "Demokratie" in den sozialistischen Ideologien - Marx, Lassalle, Engels*. Inaugural Dissertation, Ruprecht-Karl-Universität Heidelberg.

Ehrmann, M. and Fratzscher, M. (2004). Taking stock: monetary policy transmission to equity markets. Working Paper Series 354, European Central Bank.

Ehrmann, M. and Talmi, J. (2020). Starting from a blank page? semantic similarity in central bank communication and market volatility. *Journal of Monetary Economics*, 111:48–62.

Erforth, B. and Keijzer, N. (2024). Green and global? a policy frame analysis of the european investment bank's re-branding from 2018–2023. *Journal of Economic Policy Reform*. Published online: 16 Aug 2024.

Escoffier, M., Hache, E., Mignon, V., and Parise, A. (2019). Determinants of investments in solar photovoltaic: Do oil prices really matter? *EconomiX Working Paper*, 28.

Espagne, E. and Aglietta, M. (2016). Financing energy and low-carbon investment in europe: Public guarantees and the ecb. In *Handbook of Research on Green Economic Development Initiatives and Strategies*, pages 132–146. IGI Global.

EU Technical Expert Group on Sustainable Finance (2020). Taxonomy : Final report of the technical expert group on sustainable finance. *Secretariat provided by the European Comission*.

European Central Bank (2022a). 2022 climate risk stress test. Accessed: 2024-07-18.

European Central Bank (2022b). Lettre de la bce à mme irene tinagli, présidente de la commission des affaires économiques et monétaires du parlement européen. Accessed: 2024-07-17.

European Commission (2020a). Commission staff working document guidance to member states recovery and resilience plans.

European Commission (2020b). European green deal.

European Commission (2023). Special eurobarometer 538: Climate change. Fieldwork: May – June 2023.

European Economic Community (1957). *Treaty Establishing the European Economic Community (Treaty of Rome)*. European Economic Community, Rome, Italy. Signed on 25 March 1957.

European Environment Agency (2017). Climate change, impacts and vulnerability in europe 2016: An indicator-based report.

European Environment Agency (2023). Annual european union greenhouse gas inventory 1990-2021 and inventory report 2023. Accessed: 2024-07-16.

European Investment Bank (2013a). Energy lending criteria. *Luxembourg : European Investment Bank*.

European Investment Bank (2013b). The economic appraisal of investment projects at the EIB. *Luxembourg : European Investment Bank*.

European Investment Bank (2015a). Climate action list of eligible sectors and eligibility criteria. *Luxembourg : European Investment Bank*.

European Investment Bank (2015b). Stratégie de la BEI en matière d'action pour le climat. *Luxembourg : European Investment Bank*.

European Investment Bank (2020). Common principles for climate mitigation finance tracking. *Luxembourg : European Investment Bank*.

Eurostat (2020). Greenhouse gas emissions statistics - emission inventories. Accessed: 2024-07-16.

Eyraud, L. and Clements, B. (2013). Green investment: Trends and determinants. *Energy Policy*, 60:852–865.

Fabra, N., Gutiérrez, E., Lacuesta, A., and Ramos, R. (2024). Do renewable energy investments create local jobs? *Journal of Public Economics*, 239:105212.

Fajeau, M., Ligonnière, S., and Mayol, A. (2022). Le fonds de sortie des emprunts toxiques: une alternative au contentieux? *Revue d'économie politique*, 32(2):313–340.

Fama, E. F., Fisher, L., Jensen, M. C., and Roll, R. (1969). The adjustment of stock prices to new information. *International Economic Review*, 10(1):1–21.

Fayolle, A. (2018). La relance par l'investissement en Europe : l'expérience de la Banque Européenne d'Investissement. *Annales des Mines : Réalités industrielles*, 1:71–74.

Fayolle, A. (2020). Covid-19, La BEI accélère sa transformation en Banque Européenne du Climat. *Revue d'économie financière*, 3:229–234.

Feld, L. P. and Hassib, J. (2024). On the role of eu cohesion policy for climate policy. Technical report, ZEW Discussion Papers.

Fitoussi, J.-P., Laurent, , and Le Cacheux, J. (2007). La stratégie environnementale de l'union européenne. *Revue de l'OFCE*, (102):381–413.

Flammer, C. (2021). Corporate green bonds. *Journal of Financial Economics*, 142(2):499–516.

Gadenne, D., Kennedy, J., and McKeiver, C. (2008). An empirical study of environmental awareness and practices in SMEs. *Journal of Business Ethics*, 84:45–63.

Gallic, E. and Vermandel, G. (2020). Weather shocks. *European Economic Review*, 124:146–158.

Garrett-Peltier, H. (2017). Green versus brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model. *Economic Modelling*, 61:439–447.

Gatti, M., Schich, S., Van der Wielen, W., and Sinnott, E. (2022). Impact assessment of eib venture debt. *EIB Impact Studies*.

Geddes, A., Schmid, N., and Schmidt, T. (2020). The politics of climate finance: Consensus and partisanship in designing green state investment banks in the United Kingdom and Australia. *Energy Research Social Science*, 69:101583.

Gerlach, S. (2007). Interest Rate Setting by the ECB, 1999-2006: Words and Deeds. *International Journal of Central Banking*, 3(3):1–46.

Gokul, C. (2015). Long-term payoffs of near-term low-carbon deployment policies. *Energy Policy*, 86:493–505.

Gokul, C., Iyer, Leon E, C., James A, E., Nathan E, H., and Haewon C, M. (2015). Long-term payoffs of near-term low-carbon deployment policies. *Energy Policy*, 86:493–505.

Griffith-Jones, S. and Carreras, M. (2020). The role of the eib in the green transformation. *Policy Study, The Foundation for European Progressive Studies (FEPS) and the Initiative for Policy Dialogue (IPD), Columbia University*.

Griffith-Jones, S. and Naqvi, N. (2020). *Industrial policy and risk sharing in public development banks: Lessons for the post-COVID response from the EIB and EFSI*. Global Economic Governance Programme, University of Oxford.

Griffith-Jones, S. and Tyson, J. (2012). The EIB and its role in regional development and integration. *M,A Macedo Cintra da Rocha Gomes (eds) The transformations of the International Financial System*, Chapter 10.

Guanglai, Z., Ning, Z., and Wenmei, l. (2018). How do population and land urbanization affect CO2 emissions under gravity center change? A spatial econometric analysis. *Journal of Cleaner Production*, 202:510–523.

Guerrieri, P., Luciani, M., and Meliciani, V. (2010). The determinants of investment in information and communication technologies. *Economics of Innovation and New Technology*, 20(4):387–403.

Guolei, C. (2018). Characteristics and influencing factors of spatial differentiation of urban black and odorous waters in China. *Sustainability*, 10(12):4747.

Guthrie, G. and Wright, J. (2000). Open mouth operations. *Journal of Monetary Economics*, 46(2):489–516.

Haan, J. and Jansen, D.-J. (2006). Look who's talking: Ecb communication during the first years of emu. *International Journal of Finance Economics*, 11:219–228.

Haldane, A. and McMahon, M. (2018). Central bank communications and the general public. *AEA Papers and Proceedings*, 108:578–83.

Havemann, T., Negra, C., and Werneck, F. (2022). *Blended finance for agriculture: exploring the constraints and possibilities of combining fi nancial instruments for sustainable transitions*, pages 347–358. Springer Nature Switzerland, Cham.

He, X. and Liu, Y. (2018). The public environmental awareness and the air pollution effect in chinese stock market. *Journal of Cleaner Production*, 185:446–454.

Helen, S. (2019). The influencing mechanism of multi-factors on green investments: A hybrid analysis. *Journal of Cleaner Production*, 239.

Howarth, D. and Kavvadia, H. (2024). The european investment bank to the rescue? covid-related lending as incremental change. *Journal of Economic Policy Reform*, 27(1):25–44.

Huliaras, A. and Petropoulos, S. (2016). European money in greece: In search of the real impact of eu structural funds. *JCMS: Journal of Common Market Studies*, 54(6):1332–1349.

Ikoro, V., Sharmina, M., Malik, K., and Batista-Navarro, R. (2018). Analyzing sentiments expressed on twitter by uk energy company consumers. In *2018 International Conference on Social Networks Analysis, Management and Security (SNAMS)*, pages 95–98, Valencia, Spain. IEEE.

IPCC (2018). Summary for policymakers, in: Global warming of 1,5°c, an ipcc special report on the impacts of global warming of 1,5°c above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development,and efforts to eradicate povert. *In press*.

Issing, O. (2005). Communication, transparency, accountability: Monetary policy in the twenty-first century. *Federal Reserve Bank of St. Louis Review*, 87(2).

Jacobs, B. W., Singhal, V. R., and Subramanian, R. (2010). An empirical investigation of environmental performance and the market value of the firm. *Journal of Operations Management*, 28(5):430–441.

Johansson, E. (2003). Intergovernmental grants as a tactical instrument: empirical evidence from swedish municipalities. *Journal of Public Economics*, 87(5-6):883–915.

Karltorp, K. and Maltais, A. (2024). Financing green industrial transitions: A swedish case study. *Energy and Climate Change*, 5:100138.

Kaser, J. (1984). European Institutions, The European Investment Bank : Its role and place within the european community system. *Yearbook of European Law*, 4(1):303–325.

Kavvadia, H. (2021a). The european investment bank's 'quantum leap' to become the world's first international climate bank. *Politics and Governance*, 9(2):185–195.

Kavvadia, H. (2021b). The european investment bank's 'quantum leap' to become the world's first international climate bank. *Politics and Governance*, 9(2):185–195.

Kemmerling, A. and Bodenstein, T. (2006). Partisan politics in regional redistribution: Do parties affect the distribution of eu structural funds across regions? *European Union Politics*, 7(3):373–392.

Klassen, R. D. and McLaughlin, C. P. (1996). The impact of environmental management on firm performance. *Management Science*, 42(8):1199–1214.

Krueger, P., Sautner, Z., and Starks, L. T. (2020). The importance of climate risks for institutional investors. *Review of Financial Studies*, 33(3):1067–1111.

Landry, J. R. (2021). The political allocation of green pork and its implications for federal climate policy. *Journal of Public Economics*, 201:104483.

Langan, M. (2014). A moral economy approach to Africa-EU ties : The case of the European Investment Bank. *Review of the International Studies*, 40(3):465–485.

Le Gallo, J., Dall'Erba, S., and Guillain, R. (2011). The local versus global dilemma of the effects of structural funds. *Growth and Change*, 42(4):466–490.

Lévêque, C. (2020). Political connections, political favoritism and political competition: evidence from the granting of building permits by french mayors. *Public Choice*, 184(1):135–155.

Li, G., Lu, S., Shao, S., Yang, L., and Zhang, K. (2021). Do environmental regulations hamper small enterprises' market entry? evidence from china. *Business Strategy and the Environment*, 30(1):252–266.

Licari, J. (1969). The EIB. *Journal Of Common Market Studies*, 8(3):192–215.

Liebe, M. and Howarth, D. (2020). The european investment bank as policy entrepreneur and the promotion of public-private partnerships. *New Political Economy*, 25(2):195–212.

Lin, B. and Zhao, H. (2023). Evaluating current effects of upcoming eu carbon border adjustment mechanism: Evidence from china's futures market. *Energy Policy*, 177:113573.

Lindbeck, A. and Weibull, J. W. (1993). A model of political equilibrium in a representative democracy. *Journal of Public Economics*, 51(2):195–209.

List, J. A. and Sturm, D. M. (2006). How elections matter: Theory and evidence from environmental policy. *The Quarterly Journal of Economics*, 121(4):1249–1281.

Liu, H., Wang, Y., He, D., and Wang, C. (2020). Short term response of chinese stock markets to the outbreak of covid-19. *Applied Economics*, 52(53):5859–5872.

Lucca, D. O. and Trebbi, F. (2009). Measuring Central Bank Communication: An Automated Approach with Application to FOMC Statements. NBER Working Papers 15367, National Bureau of Economic Research, Inc.

Marinoni, O., Higgins, A., Hajkowicz, S., and Collins, K. (2009). The multiple criteria analysis tool (MCAT): A new software tool to support environmental investment decision making. *Environmental Modelling Software*, 24(2):153–164.

Marques Santos, A., Reschenhofer, P., Bachtrögler-Unger, J., Conte, A., and Meyer, N. (2022). Mapping low-carbon industrial technologies projects funded by erdf in 2014-2020. Technical report.

Marty-Gauquie, H. (2004). The EIB and the financing of renewable energy sources; La BEI et le financement des energies renouvelables. *Revue de l'Energie*, 560.

Marzinotto, B. (2011). A European fund for economic revival in crisis countries. *Bruegel Policy Contribution*, 01.

Masciandaro, D., Peia, O., and Romelli, D. (2024). Central bank communication and social media: From silence to twitter. *Journal of Economic Surveys*, 38(2):365–388.

Matikainen, S., Campiglio, E., and Zenghelis, D. (2017). The climate impact of quantitative easing.

McAlexander, R. J. and Urpelainen, J. (2020). Elections and policy responsiveness: evidence from environmental voting in the US congress. *Review of Policy Research*, 37(1):39–63.

Meunier, G. and Ponssard, J.-P. (2018). The economics of subsidizing clean technologies. *Journal of Environmental Economics and Management*, 90:128–144.

Miao, C., Fang, D., Sun, L., Luo, Q., and Yu, Q. (2018). Driving effect of technology innovation on energy utilization efficiency in strategic emerging industries. *Journal of Cleaner Production*, 170:1177–1184.

Mielke, J. and Gesine A, S. (2018). Green investment and coordination failure: An investors' perspective. *Ecological Economics*, 150:88–95.

Misonne, D. (2018). Legal aspects of environmental commons. *Environmental Policy and Law*, 48(2):77–90.

Moczall, S. (2014). Micro-econometric evaluation of subsidized employment in morocco: the case of the 'idmaj' program. *Journal for Labour Market Research*, 47(3):223–245.

Mohl, P. and Hagen, T. (2010). Do eu structural funds promote regional growth? new evidence from various panel data approaches. *Regional Science and Urban Economics*, 40(5):353–365.

Morvan, C. and Paty, S. (2024). Natural disasters and voter gratitude: What is the role of prevention policies? *Public Choice*, 198(3):427–465.

Moschella, M., Pinto, L., and Martocchia Diodati, N. (2020). Let's speak more? how the ecb responds to public contestation. *Journal of European Public Policy*, 27(3):400–418.

Mourao, P. R. (2019). The effectiveness of green voices in parliaments: Do green parties matter in the control of pollution? *Environment, Development and Sustainability*, 21:985–1011.

Muraközy, B. and Telegdy, Á. (2016). Political incentives and state subsidy allocation: Evidence from hungarian municipalities. *European Economic Review*, 89:324–344.

Neszveda, G. and Siket, B. (2023). Green ecb speeches matter. *Journal of Sustainable Finance & Investment*, 0(0):1–18.

Network for Greening the Financial System (2019). Macroeconomic and financial stability implications of climate change. *Technical supplement to the First comprehensive report". Banque de France.*

Neumayer, E. (2003). The determinants of aid allocation by regional multilateral development banks and united nations agencies. *International Studies Quarterly*, 47(1):101–122.

Newell, R., Jaffee, A., and Stavins, R. (1999). The induced innovation hypothesis and energy-saving technological change. *Quarterly Journal of Economics*, 114(3):941–975.

Nicolas, R., Titl, V., and Schotanus, F. (2025). European funds and green public procurement. *Ecological Economics*, 227:108400.

Noailly, J., Nowzohour, L., Van Den Heuvel, M., and Pla, I. (2024). Heard the news? environmental policy and clean investments. *Journal of Public Economics*, 238:105190.

Oreskes, N. (2004). The scientific consensus on climate change. *Science*, 306:1686.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.

Ou, Y., Song, W., and Nam, K.-M. (2024). Metro-line expansions and local air quality in shenzhen: Focusing on network effects. *Transportation Research Part D: Transport and Environment*, 126:103991.

Panayotou, T. (1993). Empirical tests and policy analysis of environmental degradation at different stages of economic development. *International Labour Office Geneva*.

Pellegrini, G., Terribile, F., Tarola, O., Muccigrosso, T., and Busillo, F. (2013). Measuring the effects of european regional policy on economic growth: A regression discontinuity approach. *Papers in Regional Science*, 92(1):217–233.

Pérignon, C. and Vallée, B. (2017). The political economy of financial innovation: evidence from local governments. *The Review of Financial Studies*, 30(6):1903–1934.

Piketty, T. and Cagé, J. (2023). *Une histoire du conflit politique: Elections et inégalités sociales en France, 1789-2022*. Seuil.

Pinder, D., Edwards, J., and Wise (1995). The European Investment Bank, transport investment and European union objectives: an exploratory analysis. *Journal of Transport Geography*, 3(3):167–178.

Porter, M. and Van der Linde, C. (1995). Toward a new conception of the environment competitiveness relationship,. *Journal of Economic Perspective*, 9(4):97–118.

Rinker, T. (2022). *sentimentr: Calculate Text Polarity Sentiment*. R package version 2.9.0.

Robinson, N. (2009). The EIB : The EU's neglected institution. *Journal of Common Market Studies*, 47,3:651–673.

Rodríguez-Pose, A. and Garcilazo, E. (2015). Quality of government and the returns of investment: Examining the impact of cohesion expenditure in european regions. *Regional Studies*, 49(8):1274–1290.

Santi, C. (2020). Investor climate sentiment and financial markets. *SSRN Electronic Journal*.

Santos, A., Barbero, J., Salotti, S., Diukanova, O., and Pontikakis, D. (2023). On the road to regional 'competitive environmental sustainability': the role of the european structural funds. *Industry and Innovation*, 30(7):801–823.

Schueftan, A., Aravena, C., and Reyes, R. (2021). Financing energy efficiency retrofits in chilean households: The role of financial instruments, savings and uncertainty in energy transition. *Resource and Energy Economics*, 66:101265.

Schulze, K. (2021). Policy characteristics, electoral cycles, and the partisan politics of climate change. *Global Environmental Politics*, 21(2):44–72.

Selmi, R., Makhlouf, F., Kasmaoui, K., Errami, Y., and Ben Atta, O. (2022). "there is no vaccine for climate change" - how well governments'covid-19 green stimulus announcements contribute to business sustainability? *International Economics*, 171:1–17.

Shahbaz, M., Solarin, S., Mahmood, H., and Arouri, M. (2013). Does financial development reduce co2 emissions in malaysian economy? a time series analysis. *Economic Modelling*, 35:145–152.

Shen, J., Wei, Y. D., and Yang, Z. (2017). The impact of environmental regulations on the location of pollution-intensive industries in china. *Journal of Cleaner Production*, 148:785–794.

Shen, Y. and Malik, M. (2021). Does green investment, financial development and natural resources rent limit carbon emissions? A provincial panel analysis of China. *Science of the Total Environment*, 755.

Shuai, G., Chen, X., Wu, Y., Tan, Y., Zhang, Y., and Shen, L. (2018). Identifying the key impact factors of carbon emission in China: Results from a largely expanded pool of potential impact factors. *Journal of Cleaner Production*, 175:612–623.

Simpere, A. (2008). BEI : l'Europe mine l'Afrique. *Amis de la Terre,*.

Solé-Ollé, A. and Sorribas-Navarro, P. (2008). The effects of partisan alignment on the allocation of intergovernmental transfers. Differences-in-differences estimates for Spain. *Journal of Public Economics*, 92(12):2302–2319.

Stef, N. and Ben Jabeur, S. (2023). Elections and environmental quality. *Environmental and Resource Economics*, 84(2):593–625.

Stern, D. (2004). The rise and fall of the Environmental Kuznets Curve. *World Development*, 32(8):1419–1439.

Stern Review (2006). Stern review: The economics of climate change.

Streimikiene, D., Klevas, V., and Bubeliene, J. (2007). Use of eu structural funds for sustainable energy development in new eu member states. *Renewable and Sustainable Energy Reviews*, 11(6):1167–1187.

Stucki, T. (2019). Which firms benefit from investments in green energy technologies? – the effect of energy costs. *Research Policy*, 48(3):546–555.

Szabo, J. and Fabok, M. (2020). Infrastructures and state-building : Comparing the energy politics of the european commission with the governments of hungary and poland. *Energy Policy*, 138.

Taylor, M. (1999). Real interest rates and macroeconomic activity. *Oxford Review of Economic Policy*, 15(2):95–113.

Testa, F., Iraldo, F., Frey, M., and Daddi, T. (2012). What factors influence the uptake of GPP (green public procurement) practices? New evidence from an Italian survey. *Ecological Economics*, 82:88–96.

Tuerk, A., Frieden, D., Sharmina, M., Schreiber, H., and Vorsatz, D. (2010). Green investment schemes: first experiences and lessons learned,. *Joanneum Research Center*.

Tuijnman, A. (2009). The education lending policy of the European Investment Bank. *European Journal of Education*, 44(1):111–125.

Vandermeulen, V., Verspecht, A., Vermeire, B., Van Huylenbroeck, G., and Xavier Gellynck, X. (2011). The use of economic valuation to create public support for green infrastructure investments in urban areas. *Landscape and Urban Planning*, 103(2):198–206.

Veiga, L. G. (2012). Determinants of the assignment of eu funds to portuguese municipalities. *Public Choice*, 153(1):215–233.

Veiga, L. G. and Veiga, F. J. (2007). Political business cycles at the municipal level. *Public Choice*, 131(1/2):45–64.

Vollmer, U. (2024). Greening central bank policies: Euro area vs non-euro area eu member states. *Intereconomics*, 59(4):236–242.

Wang, C., Zhang, H., Lu, L., Wang, X., and Song, Z. (2019). Pollution and corporate valuation: evidence from china. *Applied Economics*, 51(32):3516–3530.

Willaert, E., Bussière, E., and Dumoulin, M. (2010). La Banque de l'Union européenne : la BEI, 1958-2008. *European Investment Bank*.

World Bank (2018). Wbg thesaurus. Technical report, World Bank Group, Washington, D.C.

Wouters, J. and Hachez, N. (2011). A responsible lender? The European Investment Bank's environmental, social and human rights accountability. *Leuven Center for Global Gouvernance Studies, Working Paper*, 72.

Wright, C. (2007). EIB : promoting sustainable development "where appropriate". *CEE Bankwatch Network*.

Włodarski, M. and Martyniuk-Peczek, J. (2017). Relevance of the eu structural funds' allocation to the needs of combating air pollution in poland: Analysis of the operational programmes of regions threatened with critical air pollution from distributed energy sources. In *IOP Conference Series: Materials Science and Engineering*, volume 245, page 082060. IOP Publishing.

Yuan, F. and Gallagher, K. (2018). Greening development lending in the Americas: Trends and determinants. *Ecological Economics*, 154:189–200.

Zepa, I. and Hoffmann, V. H. (2023). Policy mixes across vertical levels of governance in the eu: The case of the sustainable energy transition in latvia. *Environmental Innovation and Societal Transitions*, 47:100699.

Zhao, X., Fan, Y., Fang, M., and Hua, Z. (2018). Do environmental regulations undermine energy firm performance? an empirical analysis from china's stock market. *Energy Research Social Science*, 40:220–231.

List of Tables

List of Figures

Antoine Ebeling

Climate Change and European Intervention

RÉSUMÉ

Cette thèse explore le lien entre les outils de financement européens et la transition écologique à travers trois chapitres. Le premier analyse les prêts de la BEI aux États membres et montre un lien positif entre le niveau de développement économique des pays et le financement de projets verts. Le second examine l'utilisation des fonds européens par les communes françaises pour des projets environnementaux. Il révèle que l'alignement politique favorise les projets bruns, tandis que des marges électorales étroites augmentent la demande de projets verts. Enfin, le troisième chapitre étudie la communication climatique de la BCE et son impact sur les marchés financiers, montrant que les indices verts bénéficient de rendements positifs après ces annonces.

Mots clefs: Changement climatique, Institutions européennes, Investissement vert, Fonds structurels

RÉSUMÉ EN ANGLAIS

This thesis explores the link between European financing tools and the green transition through three chapters. The first analyzes EIB loans to member states and shows a positive correlation between the economic development level of countries and the financing of green projects. The second examines the use of European funds by French municipalities for environmental projects. It reveals that political alignment favors brown projects, while narrow electoral margins increase the demand for green projects. Finally, the third chapter studies the ECB's climate communication and its impact on financial markets, showing that green indices experience positive returns following these announcements

Keywords: Climate change, European institutions, Green investment, Structural funds