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THE EUROPEAN TAXONOMY FOR SUSTAINABLE ACTIVITIES: A REGULATORY MECHANISM FOR THE ECONOMIC TRANSITION TO CLIMATE NEUTRALITY

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THE EUROPEAN TAXONOMY FOR SUSTAINABLE ACTIVITIES: A
REGULATORY MECHANISM FOR THE ECONOMIC TRANSITION TO
CLIMATE NEUTRALITY

by

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Abstract

The transition to climate neutrality requires a process of economic transformation in which economic growth, sustainability and environmental protection are integrated in a harmonious way. However, according to the Climate Policy Initiative, current flows of green finance investment are not sufficient to achieve this goal. This raises the question of whether current public policy mechanisms are adequate to bring about this transformation, and, in particular, whether the European Union Taxonomy for Sustainable Activities contributes to the reallocation of productive investment towards economically sustainable activities in the member states of the European Union. To answer this question, empirical research is carried out using an econometric Difference in Differences approach to identify the effect of the EU Taxonomy on productive investment flows in 19 European Union countries from 2017 to 2023. The empirical results show that the EU Taxonomy generates, on average, an increase of 137 million in Purchasing Power Standard (PPS) of productive investment towards sustainable activities. The findings of this research, therefore, contribute to understanding the impact of the EU Taxonomy in facilitating the transition to climate neutrality.

Keywords: Environmental neutrality, Economic Transformation, Productive Investment, European Union, Taxonomy of sustainable activities, Difference in Differences Approach.

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List of Abbreviations

ATET	Average Treatment Effect on the Treated
CapEx	Capital Expenditure
CSDDD	Corporate Sustainability Due Diligence Directive
CSRD	Corporate Sustainability Reporting Directive
DA	Delegated Acts
DID	Difference-in-Differences Econometric Approach
DNSH	Do No Significant Harm
EIB	European Investment Bank
EIS	European Innovation Scoreboard
ESAs	European Supervisory Authorities
ESEA	Environmentally Sustainable Economic Activities
ESG	Environmental, Social, and Governance
ETS	Emission Trade Systems
EU	European Union
FMP	Financial Market Participants
GAR	Green Asset Ratio
GFCF	Gross Fixed Capital Formation
MS	Minimum Safeguards

MSEG	Member State Expert Group on Sustainable Finance
NEPP	National Energy Producer Price Index
NFRD	Non-Financial Reporting Directive
OpEx	Operational Expenditure
PPS	Purchasing Power Standard
PSF	Platform on Sustainable Finance
SC	Substantial Contribution
SFDR	Sustainable Finance Disclosure Regulation
TEG	Technical Expert Group on Sustainable Finance
TSC	Technical Screening Criteria

Chapter 1: Introduction

This research contributes to the academic debate on the transition toward climate neutrality by analysing how financial resources are reallocated toward environmentally sustainable economic activities. The European Climate Law as stipulated in Regulation (EU) 2021/1119 establishes that climate neutrality is a process of transformation aiming to reduce the greenhouse gas emissions of the economy to net zero through structural changes in production, investment and consumption. To achieve this transformation, the climate neutral transition is intended to move away from the carbon intensive economic activities towards environmentally sustainable activities. However, there are structural market barriers that hinder this transition despite growing recognition of the urgency of climate action. One crucial barrier is the persisting financial gap between climate objectives and actual investment flows (Climate Policy Initiative, 2025; EU Platform on Sustainable Finance, 2024).

The persistence of these financial gaps is related to structural failures of the financial system which lead to inaccurate pricing of long-term effects of pollution from unsustainable business practices within the financial markets. Although the existence of economic and informational tools aimed to address it, especially carbon pricing, they are not designed to overcome the structural failures that increase the transaction cost of identifying sustainable activities. This creates a policy gap that the European Taxonomy for Sustainable Activities (“The EU Taxonomy”) is intended to address by functioning as an informational and institutional driver that reduces the transaction cost of the reallocation of financial flows necessary for the transition to climate neutrality. Hence, The EU Taxonomy functions as a mechanism to direct and monitor investment flows towards environmentally sustainable activities through classifying and disclosing the degree of environmental sustainability of these activities (EU Platform on

Sustainable Finance, 2024). As a regulatory mechanism, this research argues that the EU Taxonomy increases confidence, reduces uncertainty and incentivizes investment in environmentally sustainable economic activities.

With this situation at hand this research seeks to answer the question **how the implementation of the EU taxonomy of sustainable activities influences the allocation of productive investment towards sustainable economic activities in the Member States of the European Union.**

While ongoing empirical research on the EU taxonomy focuses mainly on its impact on financial instruments and firms' investment strategies, mostly relying on revenue-based metrics, this study focuses on its role in directing the allocation of productive investments at the macroeconomic level. To answer the research question, this study uses a difference-in-differences econometric approach using data from 19 EU Member States from 2017 to 2023. This research is structured as follows: Chapter 2 presents the theoretical framework established to analyse the reallocation process of productive investment by the EU Taxonomy for the transition to the climate neutrality. Chapter 3 sets out the methodological process required to answer the research question. Chapter 4 outlines and discusses the results of this research and the academic debate about them. And finally, chapter 5 presents the conclusion, integrating the findings of this research.

Chapter 2: Literature Review

A climate-neutral economy requires mechanisms to redirect financial flows towards environmentally sustainable sectors. Market-based policies, especially carbon pricing, have been the main tools to manage the reallocation of resources resulting from pollution externalities in the economy (Lehmann, 2012). However, these policies have been insufficient to align capital flows with sustainable objectives because they focus solely on regulating externalities rather than influencing capital allocation in favour of the goal of climate neutrality (Cojoianu et al., 2023; Stern & Stiglitz, 2017).

Institutional frameworks such as the EU Taxonomy have emerged as tools for steering investment flows to reduce transaction costs and information asymmetry in sustainable financial markets, thus complementing existing public policy tools (Cojoianu et al., 2023; Stern & Stiglitz, 2017).

In this chapter, the theoretical and empirical foundations will be established to understand the EU Taxonomy as a transformative institutional driver. The chapter begins by identifying the systemic market failures that this framework is intended to address (Section 2.1). It then presents the evolving institutional structure and governance, current empirical studies, policy hurdles faced by the EU Taxonomy as well as the contribution of this study (Sections 2.2). Central to this analysis is the conceptualization of productive investment (Section 2.3). Finally, the last section presents the specific mechanisms through which the EU Taxonomy signals a reallocation of capital and establishes it as unified institutional driver of the reallocation process (Section 2.4), culminating in the research hypothesis that guides this study.

2.1 Framing the Problem: Market Failures and Policy Gap

2.1.1 Capital Market Failure in the Presence of Environmental Externalities

The expansion of sustainable economic activities requires the financial sector to channel scarce capital funds efficiently. This also implies an increase in physical and financial investment, and also an increase in lending capital to the real economy sectors, thereby steering the transition to a climate neutral economy. However, the current process of reallocation of capital follows the short-term logic of the financial system and is also affected by information failures. These failures produce difficulties in the process of identification and pricing of investment opportunities. The EU Taxonomy is specifically designed to mitigate this informational deficit.

Financial system's structural focus on the short-term limits its capacity to integrate long-term sustainability considerations. Its structural focus is based on a one-dimensional logic of immediate profit maximization, especially in the return on investment, leaving aside long-term environmental and social stability (Thomä & Chenet, 2017). Following this logic, discounting the present value of investment does not account for the significant cost of long-term environmental and social failures that the investment may incur. This happens due to minimizing the current cost of these future distant expenses by discounting the future heavily (Thomä & Chenet, 2017). Thus, the current financial system's structure does not provide financial incentives to account for environmental and social factors as long as the investment is profitable.

Furthermore, this could incentivize Financial Market Participants (FMP), especially managers, to externalize business costs, such as pollution, depletion of natural resources, or impacts on human rights, thereby eroding incentives to invest in more sustainable and less socially harmful economic activities (Thomä & Chenet, 2017). As has been stated, efficient resource allocation for a sustainable economy

transition requires that the Financial System, namely the Capital Market, overcomes the short-term profits logic and the information gaps. It needs comparable, transparent, and reliable sustainable data to distinguish promising sustainable investment opportunities from non-sustainable ones.

In this context financial regulations aimed at regulating capital markets fail to take into account the cost of environmental externalities and the financial transition risk in the pricing of assets. Although the capital market relies on market forces to establish pricing for sustainable assets, this could be skewed by informational market failures related to asymmetric information and agency costs. These issues lead to a misallocation of capital in assets that do not reflect their social and environmental cost (contribution or harm) and their financial risk resulting from the impacts of different adjustments – i.e. climate policy, technological breakthrough, market preferences, and social norms– to the climate neutral transition (Campiglio & Van der Ploeg, 2011; Thomä & Chenet, 2017).

Asymmetric information arises when one party has more knowledge and few incentives to reveal it concerning an asset in a trade-off, hiding substantial information that is likely to compromise the efficiency of the market. Hiding the impact of a polluting asset and its financial risk in the transition implies that the asset does not bear its moral hazard, i.e. its full social and environmental cost and financial risk. This prevents an investor from comprehensively assessing sustainable assets and can lead to phasing out assets which may have contributed to the transition, a mechanism which is known as adverse selection.

Moreover, in this pricing process, in most cases, the FMP (principal) intervene in it by delegating the task to a third party (agent), such as an asset manager or company manager, whose incentives and interests could be misaligned from the sustainable long-

term investor interests. From this misalignment, an additional information failure arises in the asset assessment process, creating an additional agency cost in the investment that will be assumed by the investors and society (Meneses Cerón et al., 2024). This flawed pricing process forces the market to use biased information due to a lack of information about potential agency costs which is potentially exacerbated by asymmetric information in the market.

As a result of this mispricing, asset valuation bubbles could appear with financial effects such as stranded assets, defaults, and increasing cost of capital (Carbon Bubble), further slowing down the climate neutral transition (Campiglio & Van der Ploeg, 2011). Therefore a corrective tool which resolves these information deficits and gear capital allocation towards transition goals is deemed necessary (Campiglio & Van der Ploeg, 2011), specially through the implementation of an environmental policy such as the EU Taxonomy.

2.1.2 Policy Gap: EU Taxonomy role.

In the transition to a climate neutral economy, carbon pricing has been the leading environmental policy tool being an indispensable part of an efficient greenhouse gas emission reduction strategy. However, carbon pricing may not be sufficient to reallocate capital resources from high-carbon unsustainable activities to low-carbon sustainable activities, as its price signal could be distorted or rendered ineffective by the financial market's structural flaws mentioned in subsection 2.1.1. Thus, a policy mix is necessary not only to support pollution internalization but also to overcome the complex, interacting market failures, especially those directing necessary financial flows to environmentally sustainable sectors needed for the transition; the EU Taxonomy could be part of such a policy mix (Tettamanzi et al., 2024).

The resulting financial incentives of carbon pricing, namely from Emission Trading Systems (ETS) and Carbon Taxes, could fail to translate into efficient and large-scale capital allocation for low-carbon and sustainable projects and activities as a result of network effects, asymmetric information, and spillover failures. These failures manifest due to imperfect and incomplete markets for low-carbon and sustainable economic activities in the capital market, thereby creating a high transition cost for this capital reallocation (Campiglio & Van der Ploeg, 2011; Lehmann, 2012; Lucarelli et al., 2020; Tettamanzi et al., 2024). To address these causes, a possible intervention could cover the entire capital market supply chain, as this distortion reinforces the pollution externalization, which is a systemic inefficiency surpassing the scope of carbon pricing policy (Lehmann, 2012; Stern & Stiglitz, 2017; Waygood, 2011).

Regarding this systemic inefficiency, a policy mix could aim for addressing this market failure reinforcement by implementing another environmental policy that reduces the high cost of transaction for identifying and funding environmentally sustainable sectors in the pace and magnitude necessary to meet the ambitious sustainable targets (Lehmann, 2012; Lucarelli et al., 2020; Tettamanzi et al., 2024).

The tandem implementation of these policies could increase the net value of internalization of the carbon pricing and provide institutional clarity among the FMP to overcome the informational failures. This would provide transparency about the welfare gains of an efficient reallocation of capital to sustainable sectors compared to the current allocation scheme. At the same time, this resulting net value of internalization from this policy mix is higher than the transaction cost of implementing this regulatory and information policy, strengthening the price signal of carbon pricing (Lehmann, 2012).

In this context, as an informational policy instrument, the EU Taxonomy not only defines common characteristics and metrics to overcome the capital market fragmentation via standardization, but also establishes a framework that allows the EU to keep influencing organizational practices, coordinate sustainable finance efforts, and facilitate and direct the implementation of transition agendas, such as the Green Deal.

2.2 Treatment variable: The EU Taxonomy as an institutional driver of capital allocation

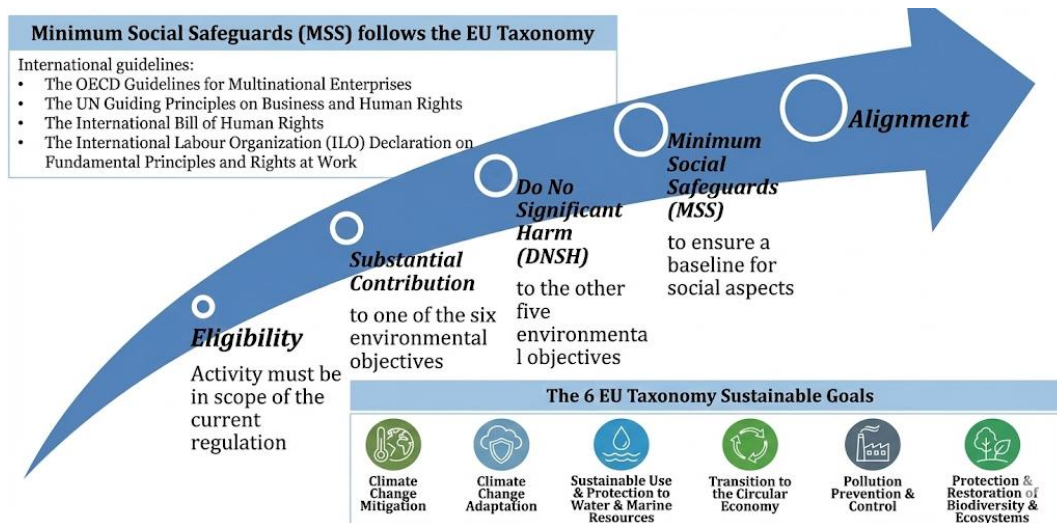
2.2.1 Institutional History, Structure, and Environmental Objectives

As a pillar of the Green Deal and a key action within the Action Plan on Financing Sustainable Growth, the EU Taxonomy is a legal framework that reduces the financing barriers of the transition to a climate neutral economy entered into force in July of 2020 as stipulated in the Regulation (EU) (2020/852) (Regulation (EU) 2020/852; Gortsos & Kyriazis, 2024; Driessen, 2024). It defines what the term “sustainable” means for the European market and combats greenwashing (Regulation (EU) 2020/852). It establishes a standardized classification system of economic activities qualified as Environmentally Sustainable Economic Activities (ESEA) and non-financial disclosure guidelines which channel the necessary private investment required for the transition (Alessi et al., 2024; Regulation (EU) 2020/852). Its structure aims to lay down user obligations ensuring that its criteria are implemented in the European market to achieve the targets set out in the Green Deal (Ostojic et al., 2024). Furthermore, the EU Taxonomy underpins other regulations regarding sustainability reporting, standards for sustainable financial products and sustainable labelling (Strilchuk et al., 2025).

As a standardized, sector-based classification system, the EU Taxonomy defines specific environmentally sustainable activities aimed at achieving the six environmental objectives derived from the Green Deal and established by the EU Taxonomy framework. This framework utilizes the official NACE Revision 2 classification to align its sustainable activities with existing economic categories (Lucarelli et al., 2020). Moreover, the EU Taxonomy establishes four overarching requirements that must be satisfied to qualify an economic activity as environmentally sustainable (see Fig 1.).

As illustrated in figure 1, the six environmental goals function as the standard for defining sustainability within the European Union. These goals delineate actions not only for climate change mitigation and adaptation but also for broader economic transition towards climate neutrality (Ostojic et al., 2024). In the substantial contribution requirement, the role of these goals is essential, as they represent the target outcomes. Consequently, each sustainable activity must comply with specific science-based Technical Screening Criteria (TSC) to ensure alignment with these objectives.

The EU Taxonomy specifies that the list of ESEA is laid down in Commission Delegated Acts wherein the TSC are established (Gortsos & Kyriazis, 2024; Ostojic et al., 2024).



Own elaboration based on Hoepner & Schneider, 2022.

Figure 1 EU Taxonomy Classification Process

Before qualifying an economic activity as ESEA, i.e. aligned to the taxonomy, it is important to identify which of a firm's economic activities may be eligible under the EU Taxonomy; if this is the case, this specific activity will be labelled as eligible. An eligible activity labelled as ESEA is required to comply with the following criteria:

1.Substantial Contribution (SC): Contribution to one of the six sustainable objectives as delineated above.

2. Do Not Significant Harm (DNSH): Comply with the principle of Do No Significant Harm to any of the other objectives.

3.Achieve the defined TSC for SC and DNSH.

4.Minimum Safeguards (MS): Meet ESG minimum safeguards based on international conventions and guidelines on Social Regulation selected in the EU Taxonomy.

Furthermore, the framework classifies Taxonomy-aligned ESEA into three categories (Ostojic et al., 2024):

1. Low-carbon or "Green" Activity: The performance of these activities is in accordance with climate neutrality if they are implemented universally in their sector (Schütze & Stede, 2024).

2. Enabling Activity: This category acknowledges activities in the supply chain that enable low-carbon activities. Crucially, they must not lead to the lock-in of assets that undermine long-term environmental goals and must have a substantial positive environmental impact based on life-cycle considerations (Ostojic et al., 2024).

3. Transitional Activity: This category includes economic activities that have an important role in the economy but currently lack a low-carbon alternative technology (Bassen et al., 2025). They are deemed Taxonomy-aligned if their GHGs emissions are below the average of the sector and they do not lead to carbon lock-in within the sector.

In regard to its role as disclosure guidelines, the framework modifies and complements some financial and non-financial information disclosure directives. On the one hand, the EU Taxonomy compels FMPs, namely financial funds focusing on sustainable investment and those offering products with sustainable characteristics, to report the share of investment in Taxonomy-aligned activities (Ostojic et al., 2024). If it is the case, these FMPs are compelled to present a disclaimer of the other different financial products offered by them against possible ESG risks (Busch, 2024; Ostojic et al., 2024). This is legally enforced through the EU Sustainable Finance Disclosure Regulation (SFDR) (Gortsos & Kyriazis, 2024; Busch, 2024), i.e. Regulation (EU) (2019/2088).

On the other hand, the EU Taxonomy modifies and complements the corporate reporting requirements, originally under the Non-Financial Reporting Directive (NFRD) and expanded by the Corporate Sustainability Reporting Directive (CSRD). Under the CSRD, the EU taxonomy broadens the scope of companies covered by NFRD, including also small listed companies; widens the information required, enforces digitally tagged sustainable reports and reports assured by an external party, and compels that the assessment and measurement of a company's ESEA follow its definition and standards (Gortsos & Kyriazis, 2024; Busch, 2024; Kirschenmann, 2022). Regarding the latter reporting requirement, Non-Financial Corporations are obliged to disclose their Turnover, Capital Expenditure (CapEx), and Operational Expenditure (OpEx) in economic activities qualified as ESEA, and in the case of financial corporations, the Green Asset Ratio (GAR) is used to assess the proportion of Taxonomy-aligned investment assets against its total assets (Schütze & Sandbaek, 2025).

As mentioned before, the EU Taxonomy not only is a classification standard but also a regulation which defines the term sustainability, standardized report requirements, and criteria that define to what extent businesses can be qualified as sustainable in the European market. It, thus, serves as a legal standard that provides technical definitions relevant for other regulations (Driessen, 2024). As a result of its legal standard function the EU Taxonomy informs the integrity of market instruments. For instance, in the voluntary European Green Bond Standard a bond is qualified as green when the money raised is invested only in Taxonomy-aligned activities (van den Hurk & van der Klooster, 2024).

Moreover, the EU Taxonomy is a mandatory reference point for the Transition Action Plan that the companies must implement, established in the EU Corporate

Sustainability Due Diligence Directive (CSDDD) (van den Hurk, 2024). These action plans are supposed to ensure that a corporate's business model, namely its supply chain, is compatible with environmental goals and may follow the report requirements of the EU Taxonomy (van den Hurk, 2024). Evidently, the EU Taxonomy is the cornerstone of the EU Sustainable Financial Plan. The EU Taxonomy's development, governance structure, and implementation unfolds within this institutional complexity (Alessi et al., 2024).

2.2.2 The Mandatory Compliance Criteria, Governance, and Dynamic Update

The institutional process of creating, establishing, and implementing the EU Taxonomy has unfolded amidst a global discussion about the importance of global environmental challenges, especially climate change, and the need to align private capital investments with sustainable goals (Alessi et al., 2024; Schütze & Sandbaek, 2025). This resulted in a rapid institutional evolution that put sustainable finance and particularly the EU Taxonomy, at the centre of the European regulation towards a climate neutral transition (Driessen, 2024).

This evolution started after the adoption of the Paris Climate agreement in December 2015, which recognized the necessity to steer private capital to the climate neutral transition (Lucarelli et al., 2020; Gortsos & Kyriazis, 2024). After the political decision was made to create and implement the Action Plan on Financing Sustainable Growth, in July 2018 the temporary Technical Expert Group (TEG) on Sustainable Finance was created and mandated to develop the key tools for sustainable finance in the EU, primarily the EU Taxonomy (Lucarelli et al., 2020). During this process, the 35 members of the TEG created the blueprint of the overarching structure of the Taxonomy by establishing the logic of the Technical Screening Criteria (TSC) and how to apply the "Do No Significant Harm" (DNSH) principle, providing the detailed logic required

to make the Taxonomy operational and effective (Lucarelli et al., 2020). During 2020, following the TEG's final report, the European Commission developed the EU Taxonomy Regulation Framework that entered into force in July 2020 and has since been directly applicable to all EU Member States (Schütze & Sandbaek, 2025).

The EU Taxonomy framework creates a governance structure aimed to ensure the relevance of the EU Taxonomy in light of market situation and technological developments (Schütze & Stede, 2024), as it can be seen in the Table 1. This governance structure also plays a role in the transformation of the EU Taxonomy from a static list into reliable, long-term regulatory framework that encourages firms and investors to commit their investments to the climate neutral transition (Schütze & Stede, 2024; Marchewitz et al., 2024).

By its executive authority, the European Commission was delegated to propose, adopt, and manage the specific delegated acts, ensuring the EU Taxonomy's materialization as well as its pertinence and its usability (Ostojic et al., 2024). To support the commission decision process, the EU Taxonomy framework establishes two consultative bodies—the Platform on Sustainable Finance and the Member State Expert Group—to provide the commission with technical expertise and account for political and national realities for making an informed decision (Gortsos & Kyriazis, 2024).

Table 1 EU Taxonomy Governance Structure

Governance Body	Mandate and Composition	Key Role in Governance
European Commission	Legislative institution empowered by the Taxonomy Framework (TF) to adopt DAs (Delegated Acts).	Defines, formally approves, adopts, and manages the specific DAs defining the binding TSC.
Platform on Sustainable Finance (PSF)	A permanent expert group established under Article 20 of the TF, succeeding the TEG. Composed of experts from the	Technical Advisor & Supporter: Provides technical assistance on TSC development, usability, impact, and potential extensions

Governance Body	Mandate and Composition	Key Role in Governance
	public sector (including ESAs, EIB), private sector, civil society, academia, and proven experts.	(e.g., social objectives).
Member State Expert Group on Sustainable Finance (MSEG)	Advises the Commission, facilitating an exchange of views among EU Member States (MS).	Political & Feasibility Advisor: Serves as the dialogue body to recommend the appropriateness and implementation feasibility of the TSC across the diverse governmental and economic contexts of the MS.
European Parliament & The Council of the EU	The EU's co-legislators. They granted the Commission legislative authority to create the TSC via delegated acts.	Legislative Oversight & Scrutiny: They maintain democratic control over the process via two key mechanisms: Scrutiny Period and Revocation of Delegation.

Own elaboration

On one hand, the Platform on Sustainable Finance – i.e. the successor of the TEG - plays the primary role in offering technical advice and support to the Commission in the overall development of the framework (Lucarelli et al., 2020). As an advisor body, the Platform provides the technical assistance and recommendation in the development, analysis, and review of the TSC so as to avoid undue administrative burdens (Ostojic et al., 2024). With regard to its supportive roles, the Platform assists the EU Commission with stakeholder engagement, mainly through the Stakeholder Request Mechanism. This mechanism allows different stakeholders to request the revision or the development of TSC for a given economic activity, supported by scientific evidence. The Platform, in addition, supports the EU Commission with the monitoring of capital flows into sustainable investment and advises on the practical application and the implementation impact of the EU Taxonomy on the European market (Ostojic et al., 2024).

On the other hand, the EU Member State Expert Group on Sustainable Finance is intended to be the dialogue body of the EU member states and the EU Commission as to the implementation feasibility of the EU Taxonomy, namely the TSC, across the diverse governmental and economic contexts of the Member States (Gortsos & Kyriazis, 2024). In its advisor role, this Expert Group mainly recommends the pertinence of the given TSC to the EU Commission and also assesses the approach used by the Platform in its development of the TSCs through a permanent exchange of information (Tettamanzi et al., 2024).

It is important to highlight that the EU Commission is not legally bound to follow the recommendations and the outputs of these two bodies (Gortsos & Kyriazis, 2024). However, the significance of these consultative bodies is that the Platform on Sustainable Finance provides the technical, expert-level advice necessary for developing and implementing the EU Taxonomy, while the Member State Expert Group ensures that the regulatory criteria and the development process align with the views and interests of the EU Member States (Gortsos & Kyriazis, 2024).

Meanwhile, the European Parliament and Council of the European Union play a crucial legislative and oversight role (Gortsos & Kyriazis, 2024). Since the EU Taxonomy framework granted the EU Commission legislative authority to create the TSC and due to its technical complexity and its need to be regularly adapted to scientific and technical progress over, the co-legislators maintain oversight authority over this process through both the scrutiny period and the revocation of delegation (Gortsos & Kyriazis, 2024). In the former, the co-legislators are granted a period of scrutiny of the given delegated act to accept or reject it in its entirety; while amendments are not permitted, this scrutiny period can last a maximum of six months (Gortsos & Kyriazis, 2024). In the latter, either co-legislator could revoke the EU Commission's delegation power at

any time (Gortsos & Kyriazis, 2024). The purpose of these mechanisms is to ensure democratic and legislative control over the technical rule-making process (Gortsos & Kyriazis, 2024).

To sum up, the EU Taxonomy is a policy-driven, scientific-based framework that was built through institutional collaboration (Hoepner & Schneider, 2022). It serves as an accountable classification and mandatory disclosure standard designed to influence the allocation of productive investment toward sustainable activities (Gortsos & Kyriazis, 2024; Hoepner & Schneider, 2022).

As shown in Table 2, the EU Taxonomy’s implementation process follows a phased approach (Gortsos & Kyriazis, 2024; van den Hurk & van der Klooster, 2024). However, this process has generated significant controversies regarding its pertinence and usability, specifically concerning the inclusion of debatable economic activities in its classification system under stringent conditions, such as gas and nuclear activities (Busch, 2024; Driessen, 2024; van den Hurk & van der Klooster, 2024; Schütze & Stede, 2024). These controversies will be examined at length in the following sections of this chapter.

Table 2 EU Taxonomy implementation timeline

Year	Month	Event or Legislative Action	Official Number	Details & Significance
2018	March	Action Plan on Financing Sustainable Growth	N/A (Policy Paper)	EU Commission launches the strategy that led to the Taxonomy Regulation.
2018	July	Technical Expert Group (TEG) Mandate (Start)	N/A	The TEG was established to develop the initial scientific draft of the technical screening criteria (TSC) (mandate ended in July 2020).
2020	June	Taxonomy Regulation	Regulation (EU) 2020/852	Published in the Official Journal (OJ) and establishes the six Objectives and four Core

Year	Month	Event or Legislative Action	Official Number	Details & Significance
		Published		Conditions.
2020	July	Taxonomy Regulation Enters into Force	Regulation (EU) 2020/852	The binding legal framework enters into force.
2021	December	Climate Delegated Act Published	Delegated Regulation (EU) 2021/2139	Defines the Technical Screening Criteria (TSC) for Climate Mitigation & Adaptation.
2021	December	Disclosures Delegated Act Published	Delegated Regulation (EU) 2021/2178	Specifies the content and presentation of company disclosures under Article 8 (KPIs, Turnover, Capex and Opex).
2022	January	Climate/Disclosures Rules Apply	Regulations(EU) 2021/2139 and 2021/2178	Application date for the first set of rules.
2022	July	Complementary Delegated Act (Gas & Nuclear) Published	Delegated Regulation (EU) 2022/1214	Includes specific gas and nuclear activities as "transitional".
2023	January	Gas & Nuclear Rules Apply	Regulation (EU) 2022/1214	Application date for the complementary criteria.
2023	November	Environmental Delegated Act Published	Delegated Regulation (EU) 2023/2486	Defines TSCs for the remaining four environmental objectives (Water, Circular Economy, Pollution, Biodiversity).
2024	January	Environmental Rules Apply	Regulation (EU) 2023/2486	Application date. Companies began mandatory Eligibility reporting for all 6 objectives.
2025	February	Omnibus Simplification Proposal	N/A (Draft Proposal)	EU Commission proposed legislative package to reduce administrative burden (Omnibus I package).
2025	July	Amending Delegated Act Adopted	Delegated Regulation (EU) 2025/ 4568 final	Technical amendments to simplify reporting (e.g., materiality exemption) and update existing Delegated Acts.
2025	September	General Court Ruling	Case T-625/22	The Court upheld the EU Commission's inclusion of Nuclear and Gas, confirming

Year	Month	Event or Legislative Action	Official Number	Details & Significance
				their legal validity.
2025	September	Stakeholder Request Mechanism Cut-off	N/A (PSF's Procedure)	Deadline for submitting proposals for new and updated criteria for the next review cycle.

Own elaboration

2.2.3 EU Taxonomy: empirical research and policy weaknesses

An ongoing empirical scrutiny of the EU Taxonomy's effectiveness has focused on its possible impact through observing the behaviour of financial and non-financial actors before its full implementation as well as international or emerging market samples to assess the regulation's "ripple effect" on global FMPs (Brabec & Macháč, 2025; Bassen et al., 2025; Pietrovito & Rancan, 2024; Sautner et al., 2025).

Consequently, The subsection 2.2.3 reviews the current state of empirical evidence, moving from the immediate reaction of financial markets in pricing climate risks to the subsequent shifts in real-world corporate investment strategies. In addition, this section addresses the systemic policy weaknesses and usability hurdles that create friction in the implementation of the EU Taxonomy, providing a balanced view of its current impact on the European Union's economy. Finally, the contribution of this study are presented.

Financial Markets and the EU Taxonomy: Empirical Evidence on Pricing and the Cost of Capital

Initial empirical findings confirm that financial markets are proactively pricing EU Taxonomy alignment, redirecting capital flows towards activities deemed sustainable ahead of full enforcement of the EU Taxonomy (Bassen et al., 2025; Sautner et al., 2025). FMPs have exhibited significant sensitivity to the new classification system, as evidenced by a statistically significant increase in "Taxonomy alignment premium" in equity markets during the early implementation phases (Bassen et al.,

2025). Research indicates that companies with a higher percentage of Taxonomy-aligned revenues experienced higher raw and risk-adjusted stock returns, particularly in 2020, the year the regulation was officially published (Bassen et al., 2025). This predictive value of Taxonomy alignment for stock returns outperformed traditional Environmental, Social, and Governance (ESG) ratings, suggesting that investors utilize the Taxonomy's specific technical thresholds to distinguish genuinely "green" firms from those merely employing strategic greenwashing (Bassen et al., 2025). Furthermore, firms operating in these sustainable sectors are approximately 1.6% less likely to be financially constrained, an effect that is significantly more pronounced for small and young firms that traditionally face higher credit rationing (Pietrovito & Rancan, 2024).

In the case of the debt markets, research has provided robust validation of the role of the EU Taxonomy as a cross-segment informational tool (Sautner et al., 2025). In the syndicated loan market, borrowers with larger shares of their revenue aligned to taxonomy transitional activities paid significantly lower interest rates in the years leading up to the regulation's formal introduction. Specifically, a one-standard-deviation increase in a firm's transitional revenue is associated with the reduction of 5 basis points in loan spreads (Sautner et al., 2025). Furthermore, climate-resilient borrowers with high levels of taxonomy transitional activities are less likely to be required to provide physical collateral to secure their loans (Sautner et al., 2025). This reduction in borrowing costs and collateral requirements is driven by a combination of a bank risk management channel and a green preferences channel. In the former, lenders recognize that transitional activities increase the resilience to regulatory and physical climate risks of a firm. In the latter, lenders committed to sustainable principles offer more favourable terms to taxonomy-aligned firms (Sautner et al., 2025). These results

demonstrate that the informational function of the EU Taxonomy successfully guides financial resource allocation toward taxonomy -aligned activities (Bassen et al., 2025; Sautner et al., 2025).

Empirical Evidence on the EU Taxonomy: A Decision Factor for Corporate Investment

By establishing a "common language" that identifies sustainable activities, on one hand, the EU Taxonomy serves as an informational tool that reduces information asymmetry and acts as a financial "de-risking" signal for lenders (Petrovito & Rancan, 2024; Sautner et al., 2025). On the other hand, according to the results of Petrovito and Rancan's research, the expansion of physical sustainable assets is closely linked to the EU Taxonomy's role in mitigating credit constraints, as firms operating in sustainable sectors are approximately 1.6% less likely to be financially constrained (Petrovito & Rancan, 2024). This mitigation of credit rationing facilitates a shift in corporate behaviour, encouraging firms to redirect capital into tangible fixed assets and long-term production processes (Petrovito & Rancan, 2024; Lucarelli et al., 2023).

Regarding the direct influence of the EU Taxonomy on corporate behaviour, research also shows a strong correlation between the level of taxonomy-aligned CapEx and the increase in productive investment at the firm level (Lucarelli et al., 2023; Schütze & Stede, 2024; Strilchuk et al., 2025). With regards to this empirical analysis of firms across 27 EU Member States, those operating in taxonomy-eligible sectors and identified at more precise level (at the NACE 4-digit level) realized significantly higher investments in fixed asset in 2019 compared to the baseline period of 2015 to 2018 (Lucarelli et al., 2023). In contrast, firms in sectors identified with less precision at the NACE 2 or 3-digit level faced higher "Taxonomy-eligibility" uncertainty and did not demonstrate a significant increase in investment (Lucarelli et al., 2023). This proactive behaviour suggests that in clearly defined sectors, firms made early strategic

preparations to improve their sustainability profiles in anticipation of the regulation's formal technical requirements (Lucarelli et al., 2023). Notably, this anticipatory increase in productive investment was most pronounced among medium and large companies which appeared more capable of managing the complexities of the new classification system than micro and small enterprises (Lucarelli et al., 2023).

This empirical results show that concerning the signal role and reputational rewards of the EU Taxonomy, the reduction of the financing barriers of the firm in the real economy creates incentives for the physical expansion of capital in sustainable economic activities (Lucarelli et al., 2023; Waygood, 2011). The current scientific consensus characterizes the EU Taxonomy as an essential component for environmentally sustainable growth provided that its framework was consistently refined and strictly applied (Lucarelli et al., 2020; Schütze & Stede, 2024; Marchewitz et al., 2024).

Policy Weaknesses and Usability Hurdles

The primary challenge to implement the EU Taxonomy is the inherent difficulty of translating complex scientific criteria into functional market regulation, a process that has resulted in significant usability hurdles and systemic risks to data integrity (Ostojic et al., 2024; Schütze & Sandbaek, 2025). Corporate reporting is specifically impeded by "subjective wording" within the TSC. Some of these TSCs employ qualitative terms as substantial savings or high durability without providing the quantifiable benchmarks necessary for a standardized assessment (Ostojic et al., 2024). This lack of technical precision, combined with an interdependence on often inaccessible or vague downstream supply chain data, frequently leads to the reporting of imprecise KPIs and distorted results for institutional metrics like the GAR (Kirschenmann, 2022; Schütze & Sandbaek, 2025).

Furthermore, the political and scientific credibility of the EU Taxonomy is further challenged by the inclusion of controversial activities such as natural gas and nuclear energy. Many critics argue their inclusion has resulted from intense political lobbying and national industrial interests rather than scientific evidence (Oberthür & von Homeyer, 2023; Sautner et al., 2025). Thus, according to some researchers, the inclusions may create a significant risk of increasingly symbolic action, thus corporations may only appear to comply with sustainability standards without achieving the real environmental progress required for a climate-neutral transition (Brabec & Macháč, 2025; Schütze & Stede, 2024).

Another structural critique of the EU Taxonomy concerns its binary classification system, which categorizes economic activities strictly as either aligned or not aligned with the framework (Marchewitz et al., 2024; Norang et al., 2023). Although the EU Taxonomy is intended to provide a common language, this binary classification lacks the necessary granularity to distinguish within a broad spectrum of non-aligned activities, lumping together high-emission "brown" sectors with low-emission service sectors like education (Schütze & Stede, 2024). This lack of differentiation reduces the informative value of institutional metrics such as the GAR, as a low ratio may simply reflect a lack of data rather than a high-risk portfolio (Schütze & Sandbaek, 2025). Furthermore, this approach may inhibit technological innovation. Once the minimum technical threshold is met, firms may not have further regulatory incentive to invest in the breakthrough technologies required for deep decarbonization (Marchewitz et al., 2024; Schütze & Stede, 2024). In hard-to-abate sectors like steel and cement, this may lead to carbon lock-in by incentivizing only marginal improvements. Consequently, the lack of a transition category, as seen in international frameworks like the ASEAN taxonomy, is increasingly viewed as a barrier to including all firms which

might qualify as partially aligned with the EU Taxonomy (Marchewitz et al., 2024; Schütze & Sandbaek, 2025).

These risks to the EU Taxonomy's scientific legitimacy are amplified by the current regulatory landscape that is not yet fully reconciled, leading to double-reporting obligations and potentially contradictory financial and non-financial information (Beerbaum, 2021). Regarding the increasingly fragmented regulatory landscape of the EU Taxonomy, both financial and non-financial firms have concerns about its reporting methodologies; this regulatory landscape, often characterized as a "regulatory tsunami", would be characterized by an overlap of requirements of the EU Taxonomy, the CSRD, and the SFDR (Garcia-Torea et al., 2024; Kirschenmann, 2022). Consequently, the initial cost of compliance involves a large investment in employee training, IT adjustments, and granular data collection, creating substantial resource constraints that disproportionately burden SMEs (Kirschenmann, 2022; Schütze & Sandbaek, 2025). Recent legislative proposals, such as the "Omnibus-initiative," further complicate this landscape by potentially reducing the scope of firms that must comply with the EU Taxonomy, which could exacerbate existing data gaps and hinder the assessment of true contributions to climate objectives by firms (Schütze & Sandbaek, 2025).

2.2.4 Contribution of this Thesis

While the empirical literature reviewed in Section 2.2.3 - most notably Sautner et al. (2022) and Lucarelli et al. (2023) - provides vital evidence of the EU Taxonomy's impact on financial pricing, and that the materialisation of these financial signals into real-economy productive investment remains contingent upon firms navigating the substantial usability hurdles and regulatory frictions inherent in the framework's practical application. Given this, this thesis addresses three research limitations that currently affect the field's understanding of the EU Taxonomy's real-world efficacy.

The first limitation is that this study addresses the gap of real empirical data to study the impact of the EU Taxonomy (Brabec & Macháč, 2025). This research contributes to filling in this gap by utilizing reported data across 19 EU Member States, moving beyond simulations to analyse actual investment outcomes. The second gap this study fills in is an analysis of the impact of the EU Taxonomy. Current studies often lack the counterfactual rigor necessary to isolate the EU Taxonomy's impact from the impact of other policy instruments like carbon pricing or subsidies (Brabec & Macháč, 2025). By employing an econometric Difference-in-Differences (DID) approach, this study provides a causal analysis to determine the magnitude of the investment effect specifically induced by the regulation. And, finally, this study addresses the "Metric Gap" by shifting the focus Revenue to Productive Investment to measure the impact of the EU Taxonomy. The current studies generally fall into financial performance indicators, banking ratios, or broader ESG signals because of limited data availability which measure only the symptoms of its impact, i.e. the market perception and current sales (Brabec & Macháč, 2025).

All in all, considering the EU Taxonomy as a unified institutional driver, this research explains how regulatory classification is transmuted into the physical expansion of environmentally sustainable assets, shifting the academic debate away from asset price dynamics and toward policy-induced changes in real-world capital allocation.

2.3 Outcome Variable: Productive Investment

While profit maximization is prioritised by the financial system, long-term environmental stability requires investment in physical, productive assets intended for a climate neutral economy. As the EU Taxonomy is presumed to reallocate capital only if they shape a firm's strategic investment decisions, productive investment acts as the

conceptual interplay between financial market dynamics and the intended structural transformation of EU's economy. For the evaluation of the EU Taxonomy's contribution to this transformation, it is preferable to investigate its capacity to steer financial flows over reported alignment ratios of investment because the former provides clarity about the impact of financial market incentives on tangible changes in infrastructure, technology, and production processes; this enables the determination of the impact of the EU Taxonomy on the reallocation of capital expenditures, thereby providing the basis for the empirical assessment of the structural transformation across the EU Member States toward a climate-neutral economy.

2.3.1 Financial Flows and Productive Investment (CapEx)

It is important to determine which financial metric is most appropriate to capture the allocation of capital expenditure within the corporate sector. The process of capital allocation is facilitated by financial flows, which represent the mechanism through which capital is channelled to its intended economic destination (Wurgler, 2000). If financial flows are defined by the capital movement from lender-savers to borrower-spenders, capital allocation represents the strategic decision-making process required to direct these resources toward specific sectors to achieve optimal returns or fulfil policy objectives (Wurgler, 2000).

In the economy the financial flow mechanism operates to fulfil the capital needs of sectors with productive opportunities via two primary routes, i.e. direct and indirect finance. Regarding the former, firms borrow money from lenders by selling securities; regarding the latter, financial intermediaries direct funds to those with productive investment opportunities (Waygood, 2011). From a theoretical standpoint, this distinction is critical: while financial flows represent "electronic flows of money" with no inherent physical impact, their significance only arises when capital is deployed to

purchase real goods or services (Waygood, 2011). Therefore, the quality of capital allocation is determined by the efficiency of these flows. The acquisition or expansion of physical and productive assets serves as the primary evidence of this efficiency, as it ensures that resources are distributed towards their most productive and sustainable uses rather than merely circulating within financial markets (Wurgler, 2000).

Consequently, provided that these financial routes are targeted by the EU Taxonomy through standardized disclosure to resolve the misallocation described in Section 2.1, it is essential to identify a metric that reflects this transition from financial movement to productive investment. This type of metric must be capable of identifying increasing investment in strategic transition industries while simultaneously tracking the decrease in industries most affected by transition risk, such as high-carbon sectors with stranded assets. In this context, the EU Taxonomy's identification of sustainable activities ensures capital is allocated toward the critical sectors that materialize a climate neutral economy (Wurgler, 2000; Schütze & Stede, 2024).

Hence, within the context of a firm's operations, Capital Expenditure (CapEx) serves as a more reliable indicator of structural shift than stock prices; it represents the "real economy" in action, where capital is directed to build infrastructure or invest in innovation and development (Schütze & Stede, 2024). To capture the reallocation of productive investment within the institutional structure of the Taxonomy, CapEx serves as a robust proxy, as it reflects the potential redirection of financial flows required to materialize the transition to a climate neutral economy (Alessi & Battiston, 2022; Schütze & Stede, 2024; Waygood, 2011).

According to the EU Taxonomy Institutional Structure, Revenue and Operating Expenditure (OpEx) metrics are also expected to identify this allocation process. However, they lack the prospective and materialization capacity needed to express what

productive investment means for the transition (Hoepner & Schneider, 2022). In comparison, CapEx represents the acquisition or upgrade of long-term physical and intangible assets, while OpEx represents the necessary spending to maintain and execute the productive process of the firm (Tettamanzi et al., 2024). Unlike revenue, which reflects current and past performance, CapEx is theorized to signal management's expectations regarding future sustainability trajectories (Alessi et al., 2024; Alessi & Battiston, 2022; Hoepner & Schneider, 2022). An increase in Taxonomy-aligned CapEx would therefore indicate a deliberate allocation of resources toward climate neutral transition, revealing the intended direction and speed of a firm's transition.

Finally, the reallocation of productive investment is empirically grounded at the firm level by CapEx, defined broadly as the investment required to maintain or expand future earnings (Driessen, 2024). Likewise, at a macro level, productive investment is interpreted as the national productive capacity of a country. This capacity is captured by the macroeconomic concept of Gross Fixed Capital Formation (GFCF), which measures the acquisition of non-financial productive assets across the economy (Hanzl-Weiss & Stehrer, 2024).

2.4 Causal Mechanisms for the Reallocation of Productive Investment by the EU Taxonomy

Having established the EU Taxonomy as a transformative institutional driver and defined productive investment as the primary target of the sustainable transition, it is crucial to examine the specific causal channels through which this regulatory classification is theorised to influence corporate capital allocation decisions. To understand how this classification and mandatory disclosure institution could achieve this reallocation of investments, this section analyses the specific and interlinked causal mechanisms that explain how the EU Taxonomy's influence on corporate and investor

behaviour occurs. These mechanisms are presented and analysed in length in the following order: Information Mechanism (see subsection 2.4.1), Regulatory Pressure (see 2.4.2), and Legitimacy and Reputational Mechanisms (see 2.4.3).

2.4.1 Information Mechanism: Addressing Asymmetric Information and Reducing Transaction Costs

The EU Taxonomy for Sustainable Activities primarily functions as a unified, science-based classification system that provides a clear definition of what constitutes an environmentally sustainable economic activity (Alessi et al., 2024; European Union, 2020; Lucarelli et al., 2020; Schütze et al., 2020). As informational instrument, the EU taxonomy aims to solve the problem of asymmetric information within the financial market regarding sustainable investments and, thereby, reduce the transaction cost (Schütze & Sandbaek, 2025; Paccas, 2021; Tettamanzi et al., 2023; Lucarelli et al., 2020).

With regard to the factors that have driven this market failure, this standardized classification system directly address the shortcomings of the proprietary ESG ratings, which struggle to properly identify sustainable investments due to the lack of comparable data, divergence among the methodologies used by these ratings and the negative incentives of the "issuer pays" model (Dumrose et al., 2022; Tettamanzi et al., 2024; Berg et al., 2022). As a result, the implementation of this classification standard resolves the above mentioned inconsistencies through providing a process of classification of scientifically-based technical criteria based on which potentially sustainable investments can qualified. These scientifically-based criteria evolve to reflect the technological innovation along with the market changes (Schütze & Sandbaek, 2025). This enhances clarity and legal certainty by reducing the inherent uncertainty and risk involved in assessing sustainable investments (European Union, 2020; Tettamanzi et al., 2023). In turn, this could lower the transaction costs associated

with distinguishing viable projects, enabling a more efficient allocation of financial resources to sustainable activities (Schütze & Sandbaek, 2025; Schütze et al., 2020; Waygood, 2011).

In addition, alongside the classification process, the financial disclosure is set out to highlight the corporation current actions towards climate neutral transition. The proposed disclosure brings about specific measure of sustainable performance of the corporations with a verifiable and highly detailed accounting framework, focusing on the specific activities of the business model being or intended to be sustainable (Alessi et al., 2024; Hoepner & Schneider, 2022; Tettamanzi et al., 2024). In contrast to previous corporate social responsibility frameworks, this financial disclosure mechanism overcomes their shortcomings which are mainly rooted in qualitative environmental information and voluntary commitments (Schütze & Stede, 2024; Tettamanzi et al., 2023).

This standardized quantitative information provides crucial benefits to investors, allowing them to accurately assess a company's environmental impact and its exposure to long-term financial risks, specifically climate transition risks (Alessi & Battiston, 2022; Thomä & Chenet, 2017). Furthermore, the required disclosure of CapEx serves to inform investors about the corporate strategic planning and commitment to environmental goals, moving beyond simple current revenue streams and voluntary commitments (Alessi & Battiston, 2022; Hoepner & Schneider, 2022).

Ultimately, this enhanced flow of clear and credible information enables the financial sector to properly integrate environmental factors and facilitate efficient pricing of climate risk (Schütze & Sandbaek, 2025; Lucarelli et al., 2020; Thomä & Chenet, 2017). This market action is demonstrated by evidence of a measurable reduction in the cost of capital for Taxonomy-aligned activities in both equity markets

and the syndicated loan market (Bassen et al., 2025; Sautner et al., 2025). This reduction of the cost of capital incentivizes firms to expand their productive investment in sustainable sectors because the lower financial hurdles make sustainable projects more financially viable (Petrovito and Rancan, 2024; Sautner et al., 2025).

2.4.2 Regulatory Pressure and Institutional Mechanism

While the EU Taxonomy plays an informational role to overcome structural market failures, it also serves to actively exert institutional pressure on FMPs, namely corporations, institutional investors, and financial intermediaries to comply with institutional measures to grant EU Taxonomy alignment labels qualifying a sustainable investment. The EU Taxonomy framework mandates regulatory obligations and mandatory disclosure requirements that redefine both the corporate and the financial sector's organizational practices (Papari et al., 2024; Regulation (EU) 2020/852; Schütze & Stede, 2024; Schütze et al., 2020). This practice redefinition transmutes sustainability commitments from voluntary to legally binding actions that influence corporate strategy and investment decisions, and also policy commitments (Fuest & Meier, 2023; Paces, 2021; Sandbaek, 2025).

The EU Taxonomy Regulation works as a mandatory process of embedding sustainable and environmental goals directly into the established legal mandates, core principles, and governance structures of financial and non-financial organizations (Paces, 2021; Regulation (EU) 2020/852; Schütze & Sandbaek, 2025). This institutional shift is primarily achieved through mandatory disclosure requirements applicable to financial and non-financial organizations with regard to their non-financial and financial operations based on verifiable environmental metrics (Schütze et al., 2020; Schütze & Stede, 2024). The thereby strengthened compliance develops a regulatory and institutional synergy that compels the both ends of the financial supply chain to

integrate corporate environmental data into financial products and risk models, thereby ensuring information circularity and verifiable transparency (Paccès, 2021; Brühl, 2023).

In the case of the non-financial organization, through the CSRD, the covered corporations are mandated to present their financial flows related to their sustainable activities by disclosing their Revenue, CapEx or Opex (Alessi et al., 2024; Tettamanzi et al., 2024). This disclosure of financial flows transforms corporate strategic planning from qualitative ESG signalling into a system focused on quantifiable and auditable alignment measures (Beerbaum, 2021; Schütze & Stede, 2024). The focus on the CapEx is especially compelling for a redefinition of investment practices. Since CapEx represents corporations' long-term commitments to infrastructure and productive assets, its disclosure guarantees that the firms integrate sustainability criteria into their long-term capital allocation, encouraging spending in innovation, namely eco-innovation, and strategic transition planning (Alessi & Battiston, 2022; Lucarelli et al., 2023). In this manner, corporations become standardized data suppliers, generating the reliable sustainability information required by the financial sector to meet its own regulatory obligations (Schütze & Sandbaek, 2025).

On the financial side, this disclosure framework similarly applies to Financial Organizations which are mandated to comply with the process of integrating sustainable data into their governance, risk management, and investment allocation processes (Paccès, 2021). By means of the SFDR and prudential frameworks, specifically the Pillar III prudential disclosures under the Capital Requirements Regulation (CRR) on the banking sector, the EU Taxonomy mandates to fulfil their quantitative disclosure obligations, such as providing their GARs. As a consequence, the corporate disclosure self-reinforces both the inputs for the Financial Sector's disclosure requirements of both

Taxonomy-aligned assets (by the CSRD) and portfolios (by SFDR) and the inputs for the Financial Sector's investment analysis (Brühl, 2023; Kirschenmann, 2022; Tettamanzi et al., 2024). Compliance with these requirements induces a systematic redefinition of core principles, requiring Financial Organizations to integrate ESG-related transition and physical risks into financial valuation models, fiduciary duties, and lending decisions (Joosen, 2024; Kirby et al., 2024; Schütze & Sandbaek, 2025). Accordingly, Financial Organizations, especially the banking sector, transform from discretionary capital allocators to gatekeepers of verifiable sustainability criteria (Paccès, 2021; Schütze & Stede, 2024).

Beyond its institutional pressure effects, the EU Taxonomy also serves as a political commitment device that strengthens the long-term reallocation of investment, thereby enhancing the credibility of climate policy (Lehmann, 2012; Fuest & Meier, 2023). Since the dynamic interaction developed by the institutional pressure rewards favourable financing conditions, the EU Taxonomy framework induces the irreversible commitment of capital expenditure in sustainable activities. The lock-in of this capital into these sectors increases the economic cost of future policy reversal, compelling even governments with weaker environmental preferences to maintain or strengthen climate policy over time (Fuest & Meier, 2023; Fuest & Meier, 2022).

In this way, the EU Taxonomy not only reallocates capital through improved information and incentives, but also stabilizes expectations by reducing regulatory uncertainty and unlocking private investment that would otherwise remain sidelined. Consequently, investing sustainably is transformed from a discretionary consideration into a legally binding determinant of corporate conduct and financial allocation, fundamentally reshaping the structure and behaviour of FMPs (Paccès, 2021; Waygood, 2011). This dynamic reshaping among corporations as data suppliers and Financial

Organizations as integrators thus establishes a mechanism that allows the reallocation of productive investment toward sustainable activities (Schütze et al., 2020; Tettamanzi et al., 2023).

2.4.3 Legitimacy and Reputation Mechanism: Establishing Credibility and Combating Greenwashing

The EU Taxonomy framework not only works through information and regulation pressure, but also as reputational mechanism that enhances the legitimacy and social validation of non-financial and financial organization operations. The EU Taxonomy could convert the compliance with its TSC into an incentive through providing standardized verification of sustainable activities or investments, which would combat greenwashing and improve corporate reputation of those firms genuinely complying with sustainable technical criteria, which enhances capital access (Regulation (EU) 2020/852; Sautner et al., 2025; Waygood, 2011). This incentive could be materialized through the disclosure of alignment KPIs that allows stakeholders to distinguish credible environmental performance from opportunistic sustainable labelling. This distinction is essential to maintaining stakeholder trust, particularly in markets where sustainability considerations increasingly influence investment decisions (Waygood, 2011; Beerbaum, 2021).

The legitimacy granted by EU Taxonomy alignment is reinforced through the requirement to comply with minimum social safeguards (MS). These MS ensure that environmental alignment is not achieved at the expense of international principles on human rights, labour practices and anti-corruption (Regulation (EU) 2020/852; Schütze & Stede, 2024). The EU Taxonomy framework links the MS to internationally recognized norms, including the OECD Guidelines for Multinational Enterprises, the UN Guiding Principles on Business and Human Rights, and the ILO Declaration on Fundamental Principles and Rights at Work and its eight core conventions (Regulation

(EU) 2020/852; Schütze & Stede, 2024; Tettamanzi et al., 2023; Ostojic et al., 2024). Therefore, the EU Taxonomy strengthens the moral and institutional legitimacy of sustainability claims by legally coupling environmental performance with social compliance, reducing the risk that alignment is perceived as narrow or opportunistic (Paccas, 2021).

This integration of standardized environmental criteria and MS plays a central role in mitigating greenwashing. The EU Taxonomy's explicit definitions, clear classification requirements, and metric-based disclosure obligations limit firms scope to engage in symbolic action or misrepresentation of non-sustainable activities as environmentally friendly (Schütze & Stede, 2024; Tettamanzi et al., 2024). The rigorous, metric-based nature of the disclosure requirements is intended to actively combat greenwashing by linking environmental performance with key financial corporate metrics. This requires concrete evidence of sustainability instead of merely corporate policy statements (Tettamanzi et al., 2024). This regulatory affirmation of genuine sustainable commitment helps strengthen investor confidence and ensures the integrity of sustainable finance instruments (Schütze & Stede, 2024; Tettamanzi et al., 2023).

In addition, The EU Taxonomy fosters the incentives for improving a firm's financial results by establishing an institutional environment that promotes technological advancement and resource efficiency. This institutional environment stems from the science-based roadmap of TSC, which enable management to align sustainable performance to potential financial returns. Therefore, the alignment with the EU Taxonomy arguably generates internal incentives for transitioning to sustainable production processes (Schütze & Stede, 2024). This institutional environment also fosters stakeholder pressure on corporate managements through the required

transparency of disclosed data, since the market increasingly rewards firms that transition toward sustainable processes. In this context, supported by quantifiable metrics explained in section 2.3.1, firms are enabled to make sustainable claims. These claims shape investor and customers perception regarding how sustainable a firm is, which leads to a shift in consumption and investment patterns through the guarantee of sustainability provided by the EU Taxonomy (Schütze & Stede, 2024). Moreover, firms obtain a pathway for financial advantages through reputational credibility created by this process in the financial market.

Therefore, FMPs can identify truly sustainable projects and economic activities of firms through verifiable KPIs required by the EU Taxonomy, which reduce their associated environmental and transition risk. Firms are expected to obtain preferable capital access through the EU Taxonomy's de-risk guarantee because it signals long-term financial resilience and lower exposure to climate-related risks (Sautner et al., 2025; Pietrovito & Rancan, 2024).

In summary, the legitimacy mechanism explains how the EU Taxonomy amplifies its effects by shaping market perceptions and stakeholder trust. The institutional environment created by the EU Taxonomy for legitimacy of the sustainable corporate claims provides incentives for firms to increase their productive investment. This incentive stems from both the expected improvement in revenues and the reduction of financial hurdles achieved through alignment with the EU Taxonomy's TSC. By combining standardized classification with enforceable MS, the EU Taxonomy transforms sustainability alignment into a credible regulatory signal that protects firm reputation and ensures that financial markets reward genuine environmental performance. Through this channel, the EU Taxonomy further strengthens the efficiency of capital allocation by directing resources toward activities that possess both

environmental merit and institutional legitimacy (Waygood, 2011; Schütze & Stede, 2024).

2.4.4 The Multi-Channel Influence on Reallocation of Productive Investment

Since the EU Taxonomy creates a systemic expectation of reallocation, interrelated channels are expected to activate an increase in productive investment toward environmentally sustainable activities (Dell’Erba, 2021; Lucarelli et al., 2020). These channels, ranging from the potential for a lower cost of capital and increased access to external finance (Dell’Erba, 2021; Lucarelli et al., 2020; Meneses Cerón et al., 2024; Sautner et al., 2025) to the reduction of credit constraints, particularly for small and young firms (Petrovito & Rancan, 2024), nurture the theoretical intuition that a shift in corporate behaviour is inevitable (Lucarelli et al., 2023). The academic consensus suggests that the convergence of market pricing, institutional pressure and a strategic shift of firm preferences (Alessi et al., 2024; Bassen et al., 2025; Fuest & Meier, 2023) results in the expansion of physical green assets (Waygood, 2011).

This theoretical framework posits that the EU Taxonomy acts as a comprehensive institutional signal designed to resolve market failures. Taking into account the information, regulatory, and legitimacy mechanisms of the EU Taxonomy, this theoretical framework provides the fundament to assume that firms consequently shift their capital structure toward sustainable activities to secure financial advantages and long-term resilience. However, the effectiveness of the EU Taxonomy depends on overcoming the uncertainties surrounding its TSC and application. Therefore, by comparing investment patterns between taxonomy-aligned and non-aligned sectors in different European Countries, this research seeks to isolate the casual impact of the EU Taxonomy on the allocation of productive investment based on the following hypothesis:

H1 : The EU Taxonomy has an impact on the allocation of productive investments due to an average increase in investment in economic activities aligned with the EU Taxonomy compared to the average increase in investment in economic activities that are not aligned with this taxonomy.

Chapter 3: Methodology

To identify the impact of the EU Taxonomy on the reallocation of productive investment towards environmentally sustainable sectors, a difference-in-difference (DID) econometric approach is employed. The impact of this policy is conducted ? for 19 of the 27 EU member states due to their availability of disaggregated productive investment data. In addition, this chapter is the basis of the research process where the operationalization of the variables, assumptions, results and methodological limitations are presented.

3.1 Variables and Data Sources

3.1.1 Productive Investment - Outcome Variable

For this study, Gross Fixed Capital Formation (GFCF) is used as an indicator of productive investment as it measures the acquisition of productive assets in the different sectors of the economy, both tangible and intangible assets. Following the definition of Hanzl-Weiss and Stehrer (2024), productive investment refers to “the measurement of Gross Fixed Capital Formation flows during a year, excluding dwellings”.

The selection of this indicator is also due to three considerations. First, it is a broad representation of expenditures on critical assets in a transition economy, such as machinery and technology. Second, this indicator measures changes in investment patterns in accordance with the sustainability criteria of the EU Platform on Sustainable Finance. Finally, GFCF data at the EU member state level are publicly available, allowing for robust cross-country and cross-temporal analyses.

The data used in this analysis come from Eurostat’s National Accounts dataset (nama_10_nfa_fl). Data is in current prices and chained volumes, taking 2015 as reference year . In addition, this database allows for the disaggregation of information

by the economic sector, as the data is classified via the NACE classification system, which is the official classification in the EU.

Ultimately, in the baseline specification, productive investment is analysed in levels rather than being normalised by population or transformed in logarithmic form. This specification is consistent with the research objective: the assessment of the reallocation of productive investment in absolute monetary terms across economic activities following the EU Taxonomy implementation. Due to the fact that the Taxonomy is designed to redirect financial flows towards environmentally sustainable activities, modelling GFCF in levels allows for direct assessment of changes in the volume of capital allocated to taxonomy-aligned sectors. Nevertheless, alternative specifications using logarithmic transformation of the treatment variable are considered in the empirical analysis as robustness checks.

3.1.2 Treatment Variable

Taxonomy - Treatment Variable.

The treatment variable specifies whether the economic activity complies with the Technical Screening Criteria of the EU Taxonomy. These criteria include making a substantial contribution to one or more environmental objectives and ensuring that the activity does not cause significant harm to other environmental objectives.

This classification of compliance with the EU Taxonomy criteria is performed using the sectoral classification developed by Alessi & Battiston (2023). This categorization applies the technical screening criteria of the EU Taxonomy to determine whether economic activities, identified by their NACE codes, conform to environmental sustainability standards. Although Alessi and Battiston also introduced country-specific coefficients to capture varying degrees of alignment, this study simplifies the classification to a binary variable, i.e., whether the economic activity is aligned to the

taxonomy criteria or not. This classification was estimated with the aid of the Excel tool that complements the research of Alessi and Battiston (Alessi & Battiston, 2023).

The use of this classification also offers advantages as it ensures consistency and transparency by rigorously adhering to the selection criteria of the taxonomy. It also facilitates the analysis as it covers a broad spectrum of NACE sectors which render a definition of the allocation of sustainable productive investments in various economic activities possible. Finally, this classification is considered methodologically valid as it is one of the approaches used to identify the alignment of investment portfolios with the EU Taxonomy in empirical research on sustainable finance (Alessi & Battiston (2023)).

Although this classification allows for the alignment of the EU Member States' economic sectors with the EU Taxonomy activities by linking their respective NACE codes, it exhibits certain limitations. This is because the classification is static, reflecting a specific moment in time, and excludes updates to the Taxonomy Technical Screening Criteria made after the tool's publication. Moreover, as noted by Alessi & Battiston (2023), the classification focuses primarily on climate change adaptation and mitigation objectives, thereby omitting other dimensions of the EU Taxonomy, such as social and governance factors. In practice, this means that the EU Taxonomy's estimated impact in productive investment may be conservative, since some economic activities from the baseline group could be appeared not aligned to the EU Taxonomy when they should be. It is also important to bear in mind that, despite the rigorous efforts to ensure accuracy, classification errors may occur, particularly in sectors where economic activities are non-aligned with the EU Taxonomy criteria.

3.1.3 Control Variables

GDP per Capita.

This study uses GDP per capita as a control variable to isolate the effect of the economic development of EU member states on the effect of the EU Taxonomy on the reallocation of productive investment.

The source of the data for this variable is Eurostat's National Accounts dataset (nama_10_gdp) in market prices and chained volumes with reference year 2015. This is included in the econometric model not only because it represents a country's average income and economic productivity, but also because it represents its financial capacity, factors that influence a country's investment flows.

Following Krueger (1995) and Trucker (1995), GDP per capita has a dual role in the context of economic growth and environmental policies. On the one hand, if an economy has a high GDP per capita, it will have sufficient financial resources for investment not only in traditional industries but also in sustainable industries. Thus, richer countries can allocate more funds to sustainable initiatives. On the other hand, the higher economic level in these countries is a factor that could influence citizens' demands for both stricter environmental policies and investments in the climate-neutral transition. These factors make GDP per capita a variable that should be taken into account when allocating resources for the transition to environmental neutrality.

However, GDP per capita has some limitations in capturing the social, political and economic effects on the allocation of sustainability investment. On the one hand, it does not account for income disparities or social dynamics, such as environmental awareness or government policies, beyond those induced by income levels. On the other hand, productivity growth associated with higher GDP per capita may affect investment

sustainable sectors, as more resources may be allocated to traditional "Brow" economic sectors, which increases carbon emissions (Wang & Li, 2021).

Trade Openness.

Trade Openness is defined as “the level of a country's participation in international trade according to the size of its economy” (Grossman & Krueger, 1991). However, Trade Openness not only reflects its role in the economic structure of a country, but also its role in the degree of competitiveness and the degree of innovation and adaptation of technologies of a country, which are factors that can influence the allocation of investments within an economy (Grossman & Krueger, 1991; Mahadevan & Sun, 2020; Pham & Nguyen, 2024).

In addition, trade openness can have nuanced effects on investment allocation, particularly in the context of the EU Taxonomy. For instance, greater trade openness may amplify the adoption of sustainable practices in export-oriented industries due to market pressures and regulatory alignment with trading partners. Conversely, in less regulated markets, trade openness may hinder sustainability by allowing environmentally harmful industries to relocate (Pata & Caglar, 2020). This provides a more accurate and complete understanding of how trade influences investment decisions in EU Member States in the context of sustainability.

The most common, standardized and academically accepted measure of Trade Openness is the ratio of a country's total trade to its GDP, allowing comparison between countries at different levels of economic development (Grossman & Krueger, 1991). In the case of this variable, most data is easily accessible for most countries. For this study, the data comes from the Eurostat National Accounts dataset (nama_10_gdp), which provides detailed information on market prices and chained volumes (reference year 2015). This dataset covers all 27 EU Member States, ensuring comprehensive and

consistent data for the analysis, which allows meaningful cross-national analyses by standardizing trade activity in relation to GDP.

Eco-Innovation Index - Pre-existing Level of Sustainable Investment.

Using the eco-innovation index as a control variable further enhances the robustness of the analysis as it captures a country's baseline eco-innovation capacity (Juracka et al., 2024; Qureshi et al., 2022; Sadiq et al., 2023). The comprehensive and standardized nature of the index ensures that it captures both the breadth and depth of sustainability efforts, providing a fundamental context for understanding the dynamics of investment in environmentally sustainable sectors. This strengthens the reliability and interpretability of the model's findings.

The European Commission's Eco-innovation Index measures the performance of EU countries in promoting and implementing innovations in the use of natural resources and in process for the climate-neutral transition in a comprehensive and multidimensional way. The source of the data for this index is the European Innovation Scoreboard- EIS and the detailed annual reports of the Member States of the European Commission. These sources provide standardized, reliable and consistent data that facilitate robust comparisons between countries and over time (European Commission: Directorate General for Research and Innovation, 2024).

This index is composed of five indicators that measure from the resources invested in eco-innovation to the environmental objectives achieved through investment in eco-innovation (Qureshi et al., 2022). For its measurement, a scale from 0 to 200 is used, which weighs the changes in the results of the indicators in this index with respect to the reference year used in the measurement, which is 2017. A score above 100 on the Eco-innovation Index reflects a country's investment priorities on sustainable technologies, practices and infrastructure.

This index, however, has some limitations due to its structure. This is a country-level measurement of multiple dimensions of eco-innovation, which does not only include prior investment in sustainable sectors. These dimensions may have different levels of importance depending on the economic activities analysed, influencing their suitability for assessing pre-existing sustainable investment levels. Likewise, the multiple dimensions aggregated at the national level may mask sector-specific nuances. This makes it necessary to interpret all data carefully depending on the specific economic context.

Energy Producer Price Index: Stringency of National Environmental Standards.

Another factor that can influence investment flows into sustainable sectors is the stringency of environmental policies. To isolate these possible effects on productive investment flows, the National Producer Price Index for the energy sector (NEPP) is used as a control variable.

This index measures annual changes in the prices of domestic products in a country's energy sector, which include electricity, gas and refined petroleum products (*Statistics Explained*, 2024). Although it is not a direct measure of the stringency of environmental policy, it provides a reasonable indicator by reflecting the cost pressure associated with such policies (Dechezleprêtre et al., 2020). Among the sources of these pressures are environmental regulatory mechanisms, such as carbon taxes, emissions trading schemes or renewable energy mandates. The advantages of this index are that changes in the stringency of environmental policies occur as a market signal which changes the prices of the energy in this index; furthermore, its data is publicly accessible. Summarizing, all those advantages render the NEPP a relevant indicator to measure the rigor of environmental policy (OECD, 2021), such as the EU Taxonomy.

However, as a proxy for the rigor of environmental policies, it is important to acknowledge that this index has limitations to differentiate between the effects of environmental policies on the increase of energy costs and investment in sustainable sectors. This is because the variation of the price is not only influenced by environmental policies, but by market factors, such as the dynamics of the global energy market, technological advancements and market regulation policies, such as subsidies or tax incentives (Dechezleprêtre et al., 2020; Marin & Vona, 2017; OECD, 2021). Consequently, higher producer prices could increase costs in all sectors, including sustainable ones, which could discourage investment if they are energy-intensive in the future (Dechezleprêtre et al., 2020; Marin & Vona, 2017).

Regarding the data access, NEPP data are sourced from Eurostat (sts_inpp_a), which provides standardized producer price indices on the reference year 2015 in all EU Member States. This makes them suitable for a comparative analysis, although variations in data availability should be acknowledged.

3.2 Descriptive Statistics

Table 1 presents the descriptive statistics of the variables used in this study. The dataset covers a seven-year period from 2017 to 2023 and includes 19 of the 27 Member States of the European Union (Appendix I). This dataset in general is balanced. However, some variables have missing data point values of its structure or disclosure requirements. With respect to the economic variables, they are transformed in Purchasing Power Standard (PPS), a common currency unit adjusted for price level differences by Eurostat. In the case of the outcome variable, the missing values result from diverging levels of data disaggregation in some countries. Regarding the NEPP Index, missing data in the datasets of Finland and Ireland occur because information is classified as confidential.

In the case of productive investment flow, the sample countries invested on average 744 million PPS in the period of 2017 until 2023. However, these countries have significant differences in their investment priorities as the standard deviation is two times larger than the average investment. Ireland recorded the highest investment flow, reaching 49,395 million PPS in 2020. However, it was also one of the four countries, alongside Greece, Latvia and Luxembourg, that reported the lowest investment flow during the same period. In terms of wealth levels and investment capacity, the economic disparity between these countries is equally pronounced. Although the average GDP per capita in the sample is 35,378 thousand PPS, its distribution is uneven: Luxembourg has the highest GDP per capita at 91,972 thousand PPS, while Bulgaria has the lowest at 15,223.42 thousand PPS. Such deviations are also observed with regard to the control variable Trade Openness. On average, the sample countries exhibit a high degree of international trade and economic integration (108.39%). However, the level of Economic Openness varies significantly across the samples, as evidenced by the high standard deviation (84.58%) observed during the period under study.

With respect to the pre-existing levels of sustainable investment in the countries under study, on average, the level of eco-innovation has been somewhat stable from year to year (97.90%) in the sample countries. However, its distribution among the countries is not homogeneous according to the standard deviation of 33.16%. Finally, the levels of environmental policy stringency, measured by the NEPP index, show that energy prices increased by an average of 42.16% during this period. This fluctuation in the NEPP index was due to abrupt changes in energy prices between countries. For instance, the largest increase recorded was in Denmark in 2022 (328%), while the largest decrease occurred in the Netherlands in 2020 (-26.2%).

Table 3 Descriptive Statistics

Table 3 Descriptive statistics

Variable	Observation	Mean	Standard deviation	Minimum	Maximum
GFCF in millions of PPS	4563	744,55	1875.38	0.00	49394.98
GDP per Capita in PPS	5355	35377.99	16971.63	15223.42	91972.38
Trade Openness in PPS	5355	108.39	84,58	0,58	302,50
Eco-innovation Rate	5355	97,90	33.16	35,50	148,80
Domestic Energy Production Prices	4739	42,16	66,59	-26.30	328.10

Own elaboration

3.3 Econometric Model

To estimate the impact of the EU Taxonomy on the allocation of productive investment to sustainable economic activities, this research uses the Differences in Differences (DID) approach, which allows estimating the impact of public policy interventions in non-experimental settings.

According to Fredriksson & De Oliveira (2019), this approach estimates the effect of a public policy by comparing the changes experienced over time between a treatment group, which is affected by the public policy intervention, and a control group, which is not affected by it. In the case of this research, the treatment group represents economic activities of EU Member States that meet the criteria of the sectoral classification developed by Alessi & Battiston (2023). In the case of the control group, all economic activities of EU Member States that do not meet the criteria of this classification scheme were grouped.

In addition, by combining elements of pre-and-post and cross-sectional analysis, this approach can control for two critical sources of bias that can arise when the impact of public policies is assessed in real-world settings. On the one hand, this approach accounts for the time-invariant differences of the countries that are part of the treatment and the control group, such as the size of the domestic markets or their geographical

position, factors that can influence investment behaviour in sustainable sectors. On the other hand, it addresses time-varying confounding factors that are common to all groups, such as global economic shocks, as in the case of the Covid-19 pandemic, which could affect observed outcomes (Bertrand et al., 2002; Fredriksson & De Oliveira, 2019; Roth et al., 2023). By examining the relative change in outcomes between the two groups before and after implementation of the EU Taxonomy, the DID approach isolates the impact of the policy while accounting for these biases, making this approach convenient for public policy impact analysis when randomized control experiments are not possible.

This method also depends on some key assumptions, which should be analysed to improve the reliability of the results, such as the parallel trends assumption and the non-anticipation effects assumption (Bertrand et al., 2002; Roth et al., 2023). The parallel trends assumption states that, in the absence of EU Taxonomy implementation, productive investments toward economic activities in the treatment and control groups would have followed similar trends in their behaviour over time. Its fulfilment is verified through two strategies: First, a visual inspection of the outcome variable trends for both groups (productive investment in environmentally sustainable sectors) is performed to identify similarities during the pre-treatment period (2017-2023). Second, pre-trend statistical tests were conducted where pre-treatment time dummy variables interacted with the treatment group indicator to detect significant differences in trends prior to the policy implementation. By using these tests, this research to validate that the econometric model satisfies the parallel trend assumption.

With respect to the non-anticipation effect assumption, the trend of productive investments towards sustainable economic activities is expected to not have changed before the formal implementation of the EU Taxonomy. This assumption is tested by

using the Granger Test, which analyses pre-treatment data for indications of changes (Fredriksson & De Oliveira, 2019). Even though this research acknowledges some degree of anticipation effects due to the gradual implementation of the EU Taxonomy, these effects are expected to be limited and not significantly distort the results. Consequentially, the presence of such effects would likely result in more conservative treatment effect estimates by potentially altering the pre-treatment years.

The econometric analysis is implemented using a panel data regression model specified in the following old linear form:

$$Y_{ist} = \beta_0 + \beta_1 \text{Treated}_{is} + \beta_2 \text{Post}_t + \beta_3 (\text{Post}_t \times \text{Treated}_{is}) + \gamma X_{it} + \epsilon_{ist}$$

Here, Y represents productive investment in the economic sectors of country i in period t . In the baseline specification, productive investment is measured in levels of GFCF expressed in millions PPS. Treated_{is} is a dummy variable that classifies the economic activities of a country as compliant or not compliant with the criteria of the EU Taxonomy by assigning 1 to activities aligned to the EU Taxonomy and 0 to activities not aligned with the EU Taxonomy. Post_t is also a dummy variable representing the treatment period, i.e. the time period in which the Taxonomy implementation occurs. This variable equals 1 for years after implementation and 0 otherwise. The interaction term $\text{Post}_t \times \text{Treated}_{is}$ captures the combined effect of an economic activity at sectoral level in the post-implementation period. This model also represents a vector of control variables, X_{it} , which includes GDP per capita, the Eco-Innovation index, Trade Openness and the producer price index for the energy sector. Finally, it is the error term, ϵ_{ist} .

The coefficient of interest, β_3 , serves as a DID estimator, measuring the Average Treatment Effect on the Treated (ATET) of the EU Taxonomy on sustainable

investments. In the baseline level specification, this coefficient is interpreted as the absolute difference investment flows between treated and control group following the EU Taxonomy implementation. According to the results of this coefficient, this study either rejects or confirms the null hypothesis.

In addition, to account for unobserved heterogeneity, a panel regression with country and time fixed effects is run. Finally, standard errors are clustered at the country level to address possible heteroscedasticity and autocorrelation. In addition to the baseline level specification, an alternative model using the natural logarithm of productive investment is estimated to assess the robustness of the results when investment is measured in relative terms. This specification assesses whether the results are robust when investment is measured in relative terms rather than in absolute monetary units.

Chapter 4: Results

This chapter presents the analysis of the empirical results of the panel dataset of 19 EU countries covering the period of 2017 to 2023. Table 4 reports the results of the baseline model. Here, the null hypothesis is rejected if the Average Treatment Effect Treated (ATET) of the EU Taxonomy presents a statistically significant coefficient. Subsequently, Table 5 presents the Treatment Effect while accounting for confounding variables, where the positive effect of EU Taxonomy is expected to remain robust. Following the presentation of these results, the chapter evaluates the assumptions of the DID approach and performs robustness checks of the model to ensure the validity of the model. Finally, the results are discussed in relation to the research question, offering theoretical implications and suggesting avenues for future research and policy development.

4.1 Main Empirical Results

The results of the baseline model are presented in Table 4. The estimated Treatment Effect (ATET) of the EU Taxonomy, captured by the interaction term between EU Taxonomy alignment and the post-implementation period, is positive and statistically significant at the 5% level. This allows us to reject the null hypothesis of expected no differential impact between aligned and non-aligned economic. Hence, the results indicate that the EU Taxonomy increases productive investments in environmentally sustainable sectors by an average of approximately 137 million PPS, compared to productive investments in non-aligned sectors.

Table 4 DID Regression Results

Table 4-DID Regression Results	
	(1) GFCF
ATET (Treatment effect)	136.524** (64.095)
Intercept	675.786*** (33.51)

Remarks	4563
Year fixed effects	yes
Country fixed effects	<u>yes</u>
<i>Standard errors are shown in parentheses</i>	
<i>*** p<.01, ** p<.05, * p<.1</i>	
Own elaboration	

Table 5 presents and compares the results of the baseline model with the result of additional models that include different combinations of the control variables. While the results of model 2 remain consistent with those of the baseline model after controlling for three of the four control variables, i.e. GDP per capita in PPS, Trade Openness in PPS and eco-innovation index, the Treatment Effect results remain statistically significant, with an average increase of 135.68 million PPS in the treatment group. Additionally, none of the control variables in this model significantly correlated with the dependent variable productive investment. This suggests that the impact of the EU Taxonomy on productive investments persists after accounting for broader economic conditions and sustainability-specific factors in the countries under study.

Table 5 Results of the DID Regressions

Table 5-Results of the DID regressions			
	(1)	(2)	(3)
	GFCF	GFCF	GFCF
ATET (Treatment effect)	136.524** (64.095)	135.680 ** (-62858)	45.181* (-26400)
GDP per capita in PPS		-0.016 (0.011)	-0.000 (0.005)
Trade Openness in PPS		3652 (-4970)	-0.272 (0.833)
Eco-innovation index		-7.341 (-7114)	-1.861 (-2123)
National price index for energy production			0.426 (0.360)
Constant	675.786*** (33.51)	1440.893 ** (-458.852)	793.332 *** (-179.672)
Remarks	4563	4563	3991
Grouping	703 groups	703 groups	615 groups
Year fixed effects	yes	Yes	yes
Country fixed effects	yes	Yes	yes

Standard errors are shown in parentheses

**** p<.01, ** p<.05, * p<.1*

Own elaboration

The introduction of the National Energy Producer Price Index (NEPP) as an additional control variable results in a decreased Treatment Effect (ATET) to 45.19 million PPS, which is marginally significant at the 10 % level, as can be seen in the results of Model 3 in Table 5. In addition, the NEPP Index shows a positive but statistically insignificant coefficient. This indicates that factors related to environmental stringency do not influence the statistical correlation between productive investment flows and the implementation of the EU Taxonomy. This outcome is consistent with the findings of other control variables.

While this model incorporates previously excluded data, the total number of observations decreases significantly (from 4,563 to 3,991) due to the absence of NEPP Index data for two countries, as mentioned in Chapter 3 . This data gap also reduces the number of clusters (from 703 to 615), which may undermine the precision of the estimates of this model. Hence, the combination of the reduced sample size, the smaller number of clusters and the lack of significance of the NEPP Index account for a variability that weakens the reliability of this model.

In comparison to Models 1 and 2 in Table 5, the lower statistical significance and methodological limitation due to the lack of complete data for two countries call into question the robustness of the findings of Model 3. This explains how the lack of information and the added variability reduce confidence in the relevance the variable NEPP to explain trends in productive investment.

4.2 Assumption Testing and Robustness Checks

Assumption Testing

To examine internal validity of the results, tests were performed to check the main assumptions of the DID approach. Regarding the analysis of parallel trends and

the assumption of a non-anticipation effect, statistical tests were conducted : the F Test and the Granger Causality Test. In addition, a graphical check of the Parallel Trends Hypothesis was performed.

With respect to the hypothesis of parallel trends, an F Test was performed with the aid of Stata's ptrend command. This test yielded a statistically insignificant result, which does not reject the null hypothesis of the test. This result confirms that there had not been any statistically significant differences in the trends of investment flows between the control and treatment groups prior to the implementation of the EU Taxonomy. This reinforces the confidence in the causal relationship established by the Treatment Effects reported in Models 1 and 2 in Table 5.

Table 6 Parallel Trend Test

Table 6- Parallel Trend Test
H0: Linear trends are parallel
F(3, 702)= 0.75
Prob> F= 0.3882
Own elaboration

Additionally, the visual inspection of the parallel trends in Figure 1 yields consistent results. An analysis of the left panel, which presents mean investment flows over the pre-treatment period, suggests that the control and treatment groups follow broadly parallel trajectories. While the control group exhibits an upward trend, the treatment group fluctuates with a upward trend. Regarding the right panel, the linear-trends model indicates that the fitted values for productive investment follow a similar upward trend with respect to the intervention period. These graphical test corroborate the formal statistical test.

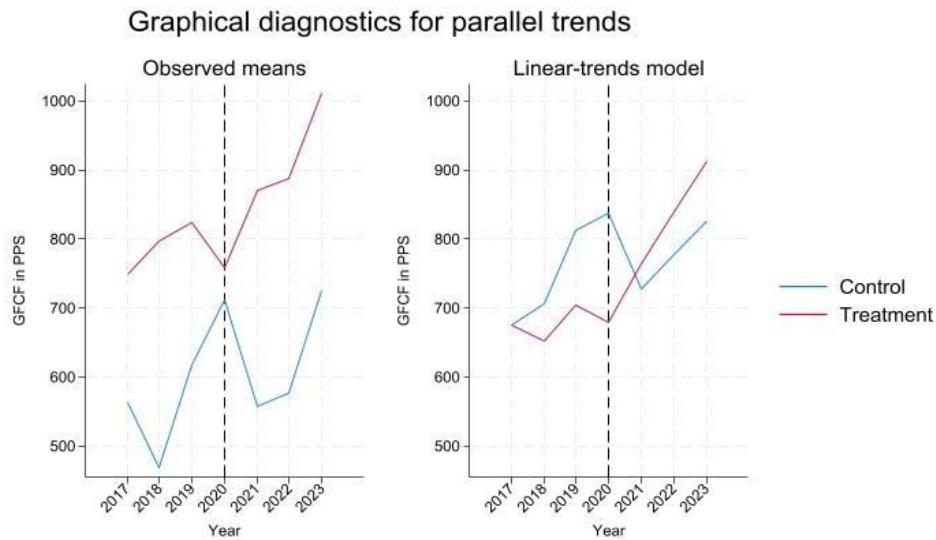


Figure 2 Visual Inspection of the Parallel Trends

Regarding the assumption of the non-anticipation effect, the Granger Causality Test indicates the presence of an anticipation effect in the implementation of the EU Taxonomy, as outlined in Table 5. This effect may be due to the prior announcement of the implementation of the EU Taxonomy. The presence of this anticipation effect will be discussed in more detail in the discussion section of this research.

Table 7 Results of the DID Regressions

Table 7-Granger Causality Test
<u>H0: No effect on treatment anticipation.</u>
F(3, 702)= 3.45
Prob> F= 0.0163
Own elaboration

Robustness Checks

The application of clustered standard errors to the three models revealed that the treatment effect and their statistical significance remained unaltered (see Appendix II). This findings suggests that within the country groupings under study, the correlation

structure of the error terms is relatively stable and that adjustment for clustering does not substantially alter statistical inference. The consistency of these results highlights the robustness of the baseline models and the effectiveness of the control variables in capturing variations in productive investment of the EU Member States under study. However, it is important to acknowledge the limitations that stem from the rejection of the anticipation assumption and challenges in the validity of Treatment Effect interpretation when controlling for the stringency of environmental policies.

As additional robust check, the baseline specification is re-estimated using the natural logarithm of productive investment as the dependent variable. Table 8 reports the results of this alternative specification. In contrast to the baseline level specification, the estimated Treatment Effect is smaller in magnitude (1.9 %) and not statistically significant. This indicates that the EU Taxonomy, while it is associated with a reallocation of investment volumes towards taxonomy-aligned economic activities, does not generate proportionally higher investment growth rates in these sectors.

Table 8 DID- In GFCF Regression Results

Table 8 DID- In GFCF Regression Results	
	(1)
	ln GFCF
ATET (Treatment effect)	0.019 (0.016)
Intercept	5.812 *** (0.104)
Remarks	4563
Year fixed effects	yes
Country fixed effects	<u>yes</u>

Standard errors are shown in parentheses

**** $p < .01$, ** $p < .05$, * $p < .1$*

Own elaboration

4.3 Discussion

The objective of this section is to link the results of this study with the academic debate on the role of the EU Taxonomy as a public policy mechanism for the reallocation of productive investment towards environmentally sustainable sectors. This discussion focuses on the contributions of this research derived from its results for future research, its limitations and the development of public policies for the transition to environmentally climate neutral economies.

Regarding the results, the positive and statistically significant effect of the EU Taxonomy provide an empirical validation of the academic intuition that it is a unified institutional mechanism to steer capital toward the environmentally sustainable sector. This reallocation is influenced by market pricing, institutional pressure or a strategic shift in firm preferences. In the case of informational and regulatory pressure drivers, the result suggests that the standardized classification and disclosure requirements create a more predictable investment environment that reduce the transaction cost for sustainable investments due to a reduction of asymmetric information failures (Alessi & Battiston, 2022; Lucarelli et al., 2023). This also reinforces the results of Lucarelli et al.'s (2023) research, indicating that companies that can accurately identify the alignment of economic activity with the EU Taxonomy have increased their investment levels due to reduced regulatory uncertainty.

Potential sources of the anticipation effect may be the implementation approach of the EU Taxonomy as well as its forward-looking signal. This effect does not undermine the empirical results overall. Nevertheless, the treatment effect may be smaller than the one obtained in the baseline model because of its limitations. If the possible anticipatory behaviour of corporations to reallocate capital due to the

reputational and legitimacy rewards resulting from their compliance with the EU Taxonomy was statistically accounted for, the treatment effect would be expected to decrease.

Moreover, the treatment effect of the baseline model persists when controlling for possible alternative determinants of productive investment. In the case of GDP per capita, Trade Openness and the Eco-innovation Index do not have a statistically significant effect on productive investment when the EU Taxonomy alignment signal is present. Although the baseline model exhibits sensitivity when controlling for environmental policy stringency (NEPP), it is not statistically significant. Summarizing, none of the control variables has a significant effect on the baseline model. This suggests that the EU Taxonomy reallocation effect stands alone when there is not a robust economic growth or preexisting innovation environment for sustainable sectors. It is important to bear in mind that the NEPP may change the baseline specification, although it is not statistically significant, because it often operates through overlapping channels, such as the price signal of the carbon pricing mechanism that already facilitates a reallocation of capital from brown to green sectors, as discussed in chapter 2.

Consequently, the results of the level (changes in productive investment) and logarithmic (percent changes in investment increase) specifications suggest that the EU Taxonomy primarily operates as a capital-allocation framework rather than a mechanism for accelerating relative investment growth. The absence of statistically significant results of the logarithmic model may evidence the existence of the EU Taxonomy's hurdles for its implementation mentioned in section 2.2.3, specifically the binary classification structure and systemic usability barriers. This suggests that the EU

Taxonomy is more suitable for capital reallocation to sustainable investments than for accelerating the growth of sustainable sectors.

While the results and their theoretical and empirical validity allow us to infer an impact of the EU Taxonomy on sustainable investments, it is also necessary to present the limitations of this research. One of the challenges faced by the EU Taxonomy research at the macroeconomic level is how to operationalize productive investment flows for sustainable economic activities. This stems primarily from missing disaggregation of data of economic activities, including difficulties to differentiate fixed capital investment from productive investment.

Although Gross Fixed Capital Formation (GFCF) is a measure of productive capacity comprising investment in fixed assets, as mentioned in chapter 3, this indicator has limitations: its level of disaggregation and its capacity to differentiate between productive capacity and productive investment. Although Eurostat provides disaggregated data on economic activities, this disaggregation is restricted to the identification of environmentally sustainable sectors according to the EU Taxonomy because it identifies related activities at NACE level 4 disaggregation. In addition, this indicator does not differentiate between sustainable and non-sustainable productive investments, requiring additional analysis for classification under the EU Taxonomy criteria within this dataset.

Therefore, this study employed the following strategies to address these limitations. On the one hand, level 3 disaggregation of economic activities is used to approximate alignment to the criteria of the investment taxonomy when sectoral granularity is insufficient, which is the most specific level of identification in this indicator. On the other hand, to distinguish whether or not economic activities are aligned with the EU Taxonomy, this study applied the sector-specific categorization

created by Alessi & Battiston (2023). Therefore, future research should take into account these limitations of the GFCF as a dependent variable.

Regarding possible effects on the internal validation of the econometric model, the information gaps of the selected variables and the relevance of the selected indices for their operationalization should be taken into account as control variables as they may affect the precision of the estimate of the treatment effect. Therefore, future research can improve the robustness of the results by addressing the data gaps on the NEPP Index using an indicator that measures the effects of environmental stringency policies more precisely for all countries under study, such as the OECD's Environmental Policy Stringency index. However, it is important to highlight that this approach is also limited by the time period and the number of represented countries because the OECD's Environmental Policy Stringency Index does not cover all EU Member States and only one year of the EU Taxonomy implementation period.

Moreover, considering the anticipation effect observed in this study, future research could explore to what extent the anticipatory actions of economic agents influence the observed impact of the EU Taxonomy. Following the argument of Cojoianu et al. (2023), financial policies shape investment behaviour not only through direct regulation, but also through market expectations and policy signalling. Therefore, it is important to consider the pre-announcement effects of the EU Taxonomy implementation to separate policy-driven behavioural changes from anticipatory behaviours of FMPs.

It is important to note that the flexible structure of the EU Taxonomy, as it evolves to include more economic activities, paves the way for future research. Based on the findings of this research, it is considered necessary to further investigate the effects of the EU Taxonomy on economic growth and eco-innovation by conducting

longitudinal studies, and also to analyse the causal relationship between them. Another avenue of investigation should focus on the extent to which the existing pricing carbon tools moderate the effect of the EU Taxonomy. Moreover, institutional studies could investigate additional independent variables that may limit or drive institutional changes incentivized by the EU Taxonomy, specifically the possible impact of national political agendas, the development of the EU Taxonomy and investment behaviour in sustainable finance markets. In addition, as a result of the recent passing of an additional legislation, i.e. the Omnibus Regulation on the Rationalisation of Reporting Requirements, this study faces additional limitations. This amending regulation aims to simplify TSC and streamline DNSH assessments, which were identified as sources of regulatory friction. Therefore, future studies would need to take into account this new legislation and examine if its adjustments of the EU Taxonomy lead to a more a stronger treatment effect due to the reduction of administrative hurdles which are expected to lower the cost of implementation.

Finally, the results of this study show the relevance of the EU Taxonomy as a resource allocation instrument for the transition to climate neutrality in the EU. However, it is necessary for decision-makers to identify in which countries there is a greater effect of the EU Taxonomy on reallocating productive investment. Furthermore, they need to decide which economic activities should be prioritized based on the assessment of their relevance for the transition to climate neutrality. In addition, it is important to investigate how the EU Taxonomy interacts with the impacts of the Eco-Innovation policy on innovation within the sustainable sectors because of potential synergy effects.

Chapter 5: Conclusion

Throughout this study, its focus is to investigate whether the EU Taxonomy has an impact on the reallocation of productive investment towards EU-aligned activities compared to non-aligned activities. Its results show empirical evidence that the EU Taxonomy has reallocated financial flows, especially productive investment, to environmentally sustainable economic sectors. The results of the econometric analysis establishes that the EU Taxonomy has a statistically significant effect on the reallocation of productive investment with an increase in investment in taxonomy-aligned sectors of an average of 137 million PPS compared to non-aligned sectors.

At the same time, the findings indicate that the impact of the EU Taxonomy is concentrated on shifting the volume of investment across sectors rather than on increasing investment growth rates within sustainable activities. This suggests that the EU Taxonomy mainly guides the direction of capital allocation instead of accelerating sectoral expansion. This may be linked to EU Taxonomy's implementation hurdles, which can limit its ability to stimulate proportional investment growth despite successfully redirecting financial flows.

The results are consistent with existing literature on capital reallocation for the transition to climate neutrality and sustainable finance. They further support the argument that a regulatory platform that identifies, prioritizes and standardizes criteria for sustainable economic activities increases investor confidence, reduces uncertainty and incentivizes investment in these sectors. Therefore, this increased flow of investment incentivizes and enables the economic transition necessary to address the challenges of climate change.

However, it is important to note that this effect may become smaller or vary over time, not only because of the methodological limitations of this research, the

anticipation effect of investors or limitations in the data used, but also because of the very nature of the EU Taxonomy, as it must adapt to the developments of sustainable finance and sustainable economic activities. Research, therefore, should take into account how the continuous improvement of sustainable investment data and complementary policies impact the achievement of the European Union's objectives to finance the transition to climate neutrality and sustainable economic growth.

With respect to the limitations of this research and possible future research pathways, the operationalization of the outcome variable and, also, certain control variables present methodological challenges regarding their precise measurement, such as the flow of productive investment. Regarding future research it is crucial to account for the effect of missing data of the variable of NEEP on the empirical validity of statistical models. The anticipation effect should also be taken into account to understand the impact of market expectations on the effects of EU Taxonomy implementation on productive investment. Beyond the methodological challenges, this research suggests that longitudinal and institutional research should focus on studying the relationship and effects of the EU Taxonomy on economic growth, eco-innovation and institutional changes for climate neutrality. It also suggests that policymakers should prioritize and enhance the reallocation of investment according to the effectiveness of the EU Taxonomy and its interaction with the European Union's Eco-Innovation framework. This thesis also implies that it is crucial to investigate the EU Taxonomy's treatment effect on economic growth, eco-innovation and changes of future investment contexts.

To conclude, the contribution of this thesis to the field of research on sustainable finance is modest but significant because it evidences that the EU Taxonomy has an impact on the transition to climate neutrality. This research also contributes to the

discussion on how public policy intervention which evidently boosts the necessary reallocation of productive investment to sustainable activities which contributes to tackling the impact of climate change.

Appendices

Appendix I- EU State Members

Table 9 EU State Member Sample

Table 9- EU State Member Sample	
1	Austria
2	Belgium
3	Bulgaria
4	Cyprus
5	Czechia
6	Denmark
7	Finland
8	France
9	Greece
10	Hungary
11	Ireland
12	Italy
13	Latvia
14	Luxembourg
15	Netherlands
16	Portugal
17	Romania
18	Slovakia
19	Sweden

Appendix II- Robustness Checks

Table 10 DID Regressions with Robustness Checks

Table 10-DID regressions with robustness checks			
	(1)	(2)	(3)
	GFCF	GFCF	GFCF
ATET (Treatment effect)	136.524** (64.095)	135.680 ** (-62858)	45.181* (-26400)
GDP per capita in PPS		-0.016 (0.011)	-0.000 (0.005)
Trade Openness in PPS		3652 (-4970)	-0.272 (0.833)
Eco-innovation index		-7.341 (-7114)	-1.861 (-2123)
National price index for energy production			0.426 (0.360)
Constant	675.786*** (33.51)	1440.893 ** (-458.852)	793.332 *** (-179.672)
Remarks	4563	4563	3991
Grouping	703 groups	703 groups	615 groups
Year fixed effects	yes	yes	yes
Country fixed effects	yes	yes	yes

Standard errors are shown in parentheses

*** $p < .01$, ** $p < .05$, * $p < .1$

Own elaboration

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