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FDI in the renewable energy sector: is FDI following the energy transition?

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ABSTRACT

Concerns over climate change and energy security have brought the energy transition to the center of the global debate. With the current energy crisis, it became imperative that countries act to ensure and accelerate such transition. Considering this necessity, governments are making reforms on their policies to incentivize investment in the energy transition. The EU has been one of the main propellers for this transition, followed by the United States. Thus, the focus of this thesis will be on the EU due to its pivotal role and its substantial influence in advancing this agenda.

This dissertation examines the relationship between FDI and the energy transition in the EU, considering the current policies addressing such transition. Thus, to evaluate FDI in the energy transition, the dissertation employes a Zero Inflated Negative Binomial regression model to examine Mergers and Acquisitions and International Project Finance deals in energy from renewable sources to understand whether these investments are following the energy transition. This study focusses on the EU-27 countries except for Cyprus, between the years of 2003 to 2022. The results show that there is evidence to support the hypothesis that FDI is following the energy transition. Since in regard to Renewable Energy Generation and Innovation in renewable energy the results present a positive and statistically significant relation with both M&As and IPF deals. However, when examining the results for the relationship between FDI in renewables and Public Policy development, only the results for IPF deals have a positive and statistically significant relationship; the results for M&As are not statistically significant.

Keywords: Foreign Direct Investment (FDI); Multinational Enterprises (MNEs); Energy Transition; Environmental regulation; Public Policy; Mergers & Acquisitions (M&As); International Project Finance (IPF).

RESUMO

As preocupações com as alterações climáticas e a segurança energética colocaram a transição energética no centro do debate global. Com a atual crise energética, tornou-se imperativo que os países tomassem medidas para assegurar e acelerar desta transição. Considerando esta necessidade, os governos têm vindo a fazer reformas às suas políticas para incentivar o investimento na transição energética. A UE foi um dos principais impulsionadores desta transição, seguida pelos Estados Unidos. Assim, o foco desta tese será a UE, devido ao seu papel pioneiro e à sua influência substancial no avanço desta agenda.

Esta dissertação examina a relação entre o IDE e a transição energética na UE, considerando as políticas atuais que abordam esta transição. Assim, para avaliar o IDE na transição energética, a dissertação utiliza o modelo de regressão, Zero Inflated Negative Binomial para examinar fusões e aquisições e acordos de financiamento de projetos internacionais em energia renovável para entender se esses investimentos têm seguido a transição de energia. Este estudo foca-se nos países da UE-27, exceto Chipre, entre os anos de 2003 e 2022. Os resultados mostram que existem evidências para apoiar a hipótese de que o IDE está a acompanhar a transição energética. No que diz respeito à produção de energia renovável e à inovação em energia renovável, os resultados apresentam uma relação positiva e estatisticamente significativa com ambos os negócios de F&A e IPF. No entanto, ao examinar os resultados para a relação entre o IDE em renováveis e o desenvolvimento de Políticas Públicas, apenas os resultados para negócios de IPF têm uma relação positiva e estatisticamente significativa; os resultados para F&A não são estatisticamente significativos.

Palavras-chave: Investimento Direto Estrangeiro (IDE); Empresas Multinacionais (EMNs); Transição Energética; Regulamentação Ambiental; Políticas Públicas; Fusões e Aquisições (F&A); International Project Finance (IPF)

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LIST OF ABREVIATIONS AND ACRONYMS

CAPMF – Climate Actions and Policies Measurement Framework

EU – European Union

FDI – Foreign Direct Investment

IPF – International Project Finance

IRENA – International Renewable Energy Agency

KBV – Knowledge Based View of the Firm

M&A – Mergers and Acquisitions

MNE – Multinational Enterprise

NB – Negative Binomial

OECD – Organization for Economic Cooperation and Development

OLI – Ownership, Location, and Internalization Advantages

OLS – Ordinary Least Squares

RBV – Resource Based View of the Firm

RISE – Regulatory Indicators for Sustainable Energy

SDG – Sustainable Development Goal

SPE – Special Purpose Entity

UN – United Nations

UNCTAD – United Nations Conference on Trade and Development

UNFCCC – United Nations Framework Convention on Climate Change

ZINB – Zero Inflated Negative Binomial

ZIP – Zero Inflated Poisson

INTRODUCTION

The energy sector has become an attractive venture for foreign investors, especially since the liberalization of the energy market (Mauro, 2022). In the past, the energy sector used to be characterized by a focus on fossil fuels, such as coal, oil, and gas (Mauro, 2022). This change of focus in the energy sector is due to pressures over concerns about global warming, climate change, and also due to the limited fossil fuel reserves that have led to the urgent need for the energy transition. Such transition consists of replacing fossil fuels with low-carbon energy sources. Currently, the investment in energy from renewable sources[1] is more than three times that in fossil fuels (UNCTAD, 2023). According to IRENA (2021), the energy sector is the largest source of CO_2 emissions, being responsible for 80% of the total, encompassing power, industry, transportation, buildings, and other sectors. Within this, the power sector stands as the primary contributor, followed by the industry and transportation sectors (IRENA, 2021).

When looking at the policy agenda implemented in the European Union (EU), we have been seeing a push towards the energy transition, led by policies such as the European Green Deal and the Fit for 55 package (European Commission, 2022). Additionally, the recent war in Ukraine has highlighted the risks of a centralized energy production reliant on fossil fuels and the fear of the energy dependency in the EU (UNCTAD, 2023). These events have created the current instability in the cost of energy and its supply. Therefore, to lower these impacts, countries will need to increase their energy production, reduce consumption, and improve efficiency (UNCTAD, 2023). To countervail the high energy dependency, especially in relation to Russia, the EU has taken action in the short term, by implementing the "REPowerEU" plan (European Commission, 2022). Considering climate change and the lack of natural fuels to produce energy, one of the best options to reach higher levels of local energy production is to invest in energies from renewable sources.

Market liberalization has resulted in the emergence of new financial instruments that offer widespread market accessibility and reduced transaction expenses, which, together with technological advancements, have appealed to investors (OECD, 2008). According to the OECD (2008), FDI can be an important source of capital, know-how, technology, and a wider product promotion. FDI has seen significant growth in recent decades. However,

[1] Although the most rigorous expression is "energies from renewable sources", for convenience we often employ the usual expression "renewable energies" in this dissertation.

global FDI in 2022 dropped by 12%, after having a recovery in 2021 (UNCTAD, 2023). The same source attributes this drop to challenges faced by FDI, such as rising interest rates, uncertainty in financial markets, high commodity prices, and geopolitical tensions, including the war in Ukraine that started in February 2022. According to UNCTAD (2023), FDI has been used to finance the energy transition with two objectives: (i) providing green energy and (ii) ensuring global access to it. Consequently, FDI in renewable energies has been on a rising trend, yet additional investment of $5.7 trillion per year is necessary to reach the energy targets for 2030 (UNCTAD, 2023).

Considering this very critical theme, this work aims to study the relationship between FDI and the energy transition, with a particular focus on the EU. Taking this into account, the dissertation examines the level of FDI's contribution to investments in renewable energy and the choice of entry mode in FDI in this sector. The objective of this dissertation will be to answer the following research question: "Is FDI following the energy transition?", with a particular interest in the effects of the current policies to promote the energy transition implemented in the EU in relation to their influence on FDI.

Therefore, the literature review will include an investigation on how recent policies addressing the current energy instability and the need for energy security impact FDI in renewable energy in the EU. Given the ever-changing geopolitical landscape and the necessity of international cooperation for a successful energy transition, it is vital to regularly revise policies pertaining to this subject, both at the multilateral and EU levels. The literature has shown that well designed policies tackling the energy transition can help mitigate climate change and to achieve the UN's sustainable development goals (SDGs) (Saqib & Dincă, 2023). Studies also revealed that the relationship between environmental policies and FDI may put pressure on certain nations to reduce their environmental standards in order to draw in FDI (Santos & Forte, 2021).

This dissertation will be structured into three main chapters. The first chapter will begin with a literature review exploring the concepts of FDI and energy transition, and the relevant theoretical background and policies concerning this topic, ending with the exploration of the main hypothesis of the study. The second chapter will consist of an empirical application, including an explanation of the study's variables and implementation of the methodology. The third chapter will present the results obtained. Finally, the conclusion will highlight the study's key findings, and identify avenues for future research.

1. Literature review

This chapter presents a literature review on the most important topics regarding the energy transition and FDI. It starts by defining the concepts of energy transition and FDI, followed by the relevant theoretical background applicable. Then it presents a review of some relevant studies regarding the relationship between the energy transition and FDI. Additionally, this chapter also presents an overview of the most important policies in the EU to foster the energy transition and concludes by deriving the relevant hypotheses that will be tested empirically via the econometric model presented in Chapter 2.

1.1. The energy transition

1.1.1. Preliminary considerations

According to the International Renewable Energy Agency (IRENA, 2023), the energy transition supports the idea that there needs to be a transformation in the global energy system. This transformation is characterized by a switch from fossil fuels to low-carbon sources in the production and consumption of energy, to cut carbon emissions to combat climate change, to limit global warming to 1.5°C, and to strengthen energy security, lowering energy dependency (IRENA, 2023). The same source highlights electrification in end-use sectors and efficiency as the main drivers for the energy transition, and it identifies the pursuit of this through the implementation of renewable energies in the production of energy and in end-use sectors. In terms of renewable energies, two of the most popular technologies are solar photovoltaic and wind power technologies, besides these two it is also important to acknowledge the existence of other technologies, such as concentrated solar power, hydropower, sustainable bioenergy, geothermal energy, and ocean-based energy (UNCTAD, 2023).

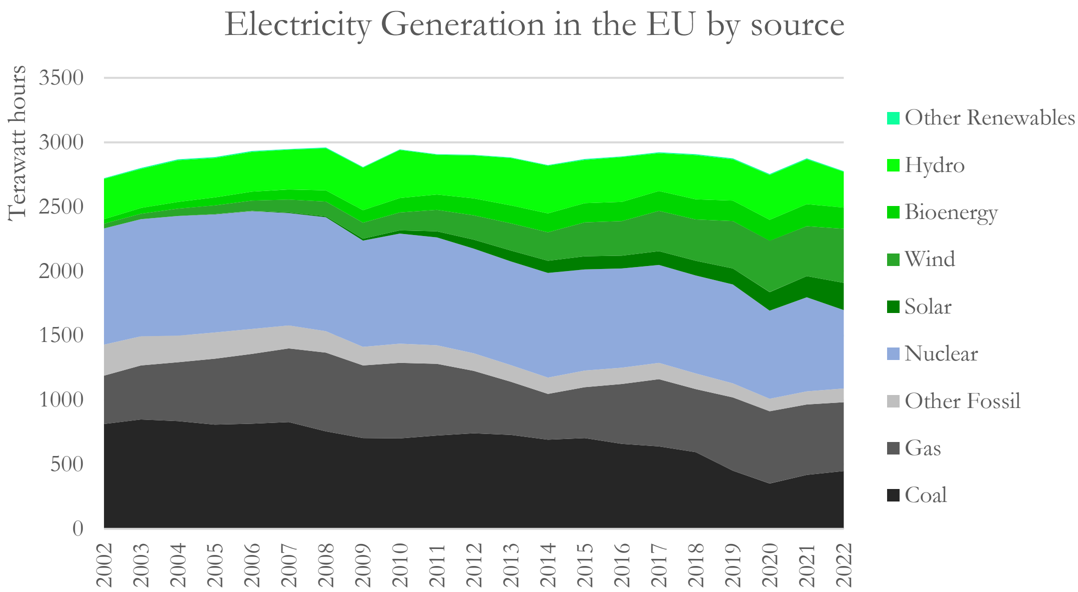
Investment in renewable energies requires considerable financial resources (UNCTAD, 2023). Because there is a need for financing in all phases of renewable energy development, such as "renewable energy generation, energy efficiency, and energy infrastructure" and "across the renewables supply chain" (UNCTAD, 2023, pp. 34 and 140). The same source highlights that while renewable energy production sees high investment, power grids, storage, and energy efficiency require greater investment and receive less importance. Yet, to facilitate the energy trade between countries, an expansion and modernization of the grid infrastructure is required (UNCTAD, 2023). When it comes to the supply chain of renewable energy, besides the need for investment in the production, installation, and operation of key technologies such as solar panels, wind turbines, and batteries, there is also a need for research and development to promote the innovation of new fuels, technologies, and materials (UNCTAD, 2023). Additionally, there is also a need for investment in the supply of minerals essential for the construction of storage infrastructure for renewable energy such as copper, nickel, lithium, and cobalt (UNCTAD, 2023). Considering the achievement of the energy targets, it is clear that additional investment is necessary. According to UNCTAD (2023) there is a need of $5.7 trillion each year in renewable energy investments. According to IRENA (2021), private capital and debt financing are gaining importance as investment sources, and the necessary funding for the energy transition is available, however, there is a need to reallocate capital towards renewables. Additionally, it is important to note that policies encouraging the deployment of renewables-based energy and discouraging the consumption of fossil fuels can stimulate investor's interest in financing energy transition technologies (IRENA, 2021).

1.1.2. The state of the energy transition

To understand the state of this transition and to prove that it is happening, we will analyze the development in the production of energy from renewable and nuclear sources in comparison to that of fossil sources. To measure the state of the energy transition, we utilize data regarding the total generation of energy by source, which is measured in terawatt-hours (TWh), extracted from Ember, an organization that conducts research and analysis on climate change and its impacts (Ember, 2023). According to its methodology, Ember collected and consolidated this data, utilizing Eurostat as their main source (Ember, 2023).

This data is broken down by fuel type and aggregated into two types: energy generated from fossil sources (coal, gas and other fossil fuels) and energy generated from clean sources, which we have subdivided in two sub-groups, renewable energy (wind, solar, bioenergy, hydro and other renewables) and nuclear (Ember, 2023). By comparing the two types of sources (clean and fossil) we plan to provide an insight into the state of the energy transition and its evolution from 2002 to 2022.

Figure 1. Electricity generation in the EU by source[2] from 2002 to 2022



Source: Own elaboration, based on EMBER data.

Records of the total electricity production in the EU by source in a span of 20 years from 2002 to 2022 are presented in Figure 1. The data indicate a clear growth in the total production of energy from clean sources. In 2022 the production of energy from clean sources represented approximately 61% of the total production of energy, while in 2002 it only represented approximately 48% in the EU (Figure 2). Regarding the distribution of clean energy sources, nuclear energy boasts the highest clean energy production, followed closely by wind, and then by hydro, solar, and bioenergy (Figure 1). However, when compared to the values of 2002, nuclear and hydro energy present a negative growth while solar presents the highest growth followed by wind.

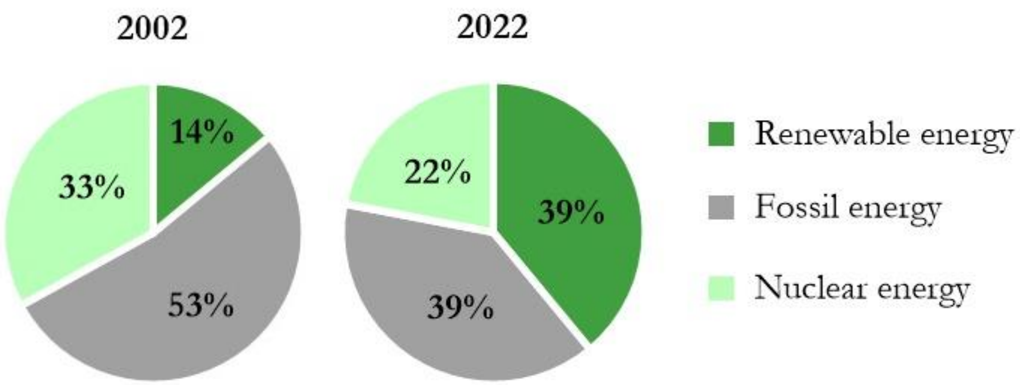
In the period considered, nuclear power had a considerable impact in energy production. However, its popularity seems to be declining, insofar as nuclear power represented approximately 33% of the total production of energy in the EUin 2002 and in 2022 it only represents approximately 22% (Figure 2). Yet, the same cannot be said about energy from renewable sources, which presented a significant growth, going from only representing 14% of the total energy production in 2002, to representing approximately 39% in 2022 (as patent in Figure 2 below).

[2] The European Union (2009), does not consider nuclear energy as a renewable energy source.

In terms of energy production from fossil sources, there has been a decline when compared to 20 years ago - in 2002 fossil energy represented 53% of the total production of energy and in 2022 it only represents 39% (Figure 2). The main source of this decline is coal and other fossil fuels, since the production of energy from gas has increased since 2002 (Figure 1).

The analyzed data lead to the conclusion that an energy transition from fossil fuels to clean renewable energy is indeed happening as it is evident that the energy mix and the share of production from distinct energy sources is changing. Nevertheless, this change seems to be happening at a slow pace, as in 2002 energy production was mainly coming from fossil fuels (approximately 53% of the total generation) and in 2022 energy production is mainly coming from clean sources, representing approximately 61% of the total generation (Figure 2).

Figure 2. Comparison of the percentage of production of energy by source



Source: Own elaboration, based on EMBER data (EMBER, 2024)

1.2. Foreign Direct Investment (FDI): relevant theoretical background

FDI is an important source of capital (and of other assets and capabilities) that may be used to foster and promote the energy transition, since public and private domestic investment do not seem able to respond to the current investment needs (OECD, 2008; UNCTAD, 2023). Hence, it is crucial to clarify the concept of FDI and its modes of establishment, as well as providing additional theoretical insights on MNEs' strategies, in order to understand the rationale behind this investment choice, particularly the decision regarding its location.

1.2.1. FDI and its modes of establishment

According to the OECD (2008, p. 48), FDI "reflects the objective of establishing a lasting interest" by an enterprise or an investor in a different enterprise resident in another country, this "lasting interest implies the existence of a long-term relationship" and "a significant degree of influence on the management". Furthermore, for this investment to be recognized as FDI, the foreign entity must have ownership of at least 10% of the voting power (OECD, 2008).

When a MNE chooses to enter a foreign market through FDI it can do so via two different modes of establishment. One is Mergers and acquisitions (M&A), which can be categorized into two strategies. A Merger occurs when two firms come together to form a new entity, where both firms remain as joint owners (Morschett, Schramm-Klein & Zentes., 2015). An Acquisition occurs when one firm acquires another (pre-existing) firm, and then "the acquired firm becomes a part of the acquirer" (Morschett et al., 2015, p. 412). The other mode of establishment is Greenfield, which refers to an entirely new investment in a foreign country, enabling the shaping of the new company with the characteristics that better respond to the needs of the investor (Morschett et al., 2015).

Another crucial concept to clarify for the purposes of this dissertation is International Project Finance (IPF). According to Müllner (2017, p. 111), International Business (IB) research has found that IPF can be used as an alternative and "efficient entry mode for large investments in high-risk environments". According to Viné, Sulstarova, Casella, and Trentini (2022), project finance is a financing structure for long-term infrastructure projects, that allows for lowering risk for the sponsors since it creates a unique entity for the project and allows for shared risk. The sponsors are the equity providers, who fund the project, these are usually a consortium of firms ranging from facility developers to suppliers and local stakeholders (Müllner, 2017). For a project to be considered project finance it needs to satisfy three conditions: the first relates to the need to establish a dedicated entity, known as a special purpose entity (SPE); the second establishes that "the SPE is the borrower"; and the third establishes that the recourse to the sponsor is limited (Viné et al., 2022, p. 162). For the project to be considered IPF, at least one of the sponsors should be a foreign resident, and for it to be considered FDI the sponsor should own 10 percent or more of the project's equity (Viné et al., 2022). IPF has particular relevance for the energy transition and more specifically for renewable energies, as it has been one of the main financing structures utilized in the promotion of investment in renewables. This fact can be confirmed by looking at project finance data because around half of all investments in renewables "involve a foreign sponsor or equity investment" (UNCTAD, 2023, p. 147).

It is also important to note that international projects tend to be larger and are more likely to be focused on more expensive renewable energy technologies, and because of this, these projects tend to also require a public-private partnership and/or a group of sponsors to support the project (UNCTAD, 2023). Besides this, projects that involve government entities tend on average to be larger (UNCTAD, 2023).

1.2.2. FDI and MNE-related Theories

This section identifies and analyzes relevant theories to help the understanding of the phenomenon under study in this dissertation.

1.2.2.1. Internalization Theory

According to Casson (2015), Internalization Theory is a fundamental theory in the field of IB studies and the most widely referenced formulation of this theory in IB is the one formulated by Buckley Peter & Casson (1976). This theory provides a framework for understanding the reasons behind the choice to engage in FDI, rather than in other entry modes involving externalization, such as licensing.

According to Dunning & Lundan (2008), Internalization Theory establishes that, considering the existence of market imperfections, the MNE might choose to internalize through its internal hierarchy, instead of relying on external market transactions. As explained by the same source, firms are inclined to pursue FDI if the "net benefits of their common ownership of domestic and foreign activities" will surpass those provided by the market (Dunning & Lundan, 2008, p.94). In other words, this theory suggests that market imperfections can help minimize transaction costs, leading to benefits in internalization that outweigh the associated costs. In their study, Buckley & Strange (2011, p. 461) highlight the importance for MNEs to consider the "relative costs and benefits of coordinating economic activities" both internally and through using the market. Internalization enables firms to govern operations more effectively, resulting in reduced expenses associated with information acquisition, coordination, and stakeholder alignment(Buckley & Strange, 2011).

According to Casson (2015), in industries that rely heavily on knowledge, companies often internalize their operations to safeguard their proprietary information from external exploitation. Similarly, FDI is more prevalent in countries with insufficient intellectual property rights, as firms opt to protect their knowledge by keeping it secret (Casson, 2015). Considering this, MNEs operating in the renewable energy sector might choose to internalize their operations to protect their strategic assets and know-how.

1.2.2.2. Resource Based View of the Firm (RBV) and Knowledge Based View of the Firm (KBV)

According to authors such as Wernerfelt (1984), the RBV is a theory based on the work developed by Penrose (1959) that tries to explain how firms achieve competitive advantage by looking at their resources. The RBV, as stated by Barney (1991), makes two distinct assumptions: firstly, that firms in the same industry have control over unique strategic resources; and secondly, that these resources are not easily transferable. According to the same source, these assumptions are considered in order to analyze the origins of a long-lasting competitive advantage.

Considering this, this theory emphasizes the strategic importance of leveraging distinctive internal and external resources, that are rare, valuable, difficult to imitate and to substitute, to achieve a sustainable competitive advantage (Barney, 1991). The value of the different resources will impact the MNE choice regarding internalization or externalization of its operations, depending on whether or not this are strategic resources (Barney, 1991). Additionally, Wernerfelt (1984) states that M&As offer companies a chance to obtain resources that would otherwise be unavailable to them. However, these resources must either complement or supplement their existing resources in order to realize the full potential of this strategic decision (Wernerfelt, 1984).

According to Kogut & Zander (1993), the KBV also offers an explanation for how companies attain competitive advantage. This perspective represents an evolution of the previous theory as it places exclusive emphasis on knowledge as a means to achieve competitive advantage (Kogut & Zander, 1993). This theory sees knowledge as an essential, scarce and valuable resource, recognizing both explicit and tacit knowledge (knowledge based on experience) as relevant (Grant, 1996). The same source emphasizes the need to possess knowledge-based resources, due to this being the main propeller for an efficient production and decision-making process. According to Kogut & Zander (1993) the MNE is efficient at transferring knowledge internationally due to its organizational capabilities, instead of it being because of market imperfections, as suggested by prior theories. Related to our topic, in this vein, Steffen et al. (2018) emphasize the importance of tacit knowledge accumulated through experience in project development in renewables, to enable firms to navigate the complexities of different regulatory frameworks and to better assess risks. Furthermore, the study done by Wasilewski et al. (2021) finds that firms operating in the fossil fuel energy market and looking to enter into the renewable energy market, do it by acquiring a renewable energy firm. This can be explained by the fact that these firms existing resources and capabilities do not provide the needed expertise to operate in the renewable energy market, due to the technological and organizational complexity that characterizes this market *vis-à-vis* the fossil fuel industry (Wasilewski et al., 2021; Wernerfelt, 1984).

1.2.2.3. Oligopolistic Reaction

Another theory that can help us understand the relationship between FDI and the energy transition is the Oligopolistic Reaction theory firstly developed by Knickerbocker (1973). According to Lizondo (1991) and Head et al. (2002), this theory supports the notion that the decision to invest internationally is incentivized by their competitor's investments in the same country, in order to retain their market share. However, according to Yu & Ito (1988), Knickerbocker's research does not consider that there might be other factors for why companies choose to internationalize besides their competitors' prior actions and the first movers' reasons to internationalize. Additionally, it is important to note that firms are more reluctant to engage in aggressive competitive tactics when they have diverse options for investing their resources or when their competitive advantage relies on technological factors (Lizondo, 1991).

According to UNCTAD (2000), evidence suggests that major M&As are occurring in industries with a limited number of dominant companies. The same source highlights that this is expected to cause a chain reaction from the competition, as they strive to protect their market share. UNCTAD (2023) reports that investments in the energy transition remain highly concentrated in specific countries and regions. This concentration can be attributed to the Oligopolistic Reaction Theory that states that firms in the energy sector tend to imitate each other's actions, as they recognize the profitability of doing so.

1.2.2.4. Dunning's Eclectic (OLI) Paradigm

The Eclectic Paradigm, also known as the OLI (Ownership, Location, and Internalization) paradigm (Dunning, 1997) is a key theoretical framework to understand the choice between different entry modes. Dunning's research analyzes how firms engage in international production through FDI in foreign countries, by explaining the motivations, the location, and the way MNE's conduct themselves when going abroad (Ferreira et al., 2011). To do this, the paradigm establishes three advantages that help determine the most suitable entry mode in distinct circumstances (Dunning & Lundan, 2008).

The first one is the ownership-specific advantage, referring to the competitive strengths that a firm owns and can exploit in a foreign environment (Dunning, 1997; Dunning & Lundan, 2008). These advantages can be divided into 3 types: "asset-specific" ownership advantages, that are related to the possession of unique or superior assets, such as technology, brands, human capital, or organizational capabilities, "transaction cost-minimizing" ownership advantages, that arise from the ability to organize transactions more efficiently than the market or other firms, and Institutional ownership advantages, reflect the firm's adaptation to the formal and informal rules, norms, and practices (Dunning & Lundan, 2008, p.100). The aforementioned advantages are absolute advantages at the firm level, and in comparison, to other firms; and they must be significant enough to offset the expenses of establishing and running a foreign operation (Dunning, 1988). The second one is the location-specific advantage, which refers to when it is more profitable to act in a foreign market in detriment of the home country (Dunning & Lundan, 2008). According to Dunning (1988, p.4), MNEs will choose to go abroad when it is considered beneficial "to combine spatially transferable intermediate products produced in the home country, with at least some immobile factor endowments or other intermediate products in another country". These advantages refer to natural resources, market size, labor costs, institutions, or policies such as FDI incentives (Dunning & Lundan, 2008). The third one is the internalization advantage, this refers to when a firm decides to exploit its competencies instead of selling them to a third party, this is usually done to protect and maintain control over the assets (Dunning & Lundan, 2008). FDI will occur when these three advantages are simultaneously present. If not, the MNE will opt for other entry modes, such as exports or licensing (Dunning, 1988).

Given the uneven diffusion of renewables and its dependence on factors such as market conditions, policy support, and institutional environment, the Eclectic Paradigm can be used to determine the most suitable mode of entry (Ferreira et al., 2011). According to Steffen et al (2018), private international players have an important role in the energy transition due to their competitive advantages, such as their technological capabilities and specialized home country experience. Hence, the Eclectic Paradigm is an important framework to identify and understand the advantages that lead firms to engage in FDI operations in the energy transition. Considering this, this paradigm will be used to explain the FDI determinants in the energy sector in the subsequently (see Table 1 in section 1.3).

1.2.3. Motivations for FDI

To understand the motivations behind the decisions on FDI activities by MNEs, Dunning (1993) identifies four main motivations that shape the firms' international location strategy: market seeking, resource seeking, efficiency seeking, and strategic asset seeking.

The first motivation, market seeking, refers to when a firm wants to invest in a foreign country to supply goods or services in a new market opportunity or protect an already existing market (Dunning & Lundan, 2008). According to the same source there are four reasons why a firm may choose to go abroad and engage in market seeking investments: to follow their suppliers or customers, to adapt products to local needs, to lower production and transaction costs or to follow a strategy currently being undertaken by the MNE.

The second motivation, resource seeking, refers to when a firm wants to invest across borders in order to obtain access to specific resources that either are not available in the home country or might be acquired at a lower cost or higher quality abroad (Dunning & Lundan, 2008). According to the same source, the objective of this type of FDI is to either increase the profitability or the competitiveness of the company. There are three types of investors that engage in resource seeking: producers and manufacturers seeking for physical resources, MNEs from places where labor is expensive seeking for cheap unskilled or semi-skilled labor and MNEs seeking for "technological capability, management or marketing expertise and organizational skills" (Dunning & Lundan, 2008, p.69).

The third motivation, efficiency seeking, happens when a firm decides to engage in FDI activities to benefit from economies of scale and scope or to benefit from differences in costs and availability of resources, technology, capital, etc., across different countries and to diversify its risk (Dunning & Lundan, 2008). The objective is to improve on the cost efficiency of the MNE, by exploiting location advantages and by concentrating the production processes to a limited number of locations (Morschett et al., 2015).

The fourth motivation, strategic asset seeking, refers to when a firm undertakes FDI activities in order to obtain access to specific resources to "promote their long-term strategic objectives", such as heightening their global competitiveness (Dunning & Lundan, 2008, p.72). When an MNE has this motivation, it is interested in acquiring either physical assets, such as technological resources, or human competences to enhance their ownership-specific advantages in comparison to their competitors, advancing the firms competitive position (Dunning & Lundan, 2008). These conceptual and theoretical contributions will support the explanations provided later in this dissertation., particularly the next section will link such contributions to FDI in the renewable energy sector (see Table 1 in section 1.3).

1.3. Relationship between the energy transition and FDI

As mentioned previously, the energy transition requires high levels of investment and, because public funding is limited and renewable energy projects tend to be expensive, the importance of attracting FDI is clear. According to Patala et al., (2021), cross-border investments by MNEs are a vital part of the energy transition as they allow for the diffusion of technology and as they have a substantial impact on the increase of renewable capacity. The same source highlights that, without FDI, the success of the energy transition is unlikely, especially in developing countries.

1.3.1. Determinants and motivations of FDI in renewables by MNEs

According to UNCTAD (2023, p. 152), the decision to invest in renewable energies is driven by "economic, regulatory, technical, and environmental factors". Among the factors identified by UNCTAD (2023, p.152), the importance of the "investment climate", "sector regulations", the "readiness and suitability of technologies", and the "availability of human and technological capacity", as well as the various expenses associated with the investment, including "exchange rates and currency risks" should be emphasized. Additionally, the same source mentions that firms tend to take into consideration the prior existence of a fossil fuel supply. The decision to invest is influenced by these factors, and this influence can be explained by the internalization theory, since this theory states that imperfections in the market can minimize the transaction costs making it more profitable to internalize.

Besides these factors, the political and policy-related context has been gaining significant importance and has the potential to influence investment decisions (UNCTAD, 2023). This idea is also supported by Curran et al. (2017), as their study reveals that a stable policy context plays a crucial role in attracting FDI in renewables from Chinese companies into the EU, identifying it as a location specific advantage. This is also more likely to affect companies who exhibit a market seeking strategy, then those who exhibit a strategic asset seeking strategy (Curran et al., 2017). Considering this, according to the internalization theory and the RBV and KBV, firms may choose to internalize their operations in markets where policies are not as strict to protect their knowledge in their energy technologies. The same study highlights the need to make a stable and unified policy a priority to incite investment in renewables in the EU, to fight investor uncertainty. It is worth mentioning that since 2019, the EU has been ramping up its efforts in the energy transition, starting with the European Green Deal, which led to a group of other policies to be implemented in the following years, as discussed in the following section.

FDI operations are usually dominated by large MNEs (OECD, 2008). This is related to the fact that FDI encompasses the transfer of a wide range of assets, such as "financial capital", "organizational expertise" and "technology" (Dunning & Lundan, 2008, p.7). According to Curran et al. (2017), one of the motivators for Chinese companies to decide to invest in the EU is the need to ensure access to technologies and knowledge, which is consistent with a strategic asset seeking strategy, the RBV and KBV theories and with the Eclectic Paradigm, considering that such technologies and knowledge can be seen as

Ownership Advantages. The same source explains that the purpose of this investment is to strengthen capabilities in crucial technologies and supply chain consolidation (the latter may be considered efficiency-seeking). According to Dunning and Lundan (2008), these assets are crucial for investment success and are typically more readily accessible to MNEs in comparison to domestic companies, which lack the same level of expertise and resources. Andriuškevičius & Štreimikienė (2022, p. 16) highlight the importance of M&As for the energy transition and find that "firms are employing M&A to "greenwash" existing operations" and to acquire renewable energy technology, as they see these acquisitions as strategic assets that can secure their place in the EU energy system and develop the efficiency of their production through innovation. Additionally, the study done by Wasilewski et al. (2021, p. 3) corroborates the previous study, emphasizing that firms who wish to enter the renewable energy market tend to choose to "acquire an already operating renewable energy company and its subsequent integration". According to Patala et al. (2021), it is evident that private MNEs are leading the way in investing in renewable energy. The same source also states that, state-owned MNEs also invest in this sector, although their strategies are generally less risky and more influenced by incentives.

Patala et al., (2021) state that existing technological capabilities and high international experience represent determining factors to propel new FDI in renewables. These determining factors lead MNEs to engage in FDI through "aggressive international expansion strategies", such as IPF (Patala et al., 2021, p. 943). Considering this, existing technological capabilities may present an ownership Advantage enabling the MNE to overcome the liability of foreignness, and to choose to internalize their deployment in a foreign market. According to Curran et al. (2017), these technological capabilities (previously acquired by these Chinese companies via strategic asset-seeking FDI in European energy companies, *inter alia*) represent an advantage driving investment from Chinese companies into the EU, who now exhibit a market seeking strategy, due to the current oversaturation of the Chinese market.

Additionally, Patala et al. (2021) also find that low international experience leads MNEs to engage in FDI in non-renewable energies, which may be because they lack the capabilities to manage the investment in renewables through different institutional settings. Considering this, an MNE with low international experience may see the lack of environmental regulations as a location advantage. According to Santos & Forte (2021), some

MNEs decide to invest in a particular place to avoid environmental regulation, in this case the motivation behind this investment is efficiency seeking, since their goal is to reduce production costs.

According to UNCTAD (2023), the cost of capital and the risks associated with an international investment can be a barrier to investment in the energy transition. However, lowering these barriers is possible by forming partnerships involving international investors, governments, and multilateral financial institutions (UNCTAD, 2023). The study done by Saqib & Dincă (2023, p.13) found that well designed policies focusing on "structural transformation, FDI, technology, and the utilization of renewable energy" can bring the triumph of the SDGs and a positive impact to climate change. In terms of policy recommendations to attract FDI to renewables, the same study highlights the implementation of financial incentives such as "tax credits, grants", and "subsidies" and the simplification of regulatory procedures. The study done by Streimikiene & Siksnelyte (2014) supports this idea, as it argues that the rise felt by investments in renewables in Lithuania and Poland is due to the policy measures implemented in these countries to promote the energy transition. Considering this, and according to the OLI paradigm we can infer that favorable policies from the host country in comparison to the home country of the firm can be seen as a Location Advantage, since these policies can make investing in a foreign market more profitable than in the home market. However, it is important to note that not every firm is going to be able to exploit these location advantages, as some firms may not have the institutional ownership advantages required to do so, such as the experience in navigating foreign regulations and in establishing relationships with foreign institutions. Table 1 below creates a synthesis of the various determinants of FDI in the energy sector relating them with the OLI paradigm, the motivations of Dunning and other relevant theories.

Table 1 Synthesis of studies focusing on the determinants of FDI in the energy sector

FDI determinants	OLI paradigm	Motivation	Explanation
Stable policy context (Curran et al., 2017)	Location specific advantage	All of them but especially Market seeking	Companies prefer to internationalize to countries with a predictable environment for business operations
Technological Capabilities (Curran et al., 2017; Patala et al., 2021)	Ownership advantage – asset specific advantage	Market seeking	Companies who possess technological capabilities export to fight oversaturation in their primary market
High international experience (Patala et al., 2021)	Ownership advantage – transaction cost minimizing advantage	All of them	Companies who possess high international experience have the capabilities to manage their investments through different institutional settings
Environmental Regulation (Andriuškevičius & Štreimikienė, 2022; Saqib & Dincă, 2023; Streimikiene & Siksnelyte, 2014)	Location specific advantage	Market seeking and Strategic asset seeking	Policies and financial incentives, such as grants and subsidies stimulate investment in renewables
Lack of Environmental Regulation (Santos & Forte, 2021)	Location specific advantage	Efficiency seeking	Companies choose to internationalize to these countries to avoid the environmental regulation present in others
Mature market with access to technologies and knowledge (Andriuškevičius & Štreimikienė, 2022; Curran et al., 2017; Wasilewski et al., 2021)	Location specific advantage	Strategic asset seeking (technology seeking)	Companies choose to internationalize to these countries to strengthen capabilities in crucial technologies and supply chain consolidation

Source: Own elaboration.

1.4. Policies to foster the energy transition

In order to support the unwavering focus on the energy transition, and the sizeable investment implied in that, the role of public policy is critical. Because of this, all major countries and economic blocs are undertaking major initiatives in this regard. According to IRENA (2021), there has been an increase in the number of countries implementing renewable energy policies, from 117 in 2014 to 143 in 2019. This section will summarize the most relevant policies implemented both at the global scale and specifically in the EU, our research focus.

1.4.1. Policies at the Global/Multilateral Level

According to the UNFCCC, the first international treaty tackling the challenge of climate change was the Kyoto protocol of 1997. The protocol's main goal was to "pursue limitation or reduction of emissions of greenhouse gases", including in the energy sector, in order to mitigate climate change (UNFCCC, 1997, p. 2). With this in mind, the objective of reducing emissions by 5% when compared to the levels registered in 1990, during the years of 2008 and 2012, was established (UNFCCC, 1997).

Among the notable endeavors addressing climate change, the Paris Agreement of 2015 holds a prominent position, drawing its inspiration from the previous protocol (Kyoto). This agreement was pursued with the objective of tackling the threat of climate change and motivating actions and investments to reduce carbon emissions (UNFCCC, 2015). The main goal of the agreement is to limit global warming, keeping it to below 2 degrees Celsius compared to pre-industrial levels and preferably lowering it even more to 1.5 degrees Celsius (UNFCCC, 2015). This agreement establishes that all countries will launch "nationally determined contributions" towards lowering climate change and that they will report regularly on their progress, being that every 5 years there will be a global assessment (UNFCCC, 2015, p. 3).

It is important to note the importance of the SDGs advanced by the UN in 2015 for the promotion of the energy transition (United Nations, 2015). The SDGs are a group of 17 goals intending to tackle social, economic, and environmental concerns (United Nations, 2015). Among the 17 goals, SDG 7 and SDG 13 are the most relevant for this work as they call for the need to ensure universal access to "affordable, reliable and sustainable energy" and for the need “to combat climate change and its impacts”, respectively (United Nations, 2015, p. 41).

1.4.2. Policies at the EU Level

Centering on the EU case, the focus of this dissertation, the EU has been implementing and updating a plethora of policies and agreements in recent years to address the energy transition. According to the European Commission (2021), the Directive 2001/77/EC could be one of the starting points for energy transition policies. Its objective was for 12% of the EU’s energy consumption to come from renewable sources by 2010 (Directive 2001/77/EC, 2001). Following up on the previous commitment, in 2009 the EU established, on a new directive, the goal of increasing the share of renewable energies in energy consumption by 20% in 2020 (European Commission, 2021). This directive has been updated both in 2018 and 2023, rising such share to 32% and 42,5%, respectively (European Commission, 2021).

Following this directive in 2001, in 2007 the Treaty of Lisbon was signed, launching the energy policy in the EU, which emphasizes the need for solidarity and security in the European energy supply (Pavy, 2023). In 2015, the European Commission establishes the Energy Union package, focusing on transforming the European energy system, creating “a fully-integrated internal energy market” (European Commission, 2015, p. 7). This package came as a response to the energy import dependency, inefficient housing, and high energy costs (European Commission, 2015). With this, the EC intends on providing strategic direction on creating an Energy Union focused on security, market integration, efficient, decarbonization and innovation (European Commission, 2015).

The year of 2019 was marked by the adoption of the European Green Deal, to reset the “commitment to tackling climate and environmental-related challenges” in support of a “just and inclusive” transition (European Commission, 2019, p. 2). This strategy set forth the goal for a climate-neutral Europe by 2050, by decarbonizing the energy sector (focusing on renewables and efficiency), reducing energy consumption in buildings by making them more efficient, supporting innovation to make the industry more sustainable, implement a cleaner and smarter transportation network (reducing emissions and increasing efficiency) and support international cooperation to improve global environmental standards (European

Commission, 2019). With this major policy endeavor, the European Commission expects to reduce emissions by a minimum of 50% until 2030, when compared to the emissions registered in 1990 (European Commission, 2019). In order to ensure the success of this strategy, there was "a need to rethink policies for clean energy" (European Commission, 2019, p. 4). As a result, the Commission incorporated the objective of achieving climate neutrality by 2050 into the European Climate Law in 2020 (European Commission, 2019).

Following on these initiatives, the European Commission established the Fit for 55 package in 2021, however this was only passed in 2023 (European Commission, 2023). This package came to make the objectives of the European Green Deal a reality by preparing a set of policies proposals to reduce emissions (European Commission, 2023). In terms of how this affected the energy sector, these policies included the update of the Renewable Energy directive, previously mentioned, and of the Energy Efficiency directive (European Commission, 2023). Besides this, it also established the phase out of polluting vehicles by 2035 and updated the emissions trading system (European Commission, 2023).

Looking at the most recent policies, it is important to emphasize the "REPowerEU" project implemented in 2022, which addresses the need to ensure a lower dependence on Russian fuels and an Energy Union (European Commission, 2022). The main goal of the project is to help the EU "save energy", accelerate the "clean energy transition", "diversify supplies" and "combine investments and reforms" (European Commission, 2022, p. 1). According to the same source, this program is aligned with EU goals, aiming for a 55% reduction in gas emissions by 2030 and climate neutrality by 2050, in line with the Fit for 55 package, through energy savings, clean energy production, and diversification. Countries seeking funding for goals, related to the REPowerEU program, integrate them into their national recovery and resilience plans under the NextGenerationEU plan, designed to address the consequences of the pandemic, making them eligible for support through grants and loans (European Commission, 2022). In 2024, the European Commission has highlighted the necessity of expediting the implementation of renewable energy sources and reducing dependence on Russia, fueled by the war in Ukraine and its consequences (European Commission, 2024). To expedite the process of granting permits and facilitate the rapid deployment of renewable energy projects, the Commission has issued new recommendations and provided guidance on areas that offer lesser environmental impacts (European Commission, 2024). These policy initiatives are bound to impact the speed and substance of the energy transition, and the studies done by Saqib & Dincă (2023), Streimikiene & Siksnelyte (2014) and Andriuškevičius & Štreimikienė (2022) support this idea, as they highlight the positive impact these policies are having on the energy transition and on related investments. Additionally, these studies also integrate future policy recommendations to ensure the further development of the energy transition and of associated investments, as the energy transition still needs great amounts of funds, as previously mentioned in section 1.1.

1.5. Hypotheses' development

Building upon the theoretical arguments' discussion presented in earlier chapters, this study aims to answer the question: "Is FDI following the energy transition?". The analysis focuses on understanding the relationship between FDI – quantified by the number of M&A and IPF deals – and the energy transition.

This study begins by proposing a hypothesis to explore whether FDI is increasingly being directed towards renewable energy sources as part of the global shift away from fossil fuels. Therefore, the first hypothesis inherent to the research question is the following:

H1: FDI in renewable energy is positively associated with renewable energy generation.

Specifically, this hypothesis is tested in the following way, via two sub-hypotheses:

H1.1: M&A activity in renewable energy is positively associated with renewable energy generation.

H1.2: IPF deals in renewable energy are positively associated with renewable energy generation.

This hypothesis (and its associated two sub-hypotheses) suggests that, as countries transition to renewable energy, there is a corresponding increase in FDI in renewables. In this vein, Caetano et al. (2024) note that renewable energy consumption increases both inward and outwards FDI and proposes that a reason for this may be the lower marginal costs of renewable energy generation that create a new competitive scenario attractive for new investments. Additionally, countries that have higher levels of renewable energy generation or consumption might be seen as more committed to the energy transition and therefore more attractive for foreign investors (Selcuk et al., 2014). Caetano et al. (2024) also supports this idea, since this study finds that a commitment to sustainable development attracts environmentally friendly FDI and that one of the pillars of sustainability is renewable energy. According to Andriuškevičius & Štreimikienė (2022), firms are engaging in M&A in the renewable energy sector to secure their place in the EU energy system, due to the importance that the EU has been giving to the energy transition. Therefore, firms are increasingly seeking to diversify their portfolios and reduce their reliance on fossil fuels (Andriuškevičius & Štreimikienė, 2022; Wasilewski et al., 2021).

Following this, we propose a second hypothesis to investigate how innovation in renewable energy is impacting FDI in renewable energy. The second hypothesis we posit is the following:

H2: FDI in renewable energy is positively associated with Innovation in renewable energy, measured by the number of patents in renewable energy.

Specifically, this hypothesis is tested in the following way, via two sub-hypotheses:

H2.1: M&A activity in renewable energy is positively associated with innovation in renewable energy.

H2.2: IPF deals in renewable energy are positively associated with innovation in renewable energy.

This hypothesis (and its corresponding two sub-hypotheses) suggest that innovation in renewable energy can make a country more attractive to foreign investors looking to invest in renewables, as innovation may signal that the sector is growing. As previously mentioned, according to Curran et al. (2017), innovation can be attractive for foreign investors who present a technology seeking motivation, therefore investors might specifically target countries that lead in renewable innovation. Firms are participating in M&As to acquire renewable energy technology, as they see these acquisitions as strategic assets that make them more competitive in the EU energy market (Andriuškevičius & Štreimikienė, 2022; Wasilewski et al., 2021). However, both Curran et al. (2017) and Patala et al. (2021) highlight the importance of possessing technological capabilities in order to go abroad to overcome oversaturation in their primary markets, therefore investors might specifically target countries that lack in renewable innovation.

We propose a third hypothesis to explore the relationship between government policies designed to enhance the appeal of the renewable energy sector and the level of FDI in renewable energy. Therefore, the third hypothesis inherent to the research question is the following:

H3: FDI in renewable energy is positively associated with public policy development in renewable energy attractiveness.

Specifically, this hypothesis is tested in the following way, via two sub-hypotheses:

H3.1: M&A activity in renewable energy is positively associated with public policy development in renewable energy.

H3.2: IPF deals in renewable energy are positively associated with public policy development in renewable energy.

This hypothesis (and the corresponding two hypotheses) highlights the role of public policy as a critical factor in attracting FDI to the renewable energy sector. These policies can include incentives such as tax breaks, subsidies, feed-in tariffs, renewable energy mandates, regulatory frameworks, or investment in infrastructure that supports renewable energy development (Nachtigall et al., 2022). Considering the existing literature, it is possible to see an interest in the study of the relationship between FDI and environmental regulation, with a majority of papers focusing on the pollution haven hypothesis and on the differences between developed and developing countries (Santos & Forte, 2021). However, previously mentioned studies such as Saqib & Dincă (2023) and Streimikiene & Siksnelyte (2014) follow a different approach, supporting that environmental regulation incentivizes investment in renewables and can make a positive difference in achieving the SDGs. The study done by Andriuškevičius & Štreimikienė (2022) supports this idea, since it argues that firms are participating in M&A in part due to the regulations implemented by the EU. Additionally, Curran et al. (2017) highlight the importance of keeping a stable policy environment to attract investment. As previously explored in section 1.4, the EU is implementing a host of policies with the aim of fostering the energy transition, however the members have the autonomy to choose different implementation and enforcement strategies as long as they are in compliance with the EU's policies, which results in differences in regulations inside the EU (De Beule et al., 2022). Therefore, our goal with this hypothesis is to study the impacts on

FDI in renewables of the differences in the policies between countries that are compliant with the EU's policies, which are considered to be strict environmental regulations.

We propose the fourth hypothesis to test if when overall global investment activity is high, more funds are likely to flow into the renewable energy sector. Therefore, the fourth hypothesis is the following:

H4: FDI in renewable energy is positively associated with FDI flows received in all sectors.

Specifically, this hypothesis is tested in the following way, via two sub-hypotheses:

H4.1: M&A activity in renewable energy is positively associated with FDI flows received in all sectors.

H4.2: IPF deals in renewable energy are positively associated with FDI flows received in all sectors.

This hypothesis takes into consideration that trends in global FDI influence FDI in renewable energy. When investors are optimistic and the global economy is strong, there tends to be more capital available for investment in various sectors, including renewable energy.

To conclude we propose the fifth hypothesis to test whether economic activity and wealth of a country makes a country more attractive for FDI in renewables. Therefore, the fifth hypothesis inherent to the research question is the following:

H5: FDI in renewable energy is positively associated with the GDP per capita.

Specifically, this hypothesis is tested in the following way, via two sub-hypotheses:

H5.1: M&A activity in renewable energy is positively associated with GDP per capita.

H5.2: IPF deals in renewable energy are positively associated with GDP per capita.

The assumption inherent to this hypothesis is that wealthier countries, with higher economic activity and better economic conditions, are more attractive to foreign investors. Which, as previously mentioned, according to UNCTAD (2023) investments in the energy transition remain highly concentrated in specific countries and regions, that are more developed and wealthier.

2. Methodology

2.1. Variables and data description

In this chapter the focus is on explaining the variables used in the empirical application presented in the next section. The 27 EU members, excluding Cyprus (explanation for the exclusion below), form the spatial dimension of this analysis, while the temporal dimension encompasses the time frame spanning from 2003 to 2022. Therefore, the analysis relies on a panel dataset covering two decades in a multi-country setting.

To test the previously mentioned hypotheses, we employ two dependent variables proxying FDI in renewable energies. The first is the number of M&As in renewable energy (M&A_RE) in each year between 2003 to 2022. The second is the number of IPF deals in renewable energy (IPF_RE) in each year between 2003 to 2022. These data were extracted from the Refinitiv (2024) database.

To measure the level of energy production from renewable sources, we use the data employed in section 1.1.2 to measure the state of the energy transition. However, we will only use the data regarding the energy generation from renewable energy sources (wind, solar, bioenergy, hydro and other renewables). Therefore, the variable chosen was the total generation of energy from renewable energy sources, measured in terawatt-hours (TWh) (Refinitv, 2024). According to the European Union (2009), nuclear energy is not considered to be a renewable energy source, so it was not included in our analyses. This variable has been lagged by one year to account for the time required for investments to respond to changes in the level of energy production from renewable sources (Lag_REG).

To evaluate the level of impact that innovation has on FDI in renewable energy, this study uses as proxy for that the variable related to the evolution of Renewable Energy Patents (REPs) during the past 20 years. As previously mentioned, access to technologies is a driver for investment in the energy sector, with this in mind it makes sense to include this variable in this study to evaluate its effect on investments, especially when compared to other variables. These data were extracted from the database from IRENA (2024).

To evaluate the environmental-related policies and regulations in place in the studied countries, the variable chosen consists of the Sectoral climate actions and policies (Sect_Pol) from the OECD Climate Actions and Policies Measurement Framework (CAPMF) (OECD, 2024). Sectoral policies are tailored to specific industries or sectors, focusing on the unique challenges and opportunities within those areas, producing a better understanding of how targeted policies can impact the energy transition (Nachtigall et al., 2022). Considering that each sector has a different impact on the energy transition, with the power sector standing as the primary contributor of greenhouse gas emissions, followed by the industry and transportation sectors (IRENA, 2021). These policies are categorized into two categories - market-based and non-market-based instruments - including policies to incentivize emissions reduction, promote renewable energy and enhance energy efficiency (Nachtigall et al., 2022). The CAPMF scores countries based on qualitative and quantitative assessments to evaluate their climate action and policy effectiveness (Nachtigall et al., 2022). Our goal with the utilization of this variable is to study the impacts of the differences in the implementation of the EU's policies between the EU countries on FDI in renewables.

To create a picture of the economic situation of the various countries the variable gross domestic product (GDP) at market prices will be used. This variable is employed to assess the level of wealth generated by resident producer units through their production activity. Taking into account the focus of this study, such data is crucial in determining the potential connection between a country's wealth and the probability of receiving investments in renewable energy. These data were extracted from the database from Eurostat (2024).

Considering that the focus of this study is FDI, it makes sense to include a lagged variable representing the track record on recently received FDI inflows – in this case, net inflows (in current US$). This variable measures FDI by evaluating the direct investment flows in the respective economy, according to the previously mentioned definition of FDI provided by the OECD. This variable has been lagged by one year to account for the time required for investments in renewables to respond to changes in FDI trends, this choice is supported by the study from (Murshed et al., 2022), which argues that the relationship between FDI and the energy transition is complex and involves lagged effects because of the needed time for investments to produce results. These data were extracted from the database from the World Bank Group (2024).

Table 2. Synthesis on the variables used in this study

	Variables	Description	Stata Name	Expected Sign	Source
Dependent	M&A deals in clean energy	Number of M&A deals by year (2003-2022) and country	M&A_RE	n.a.	Refinitiv (2024)
	IPF deals in clean energy	Number of IPF deals by year (2003-2022) and country	IPF_RE	n.a.	Refinitiv (2024)
Independent	Energy generation from Renewable sources	Electricity Generation in renewable energy by year (2003-2022) and country	Lag_REG	+	Ember (2024)
	Innovation	Renewable Energy Patents Evolution by year (2003-2022) and country	REPs	**+ or –**	IRENA (2024)
	Environmental Regulation	Sectoral Climate Actions and Policies framework by year (2003-2022) and country	Sect_Pol	+	OECD (2024)
	Economic Activity	Gross domestic product (GDP) per capita by year (2003-2022) and country	GDP	+	Eurostat (2024)
	FDI	FDI, net inflows (BoP, current US$) by year (2003-2022) and country	Lag_FDI	+	World Bank Group (2024)

Source: Own elaboration.

2.2. Econometric model

This section discusses the choice of the econometric model used in this study. Considering the research question, our goal is to test if, over time, there is a significant relationship between FDI in the renewable energy sector and indicators related to energy transition (as well as an indicator of economic activity and of prior FDI received). Therefore, the modelling strategy involves two equations, to account for the two types of FDI this study aims to analyze. The first aims to explain the relationship between M&As in renewable energy and the indicators of energy transition. The second aims to explain the relationship between IPF deals in renewable energy and the indicators of energy transition (as well as an indicator of economic activity and of prior FDI received). These models allow to test the posited hypotheses.

Due to the dependent variables being a count of the number of M&A's and IPF deals the ordinary least squares (OLS) regression is not appropriate. That is because these variables cannot reach negative values and, therefore, do not possess a normal distribution, which is an assumption of the OLS regression model (Greene, 2003). For this analysis, we will need to utilize a regression model appropriate to analyze count data, which can either be the Poisson regression model, the Negative Binomial (NB) regression model or a zero-inflated model (Alba et al., 2007).

According to Greene (2003), the Poisson regression model is the most widely used model to study count data. However, the same source highlights that one of the biggest critiques of this model relies in its assumption that the variance of the dependent variable equals its mean. Hence, when the variance to mean ratio[3] is greater than 1, we conclude that the data experiences overdispersion and that the Poisson regression model is not suited for the analyses. In this case, there are other models that can be employed such as the NB regression model, which is an extension of the Poisson regression, utilized for cases with overdispersion (Greene, 1994). One of the most common reasons for the presence of overdispersion is the presence of unobserved heterogeneity, a factor not taken into account by the Poisson regression model (Greene, 2003). Therefore, to correct for overdispersion, the NB regression model incorporates overdispersion by specifying the variance as a function of the conditional mean (μ) and a dispersion parameter (α) (Greene, 2003).

Given the significantly larger variance of the dependent variables M&A_Clean (67.551) and IPF_Clean (9149.533) compared to their respective means (4.158 and 42.64), as seen in Table 3, and the fact that the respective Variance-to-Mean Ratios of 16.24 and 214.58 are much greater than 1 show that a NB regression model might be more appropriate. The fact that the data for the two dependent variables experiences overdispersion can be explained by the fact that there is a concentration of FDI in renewable energy in the countries studied, and that FDI is not equally being employed in every country.

Additionally, to ensure that the data experiences overdispersion and that the NB model is preferred over the Poisson we employ a likelihood ratio test of α (Greene, 2003). If

[3] The variance to mean ratio is calculated by dividing the variance by the mean.

α=0 than the null hypothesis is verified, and the Poisson model is utilized. Considering the test results, we conclude that this data experiences overdispersion, since the α is greater than 0 (1676.99), thus, we reject the null hypothesis, meaning that the NB model is a better fit for the data.

As seen in Table 3, our data set includes 520 observations from 2003 to 2022 for 26 countries. However, considering that the dependent variables include a considerable number of observations equal to zero, we need to test if a zero-inflated model might be more appropriate (Greene, 2003). Considering the first dependent variable, M&A_RE, there are a total of 302 non-zero values and 218 zero values, this means that approximately 42% of all observations have a zero value, proving that for the variable M&A_RE there are excess zeros. For the second dependent variable, IPF_RE, there are a total of 423 non-zero values and 97 zero values, this means that approximately 19% of all observations have a zero value, proving that for the variable IPF_RE there are excess zeros.

Table 3. Descriptive statistics of the variables

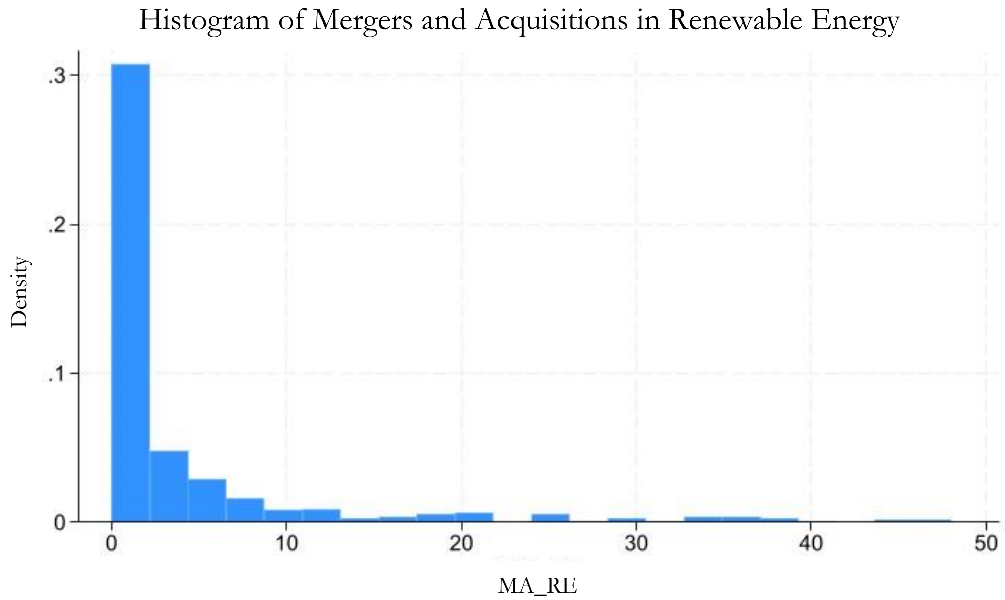
Descriptive Statistics

Variable	Obs	Zero Obs	Mean	Std. Dev.	Variance	Min	Max
Year	520	0	2012.5	5.772	33.314	2003	2022
MA RE	520	218	4.158	8.219	67.551	0	48
IPF RE	520	97	42.64	95.653	9149.533	0	797
Lag REG	520	16	26.809	39.991	1599.309	0	251.49
REPs	520	17	297.856	728.984	531418	0	4955
Sect Pol	520	0	2.726	1.187	1.409	.136	5.605
Lag FDI	520	0	11956.567	28926.564	8.37e+08	-322053.78	217866.42
GDP	520	0	32957.753	22876.11	5.23e+08	2679.406	133711.79
Country id	520	0	13.5	7.507	56.358	1	26

Source: Own calculations using Stata 18.0.

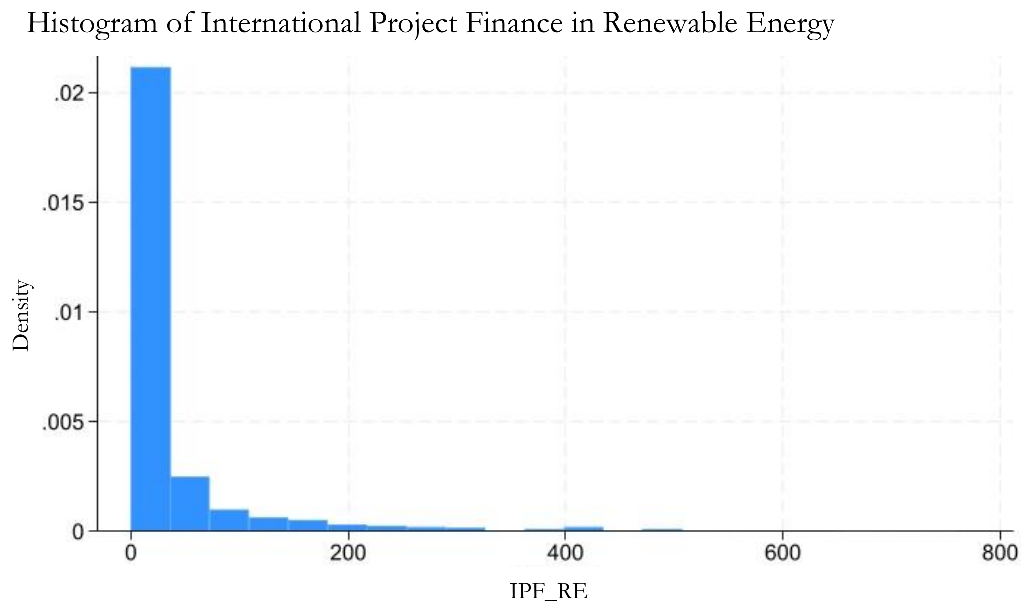
This is also observable in Figures 3 and 4, the histograms show the distribution of the dependent variables, showing that both variables are heavily skewed towards the right (positive skew). Considering that the highest variable is at the very beginning of the histogram, most of the countries have a small amount of M&A and IPF deals in each year. However, taking into account that the x-axis stretches up to 50 deals in the case of M&As and up to 800 deals in the case of IPF, this shows that there are a few countries which have a high number of FDI activity happening. This likely reflects an industry which is highly concentrated in a few major countries.

Figure 3. Histogram of M&A deals in renewable energy



Source: Own elaboration using Stata 18.0.

Figure 4. Histogram of IPF deals in renewable energy



Source: Own elaboration using Stata 18.0.

Taking this into account the analysis above, we conclude that the data has excess zeros and that a zero inflated model is the most appropriate model (Alba et al., 2007). A zero inflated model assumes a binary probability model, that combines two groups: the first group only has zero counts (count model) and the second has a non-zero probability of having counts other than zero (inflation model) (Greene, 2003).

According to Greene (1994), excess zeros can masquerade as overdispersion, however it is important to differentiate between the two because there are different causes for each one: overdispersion reflects a problem of the lack of account for unobserved individual heterogeneity and excess zeros reflect the need for a different process to explain the existence of some zero counts from the remaining counts. Therefore, we employ a likelihood-ratio test of α against the zero inflated poison (ZIP) regression model, to ensure that the ZINB is the most appropriate model. Considering the results, we reject the null hypothesis, meaning that the ZINB model is a better fit for the data, because these data experience overdispersion.

Hence, due to these explanations, the regression model of FDI, measured by the number of M&As and IPF deals, will follow a ZINB distribution. The ZINB regression model has two components: the first is the count model that studies how the independent variables influence the count of events when they occur, and the second is the inflation model that studies the probability of having a zero count.

The ZINB regression model of M&As by country $\boldsymbol{i}$ at time $\boldsymbol{t}$ is given by the equations 1 and 2 below. Equation 1 refers to the count model and studies how the predictors affect the amount of M&As in renewable energy. Equation 2 refers to the inflation model and studies the probability of encountering excess zeros, indicating if the predictors affect the probability of encountering an excess zero in M&As. Thus, the data should be fitted with the two following equations (Greene, 2003).

$$\boldsymbol{log\left(v_{i,t}\right) = \beta_0 + \beta_1 Lag\_REG_{i,t} + \beta_2 REPs_{i,t} + \beta_3 Sect\_Pol_{i,t} + \beta_4 Lag\_FDI_{i,t} + \beta_5 GDP_{i,t}} \tag{1}$$

$$\log\left(\frac{p_{i,t}}{1-p_{i,t}}\right) = \gamma_0 + \gamma_1 Lag\_REG_{i,t} + \gamma_2 REPs_{i,t} + \gamma_3 Sect\_Pol_{i,t} + \gamma_4 LagFDI_{i,t} + \gamma_5 GDP_{i,t} \quad (2)$$

$\boldsymbol{\nu_{i,t}}$ is the expected count for the observation for the country i in the year t.

$\boldsymbol{\beta_0}$ is the y-axis intercept term, which is not a relevant term.

$\boldsymbol{\beta_1}, \boldsymbol{\beta_2}, \dots, \boldsymbol{\beta_5}$ represent the coefficients for the count model.

$\boldsymbol{p_{i,t}}$ is the probability that the observation for the country i in the year t is an excess zero.

$\boldsymbol{\gamma_0}$ is the y-axis intercept term, which is not a relevant term.

$\boldsymbol{\gamma_1}, \boldsymbol{\gamma_2}, \dots, \boldsymbol{\gamma_5}$ represent the coefficients for the inflation model.

The same treatment can be used for the second dependent variable, IPF deals. Hence the ZINB regression model of IPF deals by country i at time t is given by equations 3 and 4.

$$log\left(\varphi_{i,t}\right) = \varrho_0 + \varrho_1 Lag\_REG_{i,t} + \varrho_2 REPs_{i,t} + \varrho_3 Sect\_Pol_{i,t} + \varrho_4 Lag\_FDI_{i,t} + \varrho_5 GDP_{i,t} \quad (3)$$

$$\log\left(\frac{P_{i,t}}{1-P_{i,t}}\right) = \omega_0 + \omega_1 Lag\_REG_{i,t} + \omega_2 REPs_{i,t} + \omega_3 Sect\_Pol_{i,t} + \omega_4 LagFDI_{i,t} + \omega_5 GDP_{i,t} \quad (4)$$

$\boldsymbol{\varphi_{i,t}}$ is the expected count for the observation for the country i in the year t.

$\boldsymbol{\varrho_0}$ is the y-axis intercept term, which is not a relevant term.

$\boldsymbol{\varrho_1}, \boldsymbol{\varrho_2}, \dots, \boldsymbol{\varrho_5}$ represent the coefficients for the count model.

$\boldsymbol{P_{i,t}}$ is the probability that the observation for the country i in the year t is an excess zero.

$\boldsymbol{\omega_0}$ is the y-axis intercept term, which is not a relevant term.

$\boldsymbol{\omega_1}, \boldsymbol{\omega_2}, \dots, \boldsymbol{\omega_5}$ represent the coefficients for the inflation model.

3. Results and Discussion

This chapter presents the estimation results of the four equations drawn up in section 2.2 to evaluate the relationship between the indicators of the energy transition and FDI in renewable energy.

Firstly, a study was done to understand whether our independent variables are truly independent, as this raises multicollinearity issues. Therefore, we begin by making an analysis of the results for the Pearson Correlation Test (Table 4 below). Considering the results provided in Table 4, we can observe that none of the variables display high values for correlation with other variables analyzed, we conclude that the variables do not present issues of multicollinearity.

Table 4. Pearson correlation statistics of the independent variables

Pairwise correlations

Variables	Lag_REG	REPs	Sect_Pol	Lag_FDI	GDP
Lag_REG	1.000				
REPs	0.625	1.000			
Sect_Pol	0.484	0.211	1.000		
Lag_FDI	-0.047	-0.006	0.004	1.000	
GDP	0.180	0.094	0.340	0.054	1.000

Source: Own calculations using Stata 18.0

It is however important to highlight that the highest correlation value is experienced by the variables REPs and Lag_REG, this suggests that there is a significant association between the variables, but not enough to create issues in our model. This behavior between these two variables is expected since innovation in renewables is likely to bring higher levels of production of energy from renewable sources, through a greater efficiency.

Considering the variable Sect_Pol there is a moderate positive correlation with the variables Lag_REG, GDP and REPs, this suggests that countries with better policies for the energy transition tend to produce more energy from renewable sources and tend to be wealthier. This can imply that the policies in support of the energy transition implemented in these countries are having a positive impact in the production of clean energy, which is their goal. As previously mentioned, this is supported by IRENA (2021) that argues that policies encouraging the deployment of renewables and discouraging the consumption of energy from fossil fuel sources can stimulate interest in the energy transition and its tech.

The weakest correlation values are found when comparing the variable Lag_FDI with the independent variables that better paint a picture of the energy transition, suggesting that prior FDI might not be an important factor for the energy transition. This could be explained by the fact that FDI in renewables doesn't always seem to follow the behavior of Global FDI flows. For example, according to UNCTAD (2023), despite the fact that there was in 2022 a decrease in Global FDI flows, FDI flows in renewables continued to grow.

Following the analysis of the results for the Pearson Correlation Test, we will analyze the results for the ZINB regression model, presented in Table 5 below. Note that the Likelihood ratio test of α, presented at the end of table 5, that tests the null hypothesis of the ZIP model being a better fit for the data, presents a value much greater than 0 and statistically significant. Therefore, we reject the null hypothesis, proving that the ZINB regression model is the most appropriate model. Table 5 is organized to provide the results for the ZINB regression model, by first providing the results for the count model and then providing the results for the inflation model.

Table 5. Results of the Zero-Inflated Negative Binomial (ZINB) Model

VARIABLES	MA_RE	IPF_RE
Dependent variable: rate of FDI		
Lag_REG	0.0174***	0.0166***
	(0.00187)	(0.00195)
REPs	0.000314***	0.000528***
	(8.11e-05)	(9.25e-05)
Sect_Pol	0.108	0.180***
	(0.0684)	(0.0564)
Lag_FDI	3.73e-08	-2.67e-06
	(1.88e-06)	(2.32e-06)
GDP	-5.62e-06*	4.54e-06
	(3.09e-06)	(3.27e-06)
Constant	0.414*	1.906***
	(0.214)	(0.158)
Dependent variable: probability of FDI		
Lag_REG	-0.0191	-0.278***
	(0.0211)	(0.0641)
REPs	-0.0133***	-0.00475
	(0.00468)	(0.00329)
Sect_Pol	-0.0901	0.434**
	(0.226)	(0.218)
Lag_FDI	-4.10e-06	-3.37e-05**
	(7.03e-06)	(1.33e-05)
GDP	-7.26e-05***	-8.24e-06
	(1.99e-05)	(6.62e-06)
Constant	2.100***	-0.432
	(0.561)	(0.531)
Log-Likelihood	-1011.56	-1991.117
Likelihood ratio test	956.74***	1.6e+04***
Number of Countries	26	26
Observations	520	520

Standard errors in parentheses

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

Source: Own calculations using Stata 18.0.

Looking at the first independent variable Lag_REG, we can observe that the coefficients for the count model are positive and statistically significant for both M&A and IPF deals, as the p-value is lower than 0.01. This implies that as the production of energy from renewable sources increases so does the number of M&A (H1.1 is verified) and the number of IPF deals (H1.2 is verified). This finding is supported by studies such as Selcuk et al. (2014), Md. Qamruzzaman (2024) and Caetano et al. (2024), that argue that countries with a robust commitment to renewable energy development and sustainability are likely to attract more FDI in renewable energy, due to them seeming more committed to the energy transition. Analyzing the inflated model, we can verify that the coefficient for Lag_REG is negative and statistically significant for IPF deals. This means that as the production of energy from renewable sources increases the likelihood of observing an excess zero in IPF deals decreases (further verifying H1.2). However, when we take into consideration the inflated model for the dependent variable M&A the same does not happen, as the coefficient for the variable Lag_REG is not statistically significant, and, therefore, does not predict the probability of an excess zero. This implies that the generation of energy from renewable sources is better at explaining the behavior of IPF deals than of M&A.

Considering all of this we can conclude that H1 is verified and, therefore, renewable energy generation is positively associated with FDI in renewable energy, implying that as renewable energy generation increases so does FDI in renewables.

While analyzing the second independent variable REPs, we can see that the behavior of the results is very similar to that of the variable Lag_REG, considering that the coefficients for the count model are also positive and statistically significant for both M&A and IPF deals. This means that as the innovation in renewables increases so does the investment in renewables, measured by the number of M&A (H2.1 is verified) and IPF deals (H2.2 is verified). This is supported by the study of Curran et al. (2017), that argues that innovation can be a determinant factor for a firm to choose to internationalize to a specific country, highlighting that the motivation behind this choice is technology/strategic asset seeking. Indeed, innovation (or innovative capabilities) can be considered a strategic asset as it may allow for the firm to became more competitive (Curran et al., 2017; Patala et al., 2021). For example for firms who are experiencing oversaturation in their primary markets, these innovative capabilities can differentiate them from the competition (Curran et al., 2017). The studies by Andriuškevičius & Štreimikienė (2022) and Wasilewski et al. (2021) also support this idea identifying renewable energy technology as a strategic asset that can make the firm more competitive in the EU energy market. Interestingly, when looking at the inflated model we observe that the coefficient for REPs is negative and statistically significant for M&A. From this we can infer that as innovation increases, the probability of observing an excess zero in M&A decreases (further verifying H1.2). The same is not verified, when studying the dependent variable IPF deals, as the variable REPs does not predict the likelihood of observing an excess zero, since its coefficient is not statistically significant. This implies that the variable renewable energy patents is better at explaining the behavior of M&A than of IPF deals.

Taking this into account we can conclude that H2 is verified and, therefore, innovation in renewable energy is positively associated with FDI in renewable energy.

Passing on to the third independent variable Sect_Pol, we cannot conclude anything regarding the relationship between this variable and the dependent variable M&A in renewable energy. Seeing as the coefficient for this variable is not statistically significant neither in the count model or the inflated model (H3.1 is not verified). These results seem to go against the literature, e.g. Andriuškevičius & Štreimikienė (2022) argue that investment in M&A has been positively impacted by the environmental regulations implemented in the EU. Additionally, Saqib & Dincă (2023) and Streimikiene & Siksnelyte (2014) also support this theory for FDI as a whole. However, this discrepancy between the literature and the result obtained can be explained by the choice of variable for this study. Taking into account that for this study we examine the variable sectoral policies and that this variable is tailored to specific industries or sectors in specific countries, focusing on the unique challenges and opportunities within those areas (Nachtigall et al., 2022). However, the mentioned studies seem to focus on the EU's policies which are more wide ranging and less specific(Andriuškevičius & Štreimikienė, 2022; Saqib & Dincă, 2023; Streimikiene & Siksnelyte, 2014).

Regarding the dependent variable IPF deals in renewable energy, we conclude that an increase in sectoral policies in renewable energy is related to an increase in IPF deals in renewable energy (H3.2 is verified). That is due to the coefficient for this independent variable being positive and statistically significant for the count model. These results are supported by the literature, notably by Saqib & Dincă (2023) and Streimikiene & Siksnelyte (2014), which concluded that FDI has been positively impacted by the environmental regulations implemented in the EU. However, in the inflated model for the dependent variable IPF deals the coefficient for the variable Sect_Pol is positive and statistically significant, meaning that as sectoral policies in renewable energy increase so does the probability of experiencing excess zeros.

Therefore, we can infer that H3 is only partially verified, considering that it is only verified for IPF deals and not for M&A. Hence, we can only verify H3.2, meaning that we can only conclude that public policy development in renewable energy is positively associated with IPF deals in renewable energy. This difference in behavior might be explained by the nature of M&A and IPF deals - considering that, for a merger to happen, there needs to be two companies that are willing to become one and for an acquisition to happen there needs to be a company that is looking to be bought and a second company that is looking to buy. However, IPF deals require a less complex procedure and therefore the reason for this difference might be related to the easiness to which IPF deals can respond to changes in public policy when compared to M&As.

Moving on to the fourth independent variable Lag_FDI, we can observe that the coefficients are very close to zero and are not statistically significant in the count model for both M&A and IPF deals. Suggesting that the FDI in all sectors does not affect FDI in renewable energy. Interestingly, when considering the inflated model for the dependent variable IPF deals, the coefficient for Lag_FDI is negative and statistically significant, meaning that as FDI in all sectors increases the probability of experiencing excess zeros decreases. The same does not happen for the dependent variable M&A.

Analyzing these results, we conclude that the H4 is not verified. However, H4.2 might be partially verified, meaning that there might be some credibility to the hypothesis that Global FDI is positively associated with IPF deals in renewable energy.

Finally, concerning the fifth and last independent variable GDP, that serves as a measure for the economic activity and wealth of a country, we can observe that the coefficients is negative and marginally statistically significant in the count model for M&A. Suggesting that the economic activity and wealth of a country has a weak negative impact on the development of FDI in renewable energy, as GDP grows M&A in renewables decreases. Moreover, when we analyze the inflated model for M&A, we observe that the coefficient for the variable GDP is negative and statistically significant, meaning that as GDP increases the likelihood of experiencing excess zeros decreases. Additionally, when analyzing the count and inflated model for the dependent variable M&A, we can observe that the coefficient of GDP is not statistically significative, therefore we conclude that the economic activity and wealth of a country does not impact the development of IPF deals in renewable energy (H5.2 is not verified).

Taking into account the last hypothesis (H5) that tests whether the wealth of a country is a determining factor for the existence of FDI in renewables, we can infer that this hypothesis is not verified. Table 6 below presents an overview of the results from the ZINB regression for each of the hypotheses proposed in this study.

Table 6. Synthesis of results for each hypothesis

Hypothesis	Sub-hypothesis	Results
H1: FDI in renewable energy is positively associated with Renewable energy generation	**H1.1**: M&A activity in renewable energy is positively associated with Renewable energy generation.	Verified in the count model
	H1.2: IPF deals in renewable energy are positively associated with Renewable energy generation.	Verified in both models
H2: FDI in renewable energy is positively associated with Innovation in renewable energy, measured by the number of patents in renewable energy.	**H2.1:** M&A activity in renewable energy is positively associated with Innovation in renewable energy.	Verified in both models
	H2.2: IPF deals in renewable energy are positively associated with Innovation in renewable energy.	Verified in the count model
H3: FDI in renewable energy is positively associated with public policy development in renewable energy attractiveness.	**H3.1:** M&A activity in renewable energy is positively associated with public policy development in renewable energy.	Not verified
	H3.2: IPF deals in renewable energy are positively associated with public policy development in renewable energy.	Verified in the count model
H4: FDI in renewable energy is positively associated with FDI flows received in all sectors.	**H4.1:** M&A activity in renewable energy is positively associated with FDI flows received in all sectors.	Not verified
	H4.2: IPF deals in renewable energy are positively associated with FDI flows received in all sectors.	Verified in the inflated model
H5: FDI in renewable energy is positively associated with the GDP per capita.	**H5.1:** M&A activity in renewable energy is positively associated with GDP per capita.	Not verified
	H5.2: IPF deals in renewable energy are positively associated with GDP per capita.	Not verified

Source: Own elaboration.

Conclusion

This dissertation proposed to answer the question "Is FDI following the energy transition?", with the objective of studying the relationship between the energy transition and FDI – the latter proxied by the number of M&As and IPF deals. When looking at the state of the energy transition, we can see that the focus on fossil fuels is dropping and the EU has taken the lead in undertaking this change, followed by the United States (IRENA, 2023). However, neither of the two is currently on track to meet the ambitious goal of limiting global warming to 1.5 degree Celsius (IRENA, 2023). Considering the literature review, we can see that there is a considerable need for investment in the energy transition, as this transition requires high levels of investment in generation, efficiency, infrastructure, and innovation (UNCTAD, 2023). Regarding the high levels of financing needed to ensure the energy transition. Foreign direct investment is an important source of capital, know-how, technology, and market access that can be used to promote the energy transition, especially when domestic investment is limited (OECD, 2008).

Even though there is an extensive amount of research on the determinants of FDI, including in the renewable energy sector, this study aims to contribute to the literature by focusing on the effects felt on M&As and on IPF deals. As previously mentioned, according to UNCTAD (2023), IPF is has been one of the main financing structures utilized in the promotion of investment in renewables and, therefore, more research on the relationship between IPF deals and the energy transition is needed. In light of the crucial role of IPF deals in the future of the energy transition, additional research on this topic is necessary, as it has only garnered attention in more recent studies. We hope that by examining this relationship we can gain a deeper understanding of how to harness FDI for the energy transition, as this knowledge can help guide decision-making processes and shape initiatives to better address the determinants of M&As and IPF deals.

Throughout the process of this research, we defined 5 hypotheses, which were then tested for both M&A and IPF deals. The sample was defined for the 27 European countries, except for Cyprus due to a lack of information regarding this country, between the years of 2003 and 2022. To accomplish the aim of this study, our data was organized as a panel and the ZINB regression model was used to estimate the econometric model. The choice of this model was due to the following considerations. The first relies on the fact that the dependent variables represent the number of observations of M&A and IPF deals in the renewable energy sector from 2003 to 2022. The second relies on the fact that our data experiences overdispersion. The overdispersion experienced in this study is explained by the variability among the observations, due to a few of the countries studied experiencing great amounts of FDI and the others experiencing very low amounts of FDI. Lastly, the third consideration relies on the fact that our data experiences excess zeros.

The ZINB regression model assumes a binary probability model, analyzing the data from two perspectives. The first perspective refers to the count model, focusing on how the predictors affect the dependent variable. The second perspective refers to the inflation model, focusing on how the predictors affect the probability of encountering an excess zero. Analyzing the ZINB regression model we were able to conclude that two of the main hypothesis of this study – FDI in renewable energy is positively associated with renewable energy generation (H1) and FDI in renewable energy is positively associated with innovation in renewable energy, measured by the number of patents in renewable energy (H2) – are verified for both the M&A and IPF deals in the count model. This finding proves that as renewable energy production and innovation increase there is a corresponding increase in M&As and IPF deals in renewable energy, highlighting the importance of these two determinants for investment in the energy transition.

Additionally, this study also proves that IPF deals are positively associated with public policy development, measured by the variable sectoral policies, in renewable energy attractiveness (H3.2). This suggests that targeted policies can significantly impact IPF deals in renewable energy. Interestingly, through our model we were unable to prove that FDI in renewable energy is positively associated with FDI flows received in all sectors and with the GDP per capita. This could mean that the prior existence of FDI and the wealth of a country are not strong predictors for its respective inward FDI flows in renewable energy.

Looking at the results from the inflation model, we observe that the likelihood of observing a zero count in IPF deals decreases as the energy generation from renewables and the FDI from all sectors increase. Regarding the likelihood of observing a zero count in M&A this decreases as the renewable energy patents and the GDP increase.

However, this study has also encountered a few limitations. One of the limitations we faced during the execution of this study was the lack of access to certain data as most databases were not freely accessible, for instance not allowing for this study to incorporate an analysis of the relationship between the energy transition and greenfield investments. Additionally, it would have been interesting to have incorporated a variable to study the level of international regulation and to compare the results with the variable studied referent to sectoral policies, however to the best of our knowledge a variable on that does not yet exist. Even though the CAPMF does include a variable to study international policies this had a large amount of missing values for many of the years and countries that we focus on in this study.

Based on all the findings presented throughout this dissertation, we detected the following opportunities for future research. Firstly, we recommend the addition of other variables to create a more complete picture of the relationship between FDI and the energy transition, such as adding greenfield investments as another dependent variable (if possible including wholly-owned subsidiaries and joint ventures, to analyze the importance of the level of control). Secondly, it would be interesting to assess the relationship between the dependent variables to the investor's perceived notion of the progress of the energy transition, possibly through the employment of questionnaires to investors. As there might be discrepancies between what is happening and what investors think is happening in the energy transition, as evidenced by Wasilewski et al. (2021). Thirdly, it would be interesting for future works to enhance the employed methodology and contribute to the research by taking into consideration the problem of overdispersion. Therefore, to address overdispersion, it would be worthwhile to explore whether dividing the countries into sub-groups based on their observed FDI levels would yield different outcomes compared to the findings of this study.

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