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MASTER THESIS

Moterų dalyvavimas valdyme ir neformaliose rinkose. Empirinis tyrimas	**Women's Participation in Management and Informal Markets. An empirical exploration**

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INTRODUCTION

Gender equality has gained increasing attention in both social and economic discourse in recent decades. From early childhood, individuals are socialized into gender-specific roles that prescribe distinct responsibilities and behavioral expectations (Eliot et al., 2023; Rexrode et al., 2022). These social norms influence how individuals perceive themselves and others, shaping educational choices, labor market participation, and career trajectories in adulthood. Understanding how such gendered expectations are formed and how they affect later-life outcomes is therefore of critical importance. With this in mind, the chosen topic aims to examine women's participation in management and informal labor markets, while also assessing whether government policies aimed at promoting gender equality can influence or mitigate the long-term effects of socially constructed gender roles on labor market outcomes.

The topic is relevant for, at least, two reasons. First, from a theoretical perspective, the research contributes to literature by providing multi-dimensional theoretical framework for analyzing gender quotas, labor market outcomes, while integrating feminist, labor and institutional economics. Hence, it contributes to multiple streams of research and offers more nuanced way of understanding women's labor market participation, focusing on informal labor participation. From practical perspective, the topic is still relevant nowadays due to consistent presence of gender inequality as well as informal employment as social challenges. The two are however closely linked as women are more inclined to be employed informally and thus to be excluded from any social protection and have low income. Accordingly, examining the evidence-based effect of gender-quota policies is important for policy creation process.

Research worldwide has determined that informal market has been one of critical components of economics. Traditionally, it has been believed that informal markets were caused by economic crisis (Blanton, Early, & Peksen, 2018; Cling, Razafindrakoto, & Roubaud, 2010; Mehrotra, 2009; Siggel, 2010; Teobaldelli & Schneider, 2013; Verick, 2006) however recent studies have emphasized that gender dimensions also have a significant impact in the matter (Buszko, 2018). In addressing the relationship of women in management and women in informal markets, several studies (see, for example, Bue & Martínez-zarzoso (2024), Buszko (2018), Islam & Amin (2022)) have indicated that women's engagement in management positions have an adverse effect on informal markets however the results have not taken into account the newest data on regulations on gender-quotas. The novelty of this research lies in its use of updated post-gender-quota data from the European Union to offer a new analytical perspective on the

relationship under the review. While previous studies have examined gender inequality and informality separately, this research systemizes existing literature by incorporating gender-quota regulations. Additionally, the research offers empirical evidence on whether gender-equality measures have altered gender-based labor markets patterns. As such, the study provides new insights relevant for both academic research and evidence-based policymaking.

The aim of this master thesis is to evaluate the relationship between women's participation in informal labor markets and female representation in management in European Union, and to determine whether the introduction of government policies has contributed to changes in gender-based labor market outcomes. To achieve the main research aim, the following objectives have been identified:

- To analyze trends of women's participation in informal markets and female representation in management positions across EU member states
- To evaluate the relationship of women's informal employment and women's representation in management using econometric methods
- To evaluate the impact of gender-quota policies on women's informal employment using econometric methods

Concerning methods used, this thesis first employs a literature review to provide a comprehensive theoretical framework. Concerning the empirical analysis, descriptive statistical analysis is firstly used to examine trends of women's participation in management as well as informal markets. From an econometric standpoint, Ordinary Least Squares (OLS) regression analysis is used, in line with previous research aimed at evaluating gender, management and informal market outcomes (see, for example, Profeta (2020)). For additional support, fixed effects models are also used for more precise results. Having in mind that OLS does not examine the treatment effect of gender-quota policies, thus Difference-in-Differences methods are further undertaken for the task.

Based on the results of this Master thesis, the following policy implications are identified. The analysis contributes to ongoing policy discussions on gender equality and labor markets by providing causal evidence. Moreover, the study provides information on design of more effective and efficient policy interventions.

Limitations. The master thesis is not without limitations. Firstly, the empirical research is based on country-level panel data which may not fully capture sector-specific informal market dynamics. As a result, the trends represent the aggregate results rather than micro-level causal mechanisms. Secondly, informal market is inherently difficult to measure and cross-country differences in definitions, reporting practices, and data quality across European Union member

states may affect the comparability results. Lastly, while study applies econometrical methods to evaluate the effects, the causal relationship may be limited by potential unobserved confounding factors. Although fixed effects and time controls are used to mitigate these concerns, the endogeneity cannot be fully ruled out.

The structure of the thesis. The thesis shall include three following chapters – analysis of the relevant scientific literature, methodology review, and practical part. The study of the relevant scientific literature shall examine the literature pertinent to the object of the research. Further, the methodology review shall determine the methods used in the thesis. And finally, the practical part of the thesis shall outline the results of the research executed.

1. ANALYSIS OF SCIENTIFIC LITERATURE

1.1 Gender, Leadership and Economic Development: Theories, Limitations and Institutional Responses

Understanding the distinction of sex and gender is fundamental task before analyzing gender disparities in economic, social and institutional context. Various studies have identified that term sex refers to biological characteristics of an individual that includes biologic, genetic and psychological expressions. While gender is identified as a socially constructed characteristics of women and men that include but are not limited to behavioral norms, roles and duties, expressions, stereotypes (Eliot et al., 2023; Rexrode et al., 2022). The gendered expectations shape how individuals act in society. In economic analysis, the distinction between two terms is crucial before taking any institutional interventions. For this work, we shall be focusing on the gender part of economic analysis.

This section reviews the literature on feminist economics. The analysis includes neoclassical theory criticism and the development of feminism in economics as well as their ideas and effect on institutional frameworks. Furthermore, we shall dig into human capital theory together with gender norms theory which explains how gender gaps arise and how they may be targeted by institutions. Thirdly, glass ceiling and glass cliff phenomena should explain the invisible limitations females are faced with. The phenomena influence females' decision making in career which in turn effects the economic development of a country. Moreover, the analysis has been performed towards the impact of women in leadership on firm's performance in various factors such as sustainability, social responsibility as well as profitability. Lastly, analysis on institutional measures taken to overcome gender inequality has been performed focusing on European Union gender quota tools.

1.1.1 Feminist Economic Theory: Critiques of Neoclassical Assumptions; Recognition of Unpaid Labor and Gender Roles.

Neoclassical economic development theory has long served as a dominant paradigm in 20th century. This theory allows us to understand nuances of economic development. However, the theory has been greatly criticized due to its exclusion of complex historical, social and structural factors that also shape economic environment (Colander, 2000; Dutt & Ros, 2008). One of the most prominent omissions is gender and unpaid labor (Agenjo-Calderon & Galvez-Munoz, 2019; Braunstein, 2007; Ferber & Nelson, 1993). Feminists have challenged the limitations and

established feminist economics as a subfield. The feminist economics have brought attention towards, by way of example, on gender injustice, inequalities in labor markets, property rights, inheritance. This section shall dive into neoclassical theory criticism, and arrival of feminist economics and the ideas that shaped it.

Neoclassical theory has been a dominant economic development theory in the 20th century. The theory suggested that the market should be self-regulating and self-sufficient, all individuals are rational, utility-maximizing and have perfect information (Arrow, 2015; Fullbrook, 2008; Piętak, 2014). However, the model has been criticized for not considering race, income inequality, religion, non-profit activities, environmental actions, history, interdependence of various economic falls and rises and most importantly gender (Colander, 2000; Dutt & Ros, 2008).

Ferber & Nelson (1993), van Staveren (1994), Bargawi (2020) and Morally (2020) agreed with the criticism that the neoclassical development theory disregards altruism of human beings, that tend to care for families and are the fact that family members interdependent (often associated with women's roles in families). The authors furthermore draw attention to the limited approach to the unpaid work of childcare and caregiving. The published work of Ferber & Nelson (1993) has been groundbreaking and helped establish feminist economics as a legitimate subfield.

Feminist economics further emphasize the effect of unpaid labor of care work towards economic development. Historically, economic issues concerning feminism on inequality in property rights, labor issues and inheritance has been prominent in during 19th and 20th centuries. (Agenjo-Calderon & Galvez-Munoz, 2019). In mid-20th century the second wave of feminism appeared, emphasizing the impact of social perspectives on economic development and thus had a clear effect of feminist economics prominence. An important milestones were the work of Waring (1990) and Ferber & Nelson (1993). While neoclassical school of thought treats households as unified decision-maker, the feminist emphasizes individual agencies and gender powered dynamics in households (Agenjo-Calderon & Galvez-Munoz, 2019; Braunstein, 2007; Ferber & Nelson, 1993).

The work has had an influence on institutions and on international level, as demonstrated by the United Nations' reports on gender and labor which reflect economic growth measures to represent broader indicators of well-being (e.g. human development index with gender-sensitive components). The first Human Development Report with gender components was introduced in 1990 (United Nations Development Programme, 1990). In 1995 the inclusion was further enhanced and gender-sensitive indices were introduced – Gender-related Development Index (GDI) and Gender Empowerment Index (GEM) (United Nations Development Programme, 1995). The inclusion was further enhanced by replacing GEM and GDI with Geder Inequality Index in 2010 (United Nations Development Programme, 2010).

Feminist economics have provided a powerful critic towards neoclassical economic thought by exposing limitations of gender inequality, labor inequality and other. By addressing the omissions, feminist economics have reshaped the understanding of economic development and value factors. The work has had an influence on institutions, such as United Nations that incorporated gender-sensitive indicators into development metrics.

1.1.2 Human Capital Theory vs. Gender Norms Theory

Human capital theory posits that accumulation of skills and knowledge is a fundamental driver of economic development (Becker, 1975, 1994; Singh, 2023). As the world is increasingly shifting towards knowledge-based industries, investments in human capital productivity, innovation and individual earnings seem to be essential. However, the studies have shown that increased educational attainment for women has shown positive results but has not closed the gender gap entirely (Donogcheng, Fanbo, & Zixun, 2021; Mammen & Paxson, 2000; Omojemite, 2024). Childbearing, caregiving responsibilities together with other factors shape the gender norms and behaviors. This section shall review human capital theory as well as gender norms theory.

Human capital theory suggests that the human capital (knowledge, skills and abilities) is a cornerstone of economic development (Tamura, 2006). As technology and innovation grow, the education, skills and knowledge of population are seen as more and more significant to any county's development structure. Singh (2023) argues that investments in human capital regardless of gender increases productivity and earnings. Obtained empirical evidence also suggests that gaps in educational access highlight the systematic limitations women face when pursuing academic disciplines which extend to professional life. Paper by Polachek & Polachek (2004) also shows how increasing female education level correlated with rising relative earnings. However, Blau, Kahn, Currie, Winkler, & Bailey (2017) show that human capital alone does not fully close the gender gap. Some other variables such as workforce interruption as childbearing still remain to have an impact.

Gender norms are social expectations that shape personal choices, roles, division of labor and institutional practices (Omojemite, 2024). The norms have an influence on people's choices as well as institutional practices (Huber & Paule-Paludkiewicz, 2024). Study by Donogcheng, Fanbo, & Zixun (2021) has shown evidence that married women tend to diminish their income to not outpace their husbands. Another study performed by Mammen & Paxson, (2000) has shown that as economic development grows, the participation of women in labor force declines and then rises. The study has also shown that fertility declines with income as well as education gap (Mammen & Paxson, 2000).

In conclusion, human capital theory has shown itself to be an important theory in economic growth, however, it does not close gender gap entirely. Education and skill-based investments can have a positive impact on economic growth, but there are structural and social barriers that allow the gender inequality to persist. Thus, policies aimed at education should also be aimed at parental leave, flexible hours and other interventions that shift the perception of traditional social roles of genders.

1.1.3 Glass Ceiling and Glass Cliff Phenomena

Women's career dynamics are not only impacted by personal choices and qualifications but also by social constructs. Two phenomena are gaining increasing attention towards the topic - glass ceiling and glass cliff phenomena. This section should review both of them and provide an analysis of how these phenomena affect women's decisions in their professional lives.

Glass ceiling outlines the unseen barriers that limit women – and often minorities – from moving beyond middle to senior management positions without consideration of their qualifications. A study by Kulich & Iacoviello (2017) has shown that women are faced with sex discrimination in workplaces and usually decide between situations of negotiation, coming to terms with situation, start up their own business or seeking opportunities in a different environment. The ones that come to terms of discrimination or try to negotiate – sometimes in the expense of their own values or believes - are nonetheless confronted with empirical evidence showing that hard work and competence are usually not enough to guarantee promotion within male-dominated power structures. Yet majority of women seem to hang on and hope for the otherwise. Stoppelmann (2019) has also presented findings that glass ceiling exists and there is a large gap between female representation at lower and upper levels which is mainly explained by the family situation and availability to long hours.

Meanwhile, glass cliff refers to phenomena when women are more likely to be appointed to leadership during organizational crises, increasing their risk to fall (Kulich & Iacoviello, 2017). Kulich (2017) and Morgenroth & Kirby (2020) found that women are more likely to be appointed to board roles after prolonged stock underperformance or in times of crises then men. Ryan et al. (2016) has shown that there is impact of glass ceiling on women in management however the matter is believed to be greatly complex. Research by Samuel & Wendt (2023) has been done on glass cliff effect on university but no significant results have been observed.

The combined effects of glass ceiling and glass cliff have significant impacts on women's career choices. Glass ceiling discourages women to improve their qualifications or take upon leadership tasks as the leadership position is believed to be appointed to men colleagues more. On the other hand, glass cliff phenomena have shown to influence women's appointment to

management in crises. Together these two concepts reveal how structural inequality and biases are affecting decisions of management appointment. Denial of opportunity due to inequality is one of the most important topics in management appointments. Understanding these two concepts may be fundamental to develop and foster equitable future community.

1.1.4 Impacts of Women in Leadership on Firm Performance

The role of women in leadership has been examined broadly in recent years. As more women are involved in management, more research has been performed in regard to what impact gender diversification in management roles has on firm performance in various aspects. This section analyses the relationship of gender diversification and potential benefits or nuances.

Table 1

Literature Analysis of Relationship of Gender Diversification and Firm Performance

Topic	Findings
Sustainability	Graafland (2020) has found that a diverse management has a nonlinear effect on sustainability reaching peak of effectiveness at 54% of board members being women. Darmawan (2024), Pierli, Murmura, & Palazzi (2022), UN Women & International Gender Champions Geneva (2017), WEDO (2022) have shown similar results with women in management contributing positively to corporate performance, innovation, investment, ESG issues etc.
Social responsibility	Chang, Wu, Lin, & Lin (2024), Reig-Aleixandre, García-Ramos, & De la Calle-Maldonado (2023), Monteiro, García-Sánchez, & Aibar-Guzmán (2022) and Setó-Pamies (2015) have found positive results on social responsibility when there is more female representation in the management. Positive effect has been also observed with women in management teams on corporate human rights performance (Muñoz, Fernández-Gago, & Godos-Diez, 2024). Interestingly, (Gennari, 2016) has found that the reason for few women in boardrooms is usually not because of lack of skill, but rather stems from firm's culture and weak commitment to corporate social responsibility. This creates vicious cycle: firms with low CSR tend to have low inclusiveness and gender equality which results in lower women numbers in boards. In turn, the absence of women in leadership means the company' misses out on the positive influence on CSR.

Topic	Findings
Economic profit / firm performance	Furthermore, studies have shown positive or not conclusive results on economic profit, firm value when gender discrimination is not present while electing management (Carter, Simkins, & Simpson, 2003; Lückerath-Rovers, 2013; Rose, 2007; Post & Byron, 2014). This has been confirmed by recent study performed by Edacherian & Karna, (2025) and (Nasta & Raoli, 2020). There have been several studies conducted which highlight that a greater presence of women in management teams acts as a driving force for positive results (M. Williams & Polman, 2015). However, Pletzer, Nikolova, Kedzior, & Voelpel (2015), Gruszczyński (2020), Simionescu, Gherghina, Tawil, & Sheikha, (2021) and Marashdeh & Alomari (2021) found no significant evidence on women's participation in management having an effect on firm's financial performance.
Decision-making	Study by Daidai & Alami (2024) has shown that diversity (including minorities and women) in management has a positive impact on investment effectiveness as well as decision-making policies. Other studies have also found positive impact on decision-making (Dezso & Ross, 2012; Ferrary & Déo, 2023; Novialumi, Widiawati, & Maisaroh, 2024).

Source: See above

Overall, the empirical evidence suggests a trend of female inclusion in management tend to positively affect various firm's areas of performance. Particularly, a positive change has been observed towards sustainability, corporate social responsibility, ethical governance. Meanwhile, the direct impact on the firm's financial performance has remained mixed or context dependent. However, decision-making has shown positive results of female representation. These findings have suggested that diversity in the management team is a significant factor in achieving strategic goals focused on firm's performance as well as social aspects of the firm.

1.1.5 Institutional Support: Gender Quotas

Gender quotas have emerged as one of the most prominent regulatory frameworks for addressing gender discrimination in leadership positions (Ahern & Dittmar, 2010). The effectiveness of such measures, however, have been found to have mixed results on companies' market valuation (Ahern & Dittmar, 2010; Zhang, 2019). Within the European Union, where gender equality is a fundamental value, gender quotas have become a key policy to counterbalance deeply rooted gender inequalities. This section shall review gender quotas definition, research results on firms' value and measures accepted by the European Union.

Gender quotas are one of the main tools used by governmental bodies in reducing gender inequality and they are conceived as a minimum share of women on corporate boards or in senior roles (Ahern & Dittmar, 2010). Quotas can be conceived as institutional pressure which signals

markets and nudges firms to diversify and alter their organizational behaviors for a broader advantage. Gender quotas are believed to be not only institutional measures to correct historical social injustice but also catalyst future organizational and organizational changes. Some researchers have found that quota-active countries achieve market valuation improvements (Zhang, 2019) while others found that in subsequent years the stock market and market valuation falls (Ahern & Dittmar, 2010). However, it is worth noting that the research by Zhang (2019) highlighted that quotas are most effective as social attitudes support the government issued laws.

In 1993 the Maastrich Treaty, also known as the Treaty of the European Union, has been established as a pivotal agreement that laid the foundation for the European Union. Further amendments of the Treaty of Amsterdam (1997), Treaty of Nice (2001) and Treaty of Lisbon (2007) have further shaped the Treaty of the European Union to the current version.

Under the Treaty of European Union, equality is described as a fundamental value. Specifically, under Article 3 (3) European Union is designed to combat social discrimination, gender inequality and promote social justice and protection (European Comission, 2007a). The Treaty of Functioning of the European Union further advises to adopt measures ensuring equal opportunities for employment among women and men (European Comission, 2007b).

European Union has a persistent gender imbalance in company boards with women being significantly under-represented in publicly listed companies (European Comission, 2022). Despite efforts in combating this issue, progress towards gender equality has been slow in the European Union countries. Consequently, the European Union introduced the EU Gender Equality Strategy 2020-2025 which was implemented in order to promote gender equality across Europe. A significant element of this strategy is Directive 2022/2381, designed to ensure a more balanced gender representation in leadership by mandating that companies achieve a specified proportion of women on their boards. (European Comission, 2022). The mentioned initiative also aligns with United Nations' Sustainable Development Goal 5 (SDG 5) which aims to achieve gender equality and empower all women and girls. SDG 5 focuses at providing equal opportunities for women's leadership at all levels of decision-making – political, economic and public life. By targeting gender quotas, EU directly contributed to the realization of SDG 5 (United Nations, 2025).

Overall, this section has provided an extensive analysis of gender and economic development relationships. The neoclassical economic development theory's limitations which led to feminist economics development. With feministic ideas rising, institutions have also aligned with presenting with economic measures which reflect gender measures. The human capital theory as well as gender norms theory has supported feministic movement by providing insights on gender gap reasoning. Glass ceiling and glass cliff phenomena deepened the understanding of gender inequality highlighting entrenched organizational and societal expectations rather than

personal choices. The analysis has further examined the impact gender diversity has on firms' performance as well as an analysis of institutional frameworks accepted in the European Union in tackling gender inequality issues. Collectively, the analysis has shown that addressing gender inequality requires both structural shifts together with cultural changes. It has highlighted that real change in gender equality may rise only from aligned institutional as well as cultural approaches.

1.2 Informal markets: Structures, Dynamics and Gender Perspectives

Informal markets, also known as shadow economy or informal economies, are widely understood as economic activities that do not fall under formal regulations. However, the definition itself is not as simple as it may sound (Williams, 2019).

Firstly, an analysis of different informal market definitions shall be carried out. The analysis focuses on different approaches of enterprise-based, employment-based and activity-based definitions which provide different views on the matter and are crucial to understanding of the informal markets. Furthermore, reasons for shadow economy's persistence should be reviewed. Thirdly, the literature review extends the understanding to determining the root causes of informality. The research further examines the complexity of informal sector measurements.

1.2.1 Complexity of Informal Markets: Definitions and Conceptual Frameworks

Defining the informal markets has been a complex task for scholars. The definition itself has numerous layers that need to be accounted for and are often disregarded. The definition itself has various names to it going from "informal", "shadow", "hidden", "black", "invisible" or "cash-in-hand" economy, market, employment, activity, sphere or any other. (Williams, 2019). In a simple manner, the term is often associated with lack of regulation or missing information. While reviewing different definitions of informal markets, three main ones can be identified: enterprise-based, job-based and activity-based.

1.2.1.1 Analysis of Enterprise-Based Definition of Informality

The enterprise-based definition has been defined by Fifteenth International Conference of Labour Statisticians (1993). According to this definition, informal markets are units engaged in the production of services or goods with a primary objective of generating income and employment for the people concerned. Assumption includes that these units are usually organized in a small scale and have low or no level of organization.

Having in mind this definition, two assumptions problems arose that differ from reality. First, people who are partly employed as formal employees and partly as informal (without any

legal arrangements) were not considered. Second, some small, based enterprises were wrongly classified as informal enterprises due to insufficient definition.

Due to the mentioned drawbacks of the definition, other frameworks have been developed. One is employment-based and another is activity-based.

1.2.1.2 Examination of Employment-Based Definition of Informal Markets

Employment-based definition has been led by The Seventeeth International Conference of Labour Statisticians (2003). The definition expanded the before-mentioned framework and includes all types of employment considering the production units by type (formal sector enterprises, informal sector enterprises or households). Table 2 as well as explanations below provide an overview of the definition.

Table 2

Conceptual Framework: Informal Employment as defined by Fifteenth International Conference of Labor Statisticians (*)

Production units by type	**Jobs by status in employment**								
	Own-account workers		Employers		Contributing family workers	Employees		Members of producers' cooperatives	
	Informal	Formal	Informal	Formal	Informal	Informal	Formal	Informal	Formal
Formal sector enterprises					1	2			
Informal sector enterprises[(a)]	3		4		5	6	7	8	
Households[(b)]	9					10			

Source: (Fifteenth International Conference of Labour Statisticians, 1993).

(*) Note: Cells shaded in dark grey represent jobs that do not exist in the type of production unit in question. Cells shaded in light grey refer to formal jobs. Un-shaded cells represent the various types of informal jobs which have been detailed below

Informal employment encompasses the following categories of jobs, as illustrated in the referenced matrix:

- Own-account workers operating in their own informal sector enterprises (cell 3). Own account workers are people working on self-employment capacity on their own account or with one or more partners with no employees (Fifteenth International Conference of Labour Statisticians, 1993)

- Employers managing their own informal sector enterprises (cell 4).
- Contributing to family workers, regardless of whether they work in formal or informal sector enterprises (cells 1 and 5). Contributing family workers are individuals who assist a family or household member in a market-oriented enterprise without receiving regular wages or salaries. Instead, they may receive in-kind benefits or occasional cash payments from the enterprise's output or household income. They do not hold decision-making authority or responsibility over the enterprise (International Labor Office Department of Statistics, 2018)
- Employees in informal jobs, whether they work in formal sector enterprises, informal sector enterprises, or as paid domestic workers in households (cells 2, 6, and 10).
- Members of informal producers' cooperatives (cell 8). Self-employed individuals who work in a cooperative that produces goods or services, where all members participate equally in decision-making regarding production, operations, investments, and profit distribution. (Fifteenth International Conference of Labor Statisticians, 1993)
- Own-account workers producing goods exclusively for their own household's final use (cell 9).

The employment-based definition of informal markets as has been mentioned has expanded the initial definition of enterprise-based definition with various types of employment. The definition thereof has helped regulators in understanding the complexity of the matter further on. However, enterprise-based as well as employment-based definitions were widely used by scholars in researching informal markets in developing countries. Meanwhile definition for advanced economies as well as post-socialist economies required an even more expanded framework. Mainly because the frameworks viewed an enterprise as either formal or informal. While reality includes cases when an enterprise could be considered as both – formal and informal. For this purpose, the activity-based definition has been introduced.

1.2.1.3 Investigation of Activity-Based Definition of Informal Markets

As has been mentioned, the enterprise-based and employment-based definitions include assumptions and limitations that restrain the definition application to reality. In response to this issue, the activity-based definition has been introduced.

Under this framework, informal economies may be defined as economic activities that do not fall under the scope of formal regulations. In addition, economic activities have interactions between each other that have an effect on overall participation in one or another activity. Thus, the relationship between those activities should also be scrutinized and evaluated for the purpose of the research.

Portes & Haller (2005) classify economic activities into three main sectors: formal, informal, and criminal. Below provided table provides a visual representation of the economic activities in question and their lawfulness (licit) and unlawfulness (illicit) in respect to processes as well as output.

Table 3

Classification of Economic Activities

Type of Economy	Production and Distribution (Process)	Final Product (Outcome)
Formal	Licit	Licit
Informal	Illicit (in terms of regulation)	Licit
Criminal	Illicit	Illicit

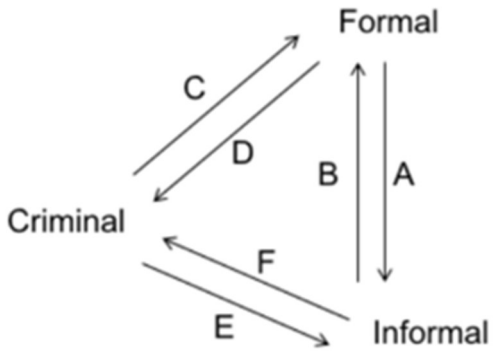
Source: (Portes & Haller, 2005)

When it comes to formal economies, the processes and outcomes are both legal. This means that firms provide licit products or services (not product that are illicit such as drugs) while complying with all required regulations (not evading taxes, performing accurate accounting and providing complete financial statements as well as any other reports to the regulator). Informal economies slightly differ from the before mentioned formal economy. Firms under this economy may evade taxes or may deviate from complying with regulations, while producing legal goods or services (the output). Small businesses or self-employed people are usually the ones called informal. And lastly, criminal economic activities include both illicit processes (evading taxes, not complying with regulations) as well as illegal production (e.g. drug trafficking, smuggling, organized crime

The framework further investigates the complexity of the relationships between the mentioned economic activities. The following figure illustrates these interactions, capturing the ways in which formal, informal, and criminal economies are interconnected. Additionally, Table 4 provides a more comprehensive breakdown of these relationships, offering a detailed analysis that complements the overview presented in Figure 1.

Figure 1

Types of Economic Activity, Definitions and Relationships



Source: (Portes & Haller, 2005)

This diagram, adapted from Portes and Castells (1989), presents a typology of economic activity by distinguishing between formal, informal, and criminal economies, along with the interrelationships between them. These arrows represent the flows and interactions between the formal, informal, and criminal economies:

Table 4

Explanations of Types of Economic Activity and Relationships Between Them

Arrow	Description
A (Formal → Informal):	Small enterprises and self-employed workers are pushed to shift to informal economic activities due to regulatory interference and high costs of it as well as big competition from large companies.
B (Informal → Formal):	As informal economic activities are usually focused on lowering costs, they are able to provide formal markets with cheap labor and goods. For example, garment industry subcontracting.
C (Formal → Criminal):	Formal firms may aim at evading taxes and by entering illicit products such as illegal lobbying, collusion.
D (Criminal → Formal):	Criminally acting economic entities may enter into money laundering or have an influence over formal and regulatory institutions.
E (Criminal → Informal):	Criminally acting entities may pursue informal markets for cheap labor and products as formal markets and exploit the marginal workers for their benefit.
F (Informal → Criminal):	Entities acting in informal activities may face exclusion and injustice or protection which may lead them to shif to criminal economic activities.

Source: (Portes & Haller, 2005)

The reviewed framework is crucial for understanding the different economic activities and their interactions between each other. This is important for policymakers as regulation in areas with informal markets spread may be difficult due to difficulties in understanding the flow of goods, labor and capital.

In summary, the Portes & Haller (2005) framework reveal that all economic activities (formal, informal and criminal) are intertwined and there are no clear boundaries between them. These blur boundaries create difficulties for policy makers as intervention in one economy could result in a reverse result in another deepening the informality in the region. Thus, effective governance requires a deep understanding of the nuances of the relationship between them. However, the framework provides a more comprehensive view on the informal markets definition which is raised for further expansion in the future.

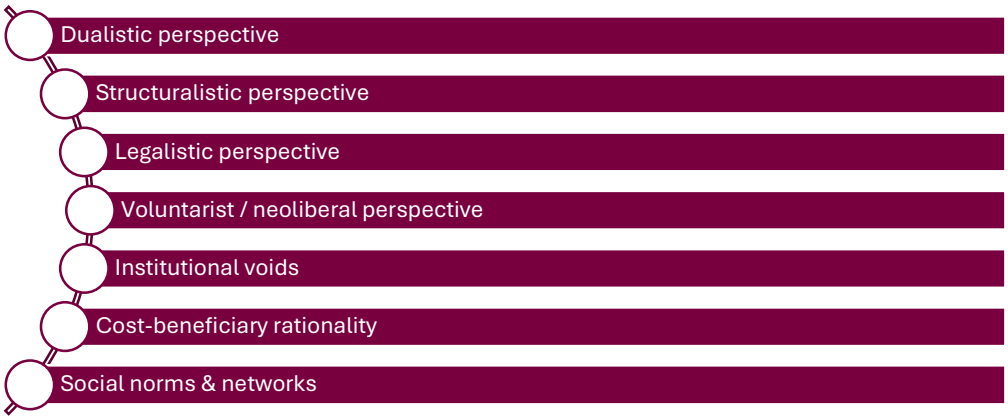
Overall, the informal markets definition has been proven to be a complex matter due to various views on the matter as well as connections between differently defined activities and employment. Enterprise-based definition has a simple approach of defining a unit as a formal or informal based on their size and production. Employment-based definition expands the definition by focusing more on the people involved in formal or informal activities rather than production units. Lastly, the activity-based approach has expanded further to define the informal market based on the activities one is performing without putting a label on a unit as either legal or illegal (accounting for the fact that it could be both). In practice, reality often diverges from these definitions. While existing frameworks seem to be comprehensive, there is a growing need for more advanced models to better explain the informal markets landscape.

1.2.2 Why Informal Markets Persist: A Comprehensive Theoretical Overview

The informal economy has been the subject of extensive theoretical and empirical inquiry. Various schools of thought (e.g. dualistic perspective, structuralist perspective, legalistic perspective, voluntaristic) provide different explanations for why informal markets exist and persist across diverse contexts. These explanations differ in their assumptions about the nature of economic agents, the role of institutions, and the structural features of the economy. Below is a synthesis of the main perspectives.

Figure 2

A roadmap of Literature on Informality Perspectives



Source: see detailed below

1. Dualistic perspective. Rooted in the work of Lewis (1954), the dualistic perspective posits that the informal sector emerges due to the formal economy's inability to absorb all available labor. It treats the informal economy as a residual and transitional segment, populated by surplus labor migrating from low-productivity sectors like agriculture. The assumption is that as economic development progresses, formal employment will expand, and informality will shrink. This view has been heavily criticized for underestimating the persistence and adaptability of informal markets.
2. The structuralist perspective, advanced by scholars such as Portes and Castells and recently summarized by Dell'Anno (2021), argues that informal markets are not autonomous but are structurally connected to the formal economy. Informal labor and production often support formal firms through subcontracting, outsourcing, and flexible labor arrangements. This integration allows formal enterprises to reduce production costs and transfer risks to informal actors. While this approach reveals important power asymmetries, it may underplay the agency and heterogeneity of informal actors, some of whom may operate independently or competitively rather than as dependents of formal firms.
3. Legalist perspective. Popularized by De Soto (2003) the legalist approach views informal entrepreneurship as a rational response to excessive regulation, complex bureaucracy, and high entry costs. According to this view, informal entrepreneurs do not lack the will or ability to formalize but are deterred by burdensome institutional barriers. Critics argue that this theory assumes that informality is entirely voluntary and overlooks structural constraints such as poverty, social exclusion, and lack of

access to capital or education. It also may neglect the role of power asymmetries in regulatory design.

4. Voluntarist / neoliberal perspective. This perspective, supported by scholars like Maloney (2004), posits that many informal workers and firms are "micro-capitalists" who deliberately avoid formalization to increase profits and maintain autonomy. From this standpoint, informality is not a response to exclusion, but a calculated economic choice based on perceived benefits of operating outside state regulation. This view may overstate the degree of choice available to informal actors and downplay constraints such as discrimination, lack of credit, or education. It also risks legitimizing a system that often lacks social protection and enforces inequality.
5. Institutional Voids. Porta & Shleifer (2008) emphasize the role of weak institutions, including the rule of law, contract enforcement, and state capacity. In this view, informality thrives where institutional frameworks are ineffective or absent, creating an environment in which formal engagement becomes difficult or unattractive. While institutional quality is undeniably important, this explanation may not fully capture the social and cultural embeddedness of informality, or the active strategies people use to navigate institutional landscapes.
6. Cost-Benefit Rationality: Proposed by scholars like Tokman (2007), this approach frames informality as a cost-minimizing strategy. Firms operate informally to evade taxes, labor laws, and regulatory compliance, especially when enforcement is low and penalties are minimal. While useful in modeling behavior, this approach can reduce informality to narrow economic reasoning, ignoring broader socio-political and historical factors, such as systemic exclusion or informal institutions.
7. Social Norms & Networks: This sociological perspective highlights the importance of cultural norms, kinship ties, ethnicity, and trust-based networks in shaping informal economic activity. Informal markets may function based on reciprocity, reputation, and community enforcement, offering advantages in environments where formal mechanisms are absent or untrusted. While this perspective captures important local dynamics, it may lack generalizability and make it harder to design scalable policy interventions. It also sometimes romanticizes informal systems that may reproduce inequality or exploitation. (Lejano & Fernandez de Castro, 2013; Peng, 2010)

Each of these perspectives shed light on different dimensions of informality—economic, institutional, and sociocultural. However, no one fully explains the multifaceted reality of informal markets. A comprehensive understanding requires an interdisciplinary approach that recognizes

informality as a product of individual agency, institutional environments, and structural economic conditions. It is precisely this complexity that makes policy design in this area so challenging—and so important.

1.2.3 Determinants of Informality: Economic Pressures, Institutional Weaknesses and Social Norms

Understanding informality often requires to first understand its determinants. Thus, this section shall dive into complexities of informal market persistence and arising determinants argued by various studies focusing on such factors as economic pressure and unemployment, weak formal sector and social norms.

Firstly, economic pressures and unemployment should be mentioned. Increased unemployment increases poverty, which is a key driver of informal work. The people are nudged to informal working in order to survive. Esaku & Mugoda (2025) support this theory as their research has revealed a positive and statistically significant correlation between unemployment and informality.

Second, weak formal sectors or institutions. Institutions and state role in economic development of a country is a driving force of economic growth (Acemoglu, 2007; Acemoglu & Robinson, 2008). Thus, with low formal sector and regulation or inefficient one, the labor market is not supervised, and people get laid off. Corruption, lack of transparency, fraudulent judicial systems discourage people from staying in formal sectors (Valdiglesias, 2025). However, overly adopted and complicated bureaucracy can also harm informality as people become overwhelmed. Empirical research supports these observations. Research by Lambrecht et al. (2012) analyzes the relationship between the quality of legislation and irregular employment in Italy, finding that improved regulatory quality can reduce the size of the informal economy. Similar conclusions have been drawn by Barra & Papaccio (2024). In addition, Sultana, Rahman, & Murad (2024) have found that in developing countries, the informal market‘s expansion is often related to institutional weaknesses.

In many societies, informal economic activities are deeply embedded in social norms and networks. Trust-based relationships, kinship ties, and community enforcement mechanisms facilitate transactions without formal contracts, especially in contexts where formal institutions are absent or unreliable. Research by Zaghmout (2024) explores how trust, relational capital, and social norms sustain the effectiveness of informal business networks across various sectors in emerging economies. The study suggests that policymakers should recognize the value of informal

networks and consider integrating them into formal economic frameworks to enhance their effectiveness and sustainability.

In conclusion, the informal sector is influenced by a combination of various factors such as economic situation, social norms and formal sectors and regulations. Empirical evidence has shown that the theories of correlation exist. Nevertheless, apart from the determinants mentioned of informality, the shadow economy is also influenced by gender norms. Please see a more detailed review of the topic in the next section.

1.2.4 Measuring the Informal Economy: Direct and Indirect Methodologies

As the previous section shows, there are no universally accepted definitions of the informal sector. Similarly, there are no universal quantifiable methods for determining the relative size of its impact that are universally acceptable and used for all cases. Please see a review of different methos below.

The Fifteenth International Conference of Labour Statisticians (1993) outlines the direct methods of measuring the informal sector:

- Household Surveys: Collect data from individuals in households to capture employment in the informal sector, including demographics, job conditions, and secondary work.
- Establishment Surveys: Target informal businesses directly to gather information on business structure, operations, and income generation.
- Mixed Household-Enterprise Surveys: Combine household and enterprise surveys—first identifying informal businesses through households, then collecting detailed enterprise data.

In some cases, direct surveys are not available for estimating informal markets. Thus, indirect estimation and data triangulation from various sources are used. Please find some listed below.

Table 5

List of Indirect Methods for Estimating Informal Markets

Method	Description	Sources
Currency Demand Approach	This method estimates the size of the informal economy by analyzing the demand for cash, under the assumption that informal transactions are predominantly cash-based	(Atanasijević, Danon, Lužanin, & Kovačević, 2022; Awad & Alazzeh, 2020; Cichocki & Torój, 2023)

Method	Description	Sources
Electricity Consumption Method	This method estimates the size of the informal economy by comparing electricity use with official GDP data. The idea is that electricity powers both formal and informal economic activities, so if electricity consumption grows faster than reported GDP, the difference may point to unrecorded (informal) economic activity.	(Dramani, Frimpong, & Ofori-Mensah, 2022; Postea, Noja, & Achim, 2023)
Multiple Indicators Multiple Causes (MIMIC) Model.	The MIMIC model treats the informal economy as a latent variable influenced by observable causes and reflected in observable indicators, allowing for estimation through structural equation modeling. Observable indicators vary among studies, however common ones are high usage of cash, low labor force participation in official statistics, gaps between electricity usage and GDP, low reported income relative to consumption	(Abu Alfoul, Mishal, Schneider, Magableh, & Alabdulraheem, 2022; Asilan, Dell'Anno, & Schneider, 2024; Dell'Anno, 2022).
Discrepancies Methods	These methods estimate the informal economy by identifying inconsistencies in national accounts, such as differences between income and expenditure or labor force statistics	(Chekenya, 2016)

Source: see the table above

All in all, it may be seen that the informal sector measurement is a complex and widely discussed issue. There are direct as well as indirect methods. Direct methods, however, are rarely used due to a lack of data availability. Alternatively, indirect methods are used that vary depending on the study subject and available data.

1.3 Women Leadership and Informal Markets: Exploring the Relationship Between Gender Representation and Shadow Economies

Informal sector remains one of the most critical components of various economies worldwide (Charmes, 2012; Elgin & Erturk, 2019). Traditionally, scholars argued that the informal sector has been shaped by economic crises, regulatory structures and institutional weaknesses. However, recent studies have drawn attention to the gender dimensions of informality. Particularly, overrepresentation of women in informal markets driven by social norms as well as limitations of access to formal employment. This section shall scrutinize research on traditional thoughts as well as digging deeper into modern thoughts on gender and informal economic relationships.

As far as traditional thoughts are concerned, Gërxzhani & Cichocki (2023) have found that formal and informal institutions go hand in hand and are integral part of each other. Some studies have shown that informal sector is greatly influenced by global crisis, economic downturns,

restructurings in economy, political openness etc. (Blanton et al., 2018; Cling et al., 2010; Mehrotra, 2009; Siggel, 2010; Teobaldelli & Schneider, 2013; Verick, 2006). Meanwhile, Sultana, Rahman, & Khanam (2022) have found that informal sector has a detrimental relationship with sustainability. The most influential factors on the shadow economy and/or shadow labor force are tax policies and state regulation, which, if they rise, increase both (Schneider, 2011). Meanwhile, Buszko (2018) notes that cultural dimensions of masculinity and femininity also have an impact. The research has found that there is a positive correlation between masculinity vs. femininity and shadow economy.

According to International Labour Organization (ILO) (2018) participation in informal markets is usually not by choice but rather by a consequence of lack of opportunities in the formal markets. Kabeer, Milward, & Sudarshan (2013) has highlighted how women are impacted by the fear of employers, communities, men. Majority of research has found that women are more inclined to work in the informal sector then men, as it offers greater flexibility towards balancing work and personal life and has less barriers to enter (Chant & Pedwell, 2008; Daymard, 2015; Fapohunda, 2012; Goel & Saunoris, 2017; Verheul, Ingrid and Van Stel, André and Thurik, 2004)

The relationship between women in informal markets have been researched from several points. DiRienzo & Das (2021) have found that there is a significant inverse relationship between the size of the informal sector and the prevalence of formal sector female entrepreneurship. Furthermore, Njoya, Ngouhouo, & Ewane (2022) have found that corruption and thus underground economy, is decreased by enhancing women‘s access to freedom of domestic movement, the right to property, non-labor force and justice.

As may be seen, a greater involvement of women in management positions as well as in politics have an adverse influence on the informal market. However, the posed research solely focusses on the outdated data without considering events and new regulations proposed in recent years. The European Union has recently introduced a directive aiming at gender equality which is not considered in none of the mentioned studies.

Starting from these premises, the research aims at understanding the relationship between women’s participation in management (specifically in the Board of Directors) and informal markets as well as determining whether the European Union’s gender quota regulations implementation had any effect on women’s participation in informal markets. Specifically, the research aim is operationalized in the following research question: Does change in women’s participation in management lead to increased or decreased participation of women in informal markets and does the government policies effect the informal market participation.

The research results may support policymakers from several perspectives. Firstly, the evidence-based research allows policymakers to arise with data-based interventions in combating

informal markets. Furthermore, the relationship analysis allows us to develop more informed gender equality policies as well as evaluate currently effective ones. Insights from the paper may provide evidence for encouraging further corporate gender diversity.

2. METHODOLOGY FRAMEWORK FOR ASSESSING GENDER-QUOTA IMPACTS

Based on the previous literature review, this section describes the research hypothesis, data and methods. To achieve the previously stated research objective,this research focuses on whether gender quota policies have a significant impact on informal employment of females. The chapter first described the hypothesis and it then continues by identifying regression model selection for obtaining preliminary view of the relationship with several layers. From a methodological perspective, given that institutional policies targeting gender-quota regulations were introduced in EU countries, the study further expands in applying Difference-in-Differences estimators to obtain unbiased dynamic treatment effects on informal market of females. Finally, the chapter describes the diagnostic and robustness tests for validity and stability of the results.

2.1 Research Hypothesis and Data Description

Literature analysis has shown that greater women participation in management positions have a declining trend towards the informal markets. The reasons for this relationship have been scrutinized to be social pressure, lack of opportunities, limitations of freedom etc. However, the posed researches have analyzed outdated data which does not account for recent institutional policies. Namely, none of the researchers have addressed the European Union's gender quota regulations on women in management boards. The research contributes to a deeper understanding of how institutional efforts to close gender gaps have an influence over informal markets size.

Research question: Does change in women's participation in management lead to increased or decreased participation of women in informal markets following the introduction of gender-gap-addressing institutional frameworks?

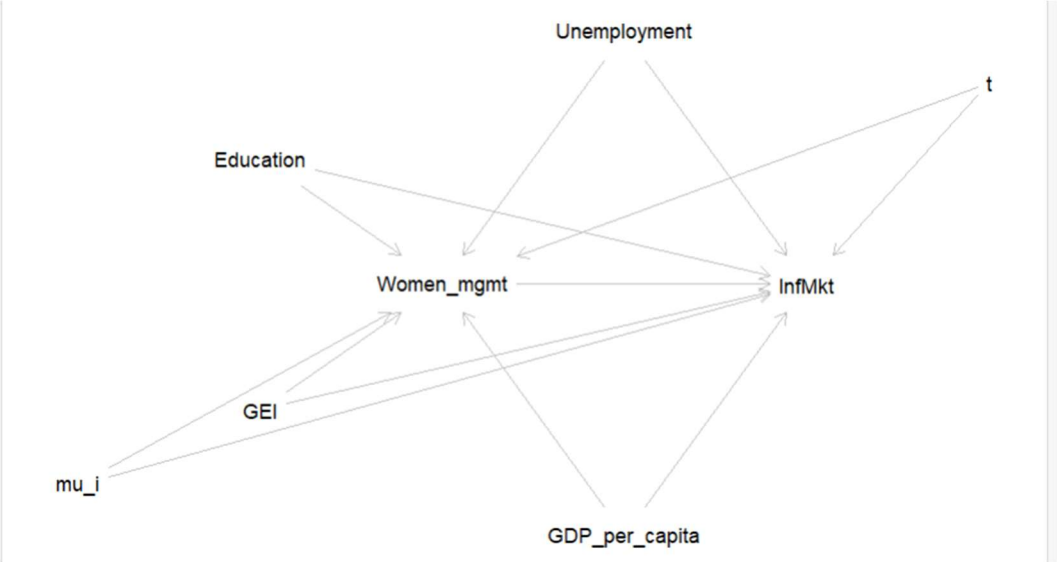
Hypothesis: Women's participation in management has a negative and statistically significant effect on informal markets size

Null hypothesis: There is no statistically significant relationship between women's participation in management and informal market size.

Below provided Figure 3 provides a graphical representation of the connections between the dependent and independent variables of this research as well as confounders that have an effect on both of the variables.

Figure 3

Direct Acyclic Graph (DAG) of Causal Relationships Between Variables



Source: Compiled by author

Figure 3 indicates that both the proportion of women in management positions (Women_mgmt) and informal market size of females (Informal_female) are jointly influenced by education level (Education), unemployment level (Unemployment), gender equality level (GEI - gender equality index) and economic development (GDP_per_capita). In addition, both variables also are believed to be affected by country-specific unobserved factors (mu_i) and common time shocks (t). These variables act as confounders because they influence both the dependent and independent variables. Please see Table 6 for causal links between the variables.

Table 6

Causal Links Between Variables and Their Underlying Rationale

Arrow	Reason
Women_mgmt → InflMkt	(Main effect of the research) Women in managerial positions are believed to have an effect on informal markets involvement of females
Education → Women_mgmt	Higher education levels increase societal acceptance of women in leadership as well as skill set
Education → InflMkt	As education increases, the informal markets are believed to be reduced as more formal job opportunities arise
Unemployment → Women_mgmt	Job scarcity hurts women's advancement by restricting opportunities in promotions or job attainments
Unemployment → InflMkt	Workers/firms shift to informal sector as unemployment rises
GEI → Women_mgmt	Equality reduces bias and barriers for women to be in leadership roles

Arrow	Reason
GEI → InflMkt	Gender-equal societies have better labor protections, better childcare and parental leave policies, thus gender policies have an impact on informal markets involvement of women.
GDPpc → Women_mgmt	Developed markets have richer job opportunities, more managerial roles.
GDPpc → InflMkt	As income per capita increases, the regulatory framework advances and informality reduces

Source: Author's elaboration

Having identified the causal links between the variables please find an overview of the dataset, the structure of treatment and control groups and the variables used in the empirical analysis.

Table 7 below indicates the general list of information regarding the data used in the research. For clarity, the information of treatment years for each treated country are included in Annex 1. Treatment and Control Classification of Countries with Placebo Treatment Years. As shown below, the study employs panel dataset covering 27 EU member states over the period of 2007-2024. The sample includes treated and untreated countries enabling the application of models designed for evaluating effect of an event. Treated countries are those implementing gender-quota or gender-equality board regulations Control countries are those that have not (or not yet) implemented regulations.

Table 7

General Information on Dataset Used for Research

Treated countries	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain
Control countries	Bulgaria, Croatia, Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Luxembourg, Malta, Poland, Romania, Slovakia, Slovenia, Sweden
Time period	2007-2024

Source: Author's elaboration

Table 8 summarizes all variables of the empirical study, including their acronyms, proxies, definitions and sources. The review provides a deeper understanding of the variables as well as their proxies and databases they have been extracted from.

Table 8

Description of the Variables' Proxies that Shall Be Used in Research

Acronym	Proxy	Source	Description
Informal_female	Informal employment rate by sex (%)	(International Labour Organization(ILO), n.d.)	Informal market size will be proxied by Informal Employment Rate by Sex in cooperation with the International Labor Organization. The rate is the percentage of all employed persons who work in informal jobs, mainly people who work in their own informal business, produce goods for their household's use, work as unpaid family helpers, hold jobs without formal arrangements.
Women_mgmt	Women and men in decision-making	(European Institute of Gender Inequality, n.d.-b)	Women in management will be proxied with the European Institute for Gender Equality Gender Statistics Database numbers on women and men in key decision-making positions. Data includes the European Union countries and other countries including Bosnia and Herzegovina, Montenegro, North Macedonia, Albania, Serbia, Türkiye, Kosovo, Iceland, Liechtenstein and Norway. The numbers include various sectors of management including but not limited to politics, public administration, media, science and research, sports, business and finance. The focus will be towards business sector.
Unemployment	Unemployment rate	(International Labour Organization ILOSTAT, n.d.)	The unemployment rate is the share of persons who are unemployed as a percentage of the labour force. A person is unemployed if not working during the reference period, available to start working and actively looking for a job. The labour fource is the sum of employed and unemployed persons.
GEI	Gender Equality Index	(European Institute of Gender Inequality, n.d.-a)	Gender Equality Index measures the level of gender equality calculated on core six domains: work (participation, segregation), money (earnings), knowledge (education), time (unpaid work, social activities), power (representation in decision-making) and health (access, status).
GDP_per_capita	Real Gross Domestic Product per capita	(Ec.eurostat, n.d.-b)	The indicator is calculated as real GDP (accounted for infliation) divided by population with GDP reported in millions and population in thousands. Real GDP represents the total value of final goods and services produced within an economy.
Education	Education level	(Ec.eurostat, n.d.-a)	The indicator measures the share of the population aged 25-34 who have successfully completed tertiary studies (e.g. university, higher technical institution, etc.)

Source: Author's elaboration

As the causal effects and the variables of the empirical study have been discussed, Figure 4 provides a general view of the research plan indicating the models used for analysing the causal effects between informal employment of females and women in managerial positions.

Figure 4

The Research Flow Regarding the Relationship Between Informal Markets and Women in Managerial Positions

Source: Author's elaboration

Please follow further sections for more details on the research flow.

2.2 Descriptive Statistics and Preliminary Data Analysis Methodology Overview

Descriptive statistics measurements are reported in Table 9. The measurements could be grouped into two groups. First one being measurement of central tendency which is represented with mean and median. Second one is measurement of dispersion and variation measured with minimum, maximum values, quartile range and standard deviation. In addition, these measurements include correlation matrix and time-series analysis which allow us to assess initial patterns as well as any trends in variables or seasonality.

Table 9

Summary of Statistical Measurements and Definitions

Measurement	Definition
Mean, Median	Mean may be indicated as the average value of a set of data. It is calculated by summing all observations and dividing them by the number of observations (Casella & Berger, 2001; Mishra et al., 2019) Meanwhile, median is also a central tendency measurement. However, it is defined as the middle point of data if the data points are arranged in an increasing or decreasing manner (Mishra et al., 2019)
Minimum, Maximum	Respectively, the minimum value is the 0 percentile, and the maximum value indicates the 100 percentile. Meanwhile, the 5^{th} and 95^{th} percentiles indicate the values left below 5 % and 95 % of the data (Tukey, 1977)
Quartile range	The figure indicates the difference between the first and third quartiles. The indicator thus shows the values of 50 % of the data (Tukey, 1977)

Measurement	Definition
Standard deviation	The figure indicates how distributed are the observations around the mean of the observations (Shi et al., 2018)
Correlation matrix	The correlation matrix is a table of correlation coefficients between variables. The correlation coefficients vary from -1 (perfect negative correlation) to +1 (perfect positive correlation). The coefficient identifies the strength and direction of the linear association between two variables. The correlation matrix is commonly used to assess multicollinearity, explore preliminary association before causal modeling and serves as diagnostic step in empirical studies (Berman, 2016; Hearon, 2025). The correlation matrix shall be performed for the dependent and independent variables only as an initial association analysis.
Time-series analysis	Time-series analysis examines how variables evolve over time and helps to identify patterns such as seasonality, trends, structural breaks (crises) etc. (Enders, 2014)

Source: (Berman, 2016; Casella & Berger, 2001; Enders, 2014; Hearon, 2025; Mishra et al., 2019; Shi et al., 2018; Tukey, 1977)

This chapter has outlined the principal descriptive statistical measured to be used in the analysis of structure and behavior of the data. The measures guide initial diagnostic assessments and support a deeper understanding of the data trends. Establishing these measures provides clarity and ensures transparency of the empirical analysis.

2.3 Ordinary Least Square Regression Models for Evaluating Effects Between Women in Management Positions and Informal Female Markets

The main purpose of this empirical study is to understand the relationship between informal markets and women in management (i.e. in the boards of directors) after institutional policies addressing gender gap issues. The analysis shall be based on balanced panel data covering European Union countries over time. Thus, this chapter shall describe the empirical approach to be used to examine the relationship using Ordinary Least Squares regression.

The research shall use regression analysis to evaluate the effect the change in women participation in management positions had on informal markets size. The selection of OLS regression analysis is based on theoretical relevance as well as prior practices of using the method evaluating gender, management and informal market outcomes. Firstly, OLS is one of the most popular methods in evaluating relationships between dependent and independent variables. In this study, it allows to examine the relationship between female leadership and informal market indicators, after controlling for gender quotas regulations. Additionally, from theoretical standpoint, OLS regression aligns with prior research performed on labor, gender, economic developments etc. (Profeta, 2020). The primary analytical method used will be Ordinary Least

Squares (OLS) regression model, where the dependent variable is informal market size and independent variable is women in management.

Countries differ systematically in cultural norms, institutional arrangements, historical gender equality norms, economic development, labor market conditions etc. In addition, global shocks have an effect on countries simultaneously. In addition, there are other socio-economic confounding elements (such as eduction, economic development, gender equality factors and unemployment) that have effect on informal markets of females and women in managerial positions which should also be accounted for in the model (please see Figure 3 for more details). Ignoring the factors mentioned could lead to biasing results.

For diagnostics testing, Hausman test will be performed. The test provides additional support for choosing between fixed-effects (FE) and random-effects (RE) models. The Hausman test assesses whether unobserved country-specific characteristics are correlated with the explanatory variables. If correlation exists, RE becomes inconsistent and FE is preferred. However, even when the Hausman test suggests RE could be valid, FE is often theoretically more appropriate in cross-country research. FE controls for differences between countries reducing omitted-variable bias and ensures the model focuses on within-country variation (Cameron & Trivedi, 2005; Hausman, 1978). Thus, the Hausman test shall be run for transparency, however, FE model has been chosen to be included in the study as a safer option.

To address the above-mentioned issues, four regression specifications are estimated, progressively incorporating layers of controls. Table 10 provides the summary of all models estimated.

Table 10

Summary of OLS Models Specifications

OLS #	Fixed effects	Additional controls
OLS 1	-	-
OLS 2	included	-
OLS 3	-	included
OLS 4	included	included

Source: Compiled by author

First of all, Ordinary Least Squares (OLS) without fixed effects is run. Capturing simple cross-country correlations without any controls. Secondly, OLS with country and year fixed effects is estimated. The model removes all country specific factors as well as common shocks. This isolates within-country variation over time providing more accurate estimates of the relationship in question. Thirdly, OLS with socio-economic controls is estimated. The model includes unemployment, gender equality, education and economic development proxies. Lastly,

OLS with fixed effects and controls accounts for observed socio-economic conditions, time-variant unobserved heterogeneity and global shocks.

The progression from simple OLS to more inclusive OLS models enables systematic evaluation of how the relationship changes upon inclusion of country-specific and time-specific confounders.

OLS 1 $$InfMkt_{i,t} = \beta_0 + \beta_1 WomenMgmt_{i,t} + \varepsilon_{i,t} \quad \{1\}$$

OLS 2 $$InfMkt_{i,t} = \beta_0 + \beta_1 WomenMgmt_{i,t} + \propto_i + \lambda_i + \varepsilon_{i,t} \quad \{2\}$$

OLS 3 $$InfMkt_{i,t} = \beta_0 + \mu_i + \beta_1 WomenMgmt_{i,t} + \gamma_1 X_{i,t} + \varepsilon_{i,t} \quad \{3\}$$

OLS 4 $$InfMkt_{i,t} = \beta_0 + \mu_i + \beta_1 WomenMgmt_{i,t} + \gamma_1 X_{i,t} + \propto_i + \lambda_i + \varepsilon_{i,t} \quad \{4\}$$

Where:

$InfMkt_{i,t}$ – informal market size

$WomenMgmt_{i,t}$ – Women in management

β_0 - grand intercept

β_1 - the coefficients of the independent variables

$\propto_i$ – unobserved country-specific heterogeneity

λ_i – year shocks common to all countries

$X_{i,t}$ – confounders including Unemployment, GEI, GDP_per_capita, Education

$\varepsilon_{i,t}$ – error term

i – geographical unit

t - period.

Robustness check shall be conducted as well to assess whether the findings are sensitive to specific features of the data. The leave-one-country-out (LOCO) method shall be used which evaluated whether the results of estimation are dependent on one individual country. The test is crucial as countries differ in size, dat quality, policy environments, labor market structures which potentially could have significant influence on results. By re-estimating model repeatedly with excluding one country, LOCO verifies that no single case drives the observed relationship. This supports the credibility and stability of the received results (Crump, Gospodinov, & Lopez, 2025; Lu & Su, 2019).

In summary, the methodology includes four progressive OLS models with diagnostic and robustness procedures to provide credible assessment of the relationship between female informal

employment and women in managerial positions. The use of fixed effects addresses the unobserved cross-country differences while socio-economic controls limit potential confounding influences. The Hausman test supports the choice of estimator, and the leave-one-country-out check ensures that results are robust. Together, these elements create a solid foundation for the initial empirical analysis.

2.4 Staggered Difference-in-Differences (DiD) for Evaluating Gender Equality Policy Impact

Having in mind that the institutional policies introducing gender-quota have been introduced in European Union, the treatment effect of such policies should be examined. OLS does not examine the treatment effect, thus Difference-in-Differences methods are further undertaken for the task.

Difference-in-Differences (DiD) is one of the common and oldest research designs. The models such as two-way fixed effects (TWFE) estimations show the difference between the change in outcomes before and after treatment for treated and untreated units. Despite it's popularity, the method has been criticized heavily in recent years for producing biased and non-interpretable estimates (Callaway & Sant'Anna, 2021; Goodman-bacon, 2021; Sun & Abraham, 2021). One of the main issues identified is that the TWFE does not account for situations when treatment does not occur simultaneously for all treated units.

In response, several modern staggered DiD methods have been developed and preferred by researchers. This research should look into two of them – estimator determined by Sun & Abraham (2021) and estimator by Callaway & Sant'Anna (2021). Alternative model specifications will be tested to verify that the conclusions do not depend on specific modelling choices. Consistent results across these variations would further confirm the robustness and reliability of the estimated effects.

2.4.1 Staggered Difference-in-Differences by Sun & Abraham

Unlike traditional DiD, the Sun and Abraham estimator first estimates the treatment effect separately for each treated group in a given year. Then it combines the effects using weights to those that were never treated. This avoids mixing all units together at different times disregarding the different treatment years. The generated estimation plot allows the researchers to evaluate the parallel trends assumption ($k < 0$), while the coefficients after treatment ($k > 0$) helps asses how the treatment effect develops over time (Sun & Abraham, 2021).

For Sun & Abraham (2021) estimator to be valid, some assumptions must hold. The crucial one is parallel trends assumption. The assumption requires that in the absence of treatment, treated and untreated groups should follow the same trend. Furthermore, there should be no anticipation (the treatment should not effect outcomes before treatment year). Thirdly, there is irreversibility of treatment, i.e. once a unit is treated, it remains treated. Moreover, there should be treated and untreated groups, so comparability would be possible. Finally, treatment timing must be as-good-as-random after conditioning on unit and time fixed effects.

Formally, the estimator is expressed as event-study regression form. Please see below in equation {5}.

$$Informal\_female_{i,t} = \alpha_i + \lambda_t + \sum_{k \neq -1}^{K} \beta_{g,k} 1\{G_i = g, t - g = k\} + \gamma_1 X_{i,t} + \varepsilon_{i,t} \qquad \{5\}$$

Where:

$Informal\_female_{i,t}$ – Outcome variable

α_i - Unit fixed effects (geography, culture, economic structure)

λ_t – Time fixed effects (global recessions, pandemics, worldwide inflation)

$\beta_{g,k}$ – treatment effect based on average treatment effect (ATT) for cohort g at event time k

$\sum_{k\neq-1}^{K} \beta_{g,k} 1\{G_i = g, t - g = k\}$ – event-time indicators (Sun&Abraham), where $t - g = k$ – event time: k=0 – treatment year, k<0 pre-treatment year, k>0 post-treatment year. $G_i = g$ – treatment cohort: G_i is the first year in which unit i becomes treated. $1\{G_i = g, t - g = k\}$ – indicator variable / dummy. 1 if unit i is in cohort g and event time k, 0 otherwise.

$X_{i,t}$ – confounders including Unemployment, GEI, GDP_per_capita, Education

$\varepsilon_{i,t}$ – error term

2.4.2 Staggered Difference-in-Differences by Callaway & Sant'Anna

Callaway & Sant'Anna (2021) estimator similarly as to Sun & Abraham (2021) estimator addresses the issues of two-way fixed effects (TWFE) models that can be biased. However, this model is different from the previous model as it is design-based estimating separate group-time ATTs using never-treated units as controls and then aggregating them into overall dynamic effects. The model puts countries treated in the same year together and then compares them to untreated groups and then combine the effects.

The estimator follows similar assumptions as Sun & Abraham estimator. It requires parallel trends assumption (if the policy never happened, the treated countries and never-treated countries would have followed similar trends). The estimator also requires no anticipation (no

change before policy acceptance), irreversibility of treatment and every treated group must have comparable control units.

Firstly, the model estimates separate effect for each cohort (the year a country first becomes treated) and each post-treatment time period. The model compares each treated cohort to an appropriate control group to obtain consistent estimates.

$$ATT\ (g,t) = E\left[Informal\_female_{i,t}(1) - Informal\_female_{i,t}(0) | G_i = g\right], t \geq g \quad \{6\}$$

where:

$Informal\_female_{i,t}(1)$ – potential outcome at time t if unit I is first treated in period g,

$Informal\_female_{i,t}(0)$ – potential outcome at time t if never treated,

$G_i = g$- indicates that unit i first receives treatment in period g,

$ATT\ (g,t)$- is the average treatment effect on the treated for cohort g at time t

Further, once the cohort-specific effects ATT (g,t) are estimated, the estimator combines them to obtain an overall average treatment effect. This involves taking a weighted average across cohorts and time periods.

$$ATT = \sum_{g} \sum_{t \geq g} w_{g,t} ATT\ (g,t) \quad \{7\}$$

, where

ATT- weighted average of ATT(g,t)

$w_{g,t}$- relative size or importance of each cohort-time cell (depending on the number of countries included in the cohort)

2.4.3 Diagnostics and Robustness Tests for Difference-in-Differences Models

For diagnostics test, placebo test shall be conducted to identify whether the estimated results are driven by treatment effects or by spurious patterns of data. The test is conducted by assigning fake treatment dates to untreated units. Because no policy change occurred at the placebo time, any estimated effect should theoretically be zero. Detecting significant effects in placebo periods would indicate violations of assumptions or sensitivity to particular time periods. Placebo test therefore serves as credibility test ensuring that model does not capture any unrelated shocks, pre-existing trends or structural breaks that lead to bias results. When placebo results cluster around zero and are statistically insignificant, this strengthens the treatment effects identified in the main model (Baker, Callaway, Cunningham, Goodman-Bacon, & Sant'Anna, 2025; Dafoe, Eggers, & Tunon, 2024; Sun & Abraham, 2021).

Robustness check shall be conducted as well to assess whether the findings are sensitive to specific features of the data. The leave-one-country-out (LOCO) method shall be used which evaluated whether the results of estimation are dependent on one individual country. The test is crucial as countries differ in size, data quality, policy environments, labor market structures which potentially could have significant influence on results. By re-estimating model repeatedly with excluding one country, LOCO verifies that no single case drives the observed relationship. This supports the credibility and stability of the received results (Crump et al., 2025; Lu & Su, 2019).

To conclude, both Callaway & Sant'Anna (2021) and Sun & Abraham (2021) estimators provide credible approaches to estimating causal effects in staggered DiD. Both methods address the same issues of bias of TWFE models when treatment occurs in different times. Sun & Abraham (2021) rely on regression framework that aligns all units relative to their treatment year and estimates dynamic treatment effects across cohorts, whereas Callaway & Sant'Anna (2021) adopt design-based approach that creates separate mini-experiments for each treatment cohort and then aggregates the results. Using both methods in the study, allows the study to test the robustness of the findings: if both estimators produce similar results, confidence in the validity of the conclusions is strengthened. In addition, the study also includes placebo test which ensures that the results of the models are not driven by spurious patterns of data. For robustness, leave-one-country-out test should be conducted to ensure no individual country is driving the results on their own.

In summary, the methodology part of the research has provided a description of integrating regression models with modern causal inference techniques to assess the relationship between women's managerial representation and informal female employment. The OLS lays down the fundamental understanding of the relationship of the variables with including fixed effects as well as socio-economic controls to mitigate biases. The staggered DiD estimators of Sun & Abraham and Callaway & Sant'Anna further expands the research to assess the treatment effect of policy change of gender-quota with accounting for different treatment years of countries. Diagnostic and robustness procedures further strengthen the confidence in the findings. Together, these components constitute comprehensive and robust empirical strategy for evaluating the impact of gender-equality reforms on informal labor market outcomes.

3. EMPIRICAL FINDINGS: DESCRIPTIVE STATISTICS, OLS MODELS, AND DIFFERENCE-IN-DIFFERENCES ANALYSIS

As described in the methodology part, the empirical research should constitute descriptive statistics of the dataset used. This chapter should provide general information on the data trends, distribution and other. Further, the section explores the results of OLS regression models as well as Difference-in-Differences models with providing analysis on the diagnostic and robustness tests.

3.1 Descriptive Statistics and Time-Series Patterns Overview

This section overviews the descriptive statistics as well as graphical patterns of the key variables used in this research. The section explores trends over time for treated and non-treated countries as well. Summary tables provide general information on the distributional characteristics and relationship between the variables. While graphical figures illustrate how variables have changed over time in response to gender-quota treatment status. Together, these tools offer preliminary overview of trends as well as relationships between the variables.

Table 11

Descriptive Statistics of Key Variables of the Research

Variable	informal_female	women_mgmt	Unemployment	GEI	GDP_per_capita	Education
Mean	3.65	19.34	11.52	64.26	30,484	39.02
StdDev	3.23	10.61	5.78	8.19	20,703	10.32
Min	-	2.10	3.15	52.81	6,670	15.50
Q1	1.81	10.73	7.61	56.87	16,035	31.30
Median	2.95	17.15	10.29	62.73	23,360	40.20
Q3	4.36	26.80	13.46	71.73	42,880	45.48
Max	19.60	47.20	37.29	82.42	109,090	65.20

Source: Author's elaboration

The mean (3.65) and median (2.95) of informal_female indicate that the average share of female informal employment typically lies between 3% and 4%, with most observations clustered toward the lower end of the distribution. However, the standard deviation (3.23) and the maximum value (19.60)—which is far above the median (2.95) and the third quartile (4.36)—reveal substantial dispersion, suggesting that while many countries have low levels of female informal employment, a few exhibit markedly high levels.

For women_mgmt, the mean (19.34) is close to the median (17.15), implying a more symmetric distribution with fewer extremes. The standard deviation (10.61) still indicates

variation across countries, but the quartile values show a more balanced spread with no major outliers.

Furthermore, unemployment shows moderate variation across countries, the quartiles indicate that majority of countries are position with lower unemployment while the maximum value indicates that a few countries have slightly higher unemployment level. As for GEI, the values are relatively clustered with limited variations and no strong outliers. This implies that countries have similar gender equality indicators. GDP per capita on the other hand shows a wider dispersion of data indicating that the sample includes countries with a wide range of economic development. Lastly, education levels indicate that countries vary considering their educational level. The minimum and maximum levels show that some countries are far below or far above the regional average of education levels.

Overall, the descriptive statistics suggest substantial cross-country diversity in all variables. The informal market of females indicates the highest dispersion, with a small number of countries with high levels of informality. Women in management are more evenly distributed. The rest of the variables also reflect various degrees of dispersion. Taken together, the descriptive statistics highlight the importance of accounting for cross-country differences in empirical analysis.

Table 12

Correlation Matrix between Informal Employment of Females and Women in Management

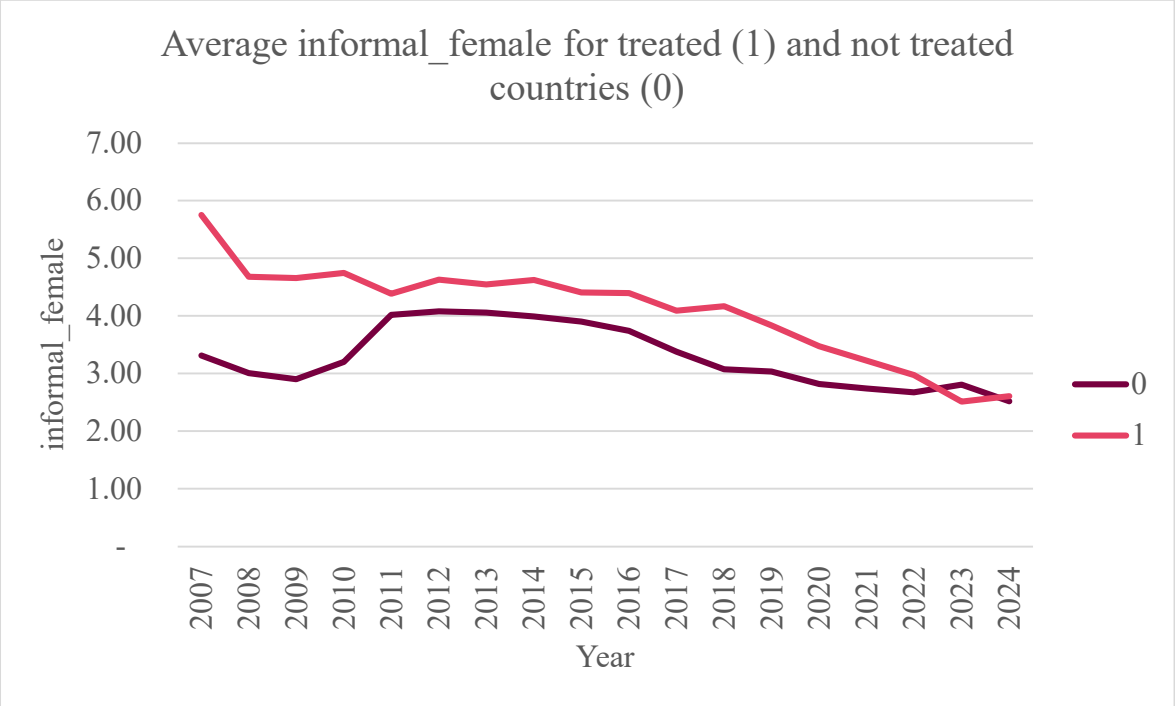
	informal_female	women_mgmt
informal_female	1.00	-0.10
women_mgmt	-0.10	1.00

Source: Compiled by author

Table 12 indicates the correlation between the two variables. The correlation of -0.10 indicates that higher levels of women in managerial positions tend to lead to be associated with lower levels of informal female employment. The correlation number however is not significant indicating that while relationship exists, it is not strong. The correlation does not imply causality but provides preliminary evidence for the inverse association that can be examined further in the work.

Figure 5

Time-Series of Average informal_female for Treated (1) and not Treated Countries (0)

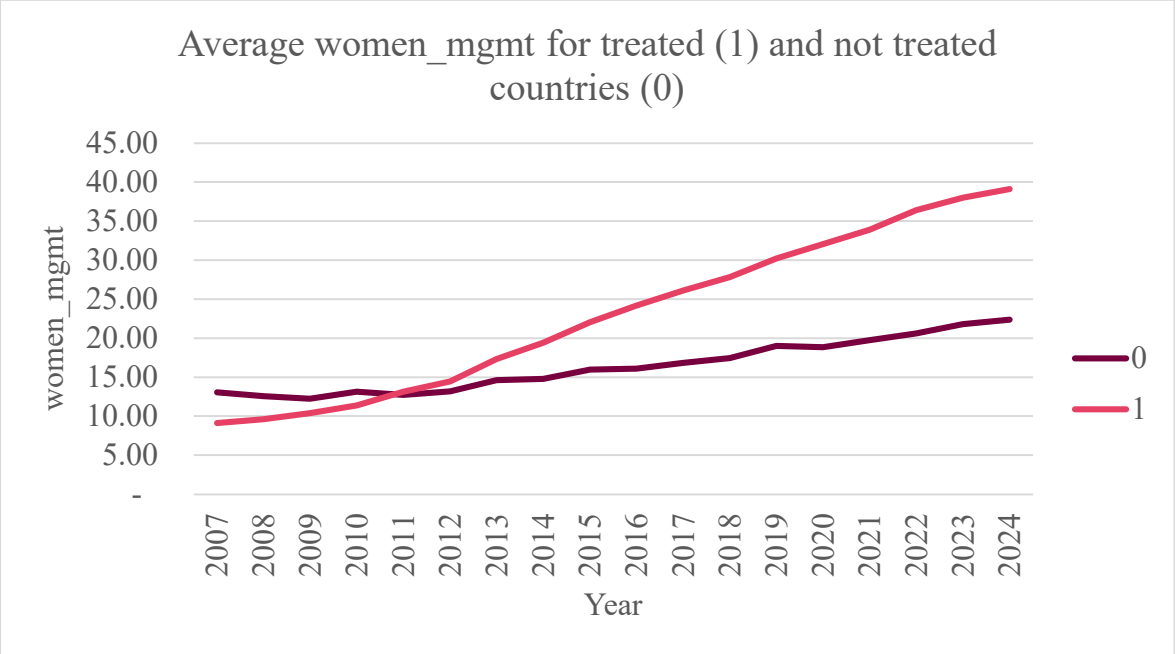


Source: Author's elaboration

Figure 5 illustrates the evolution of female informal markets from 2007 to 2024, comparing treated and not treated countries. At the beginning of the period, treated countries exhibit higher informal market of females comparing to non-treated countries. Over time, all countries face a decline in female informal employment and the two lines remain close and similar downward trend. From around 2022 the gap narrows and converges into nearly identical numbers.

Figure 6

Time-Series of Average women_mgmt for Treated (1) and not Treated Countries (0)

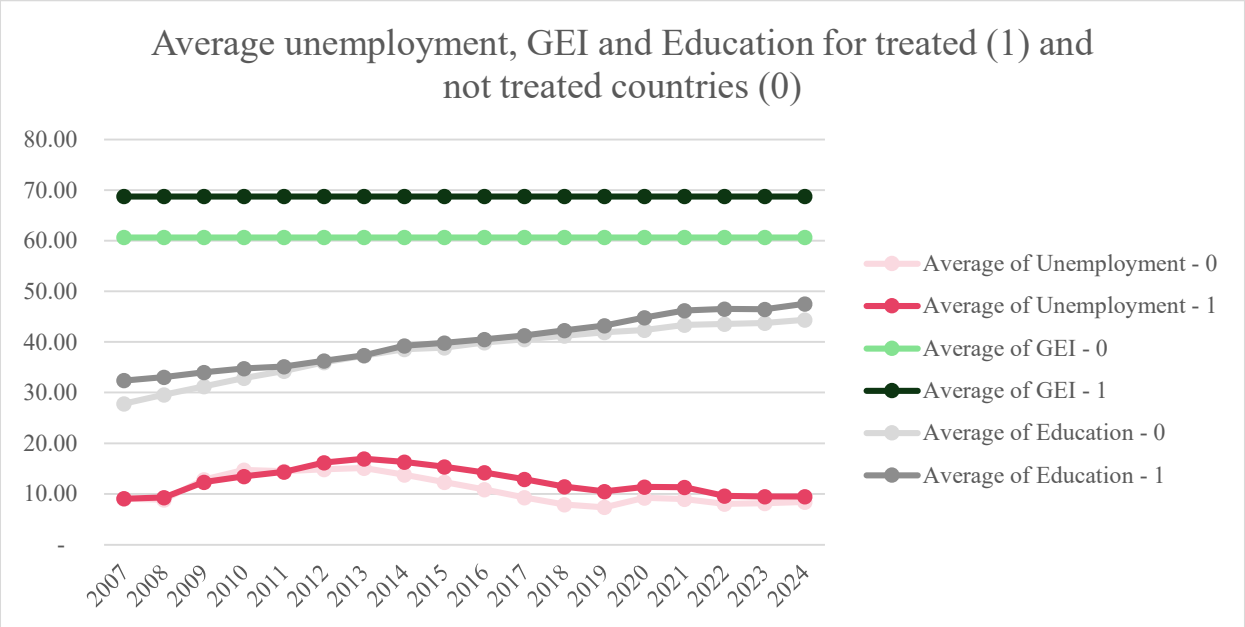


Source: Author's elaboration

Furthermore, Figure 6 visualizes women in management positions from 2007 to 2024 for treated and non-treated countries. The graph illustrates a growing trend of women representation in management positions overtime. The trends suggest that treated countries have achieved a much better results in gender equality goals with targeting women representation in managerial positions. The widening gap between the two groups implies that whatever policy or structural change defines the "treatment" may be associated with stronger improvements in gender representation in leadership positions.

Figure 7

Time-Series of Average unemployment, GEI and education for Treated (1) and not Treated Countries (0)

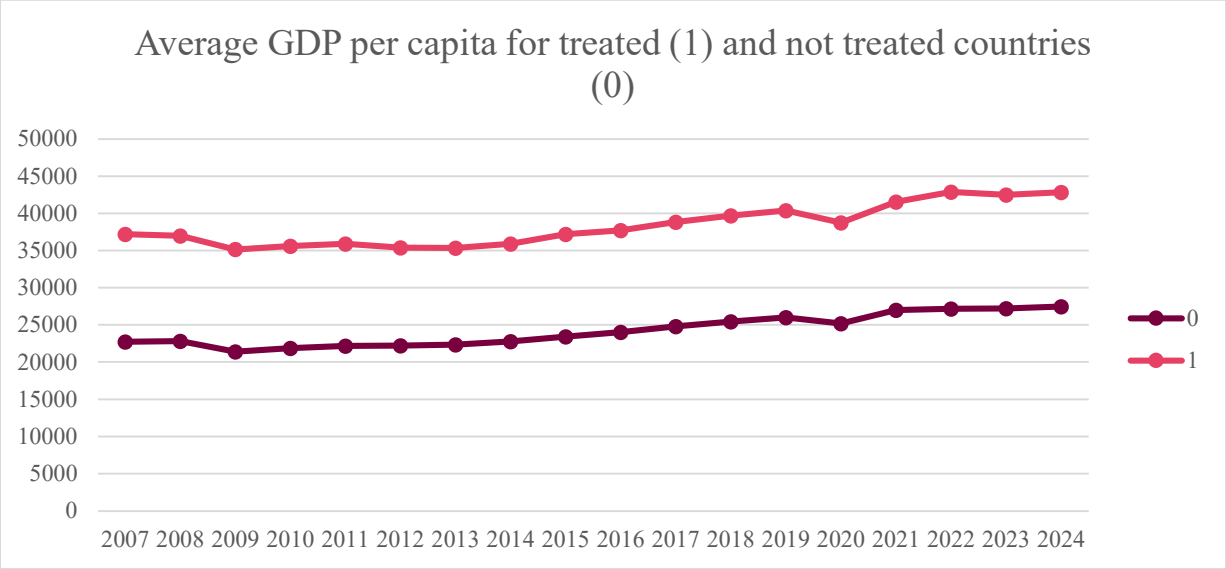


Source: Author's elaboration

Figure 7 represents the average movement of unemployment, gender equality index and education index of treated and not treated countries in the period of 2007-2024. The unemployment rate is seen to be slightly higher in the treated group however it is more volatile compared to the untreated group. This may indicate that the treated group had undergone labor-market shocks in the period of 2014-2016 which were not present for untreated countries. Furthermore, GEI shows a consistent higher number for the treated countries with no significant fluctuations. The constant gap of the index between the groups suggests that the treated countries have generally better institutional and social equality conditions even before treatment. Lastly, education indicators are seen to rise for both groups throughout the period with treated group showing a slightly steeper increase which may suggest that the treated countries have had greater investments for education.

Figure 8

Time-Series of Average GDP_per_capita for Treated (1) and not Treated Countries (0)



Source: Author's elaboration

Figure 8 further examines GDP per capita variation over time. The graph indicates a substantially higher GDP per capita for treated countries with a large gap compared to untreated countries. This indicates that treated countries are generally more economically developed. As far as growth goes, both groups show growth of GDP per capita however treated countries exhibit a steeper incline.

Taken together, the descriptive statistics provide a clear preliminary picture of the differences between treated and untreated countries through several dimensions of socio-economic, gender related as well as economic fields. The tables reveal substantial variations across countries in female informal markets, GDP per capita. The correlation matrix has also indicated slight inverse relationship between female informal markets and women in managerial positions. Further, the time-series analysis has shown that the treated countries begin the period with higher levels of female informality which normalize towards the untreated group through the period. As far as women in management go, the data shows that the treated countries start off with lower numbers however the steep incline overperforms the untreated group with creating a significant gap of women in management in 2024. The socio-economic factors further show that the treated countries are institutionally and economically advanced with higher gender equality, education levels, and income per capita. Overall, the analysis has highlighted the need for careful empirical analysis on the gender quota regulations on labor markets by having in mind the differences of the treated and non-treated group.

3.2 Ordinary Least Squares Analysis of Women's Representation in Management and Informal Labor Markets

This section explores empirical analysis of the relationship between women's representation in managerial positions and female participation in informal labor markets across Europe using Ordinary Least Squares regression model.

In panel data, the countries differ in time-variant factors (e.g. cultural norms, geography, institutional power etc.) as well as global shocks (e.g. economic crises, covid-19 etc.) have an effect on all of the countries in the same years. Ignoring these could lead to biased and misleading results (heterogeneity risk).

As a standard diagnostic check, Hausman test has been performed to compare fixed-effects and random-effects specifications in the panel data. The test did not reject the null hypothesis, indicating that the random-effects estimator could be consistent. Nevertheless, the fixed-effects estimator was retained as it better fits the data structure. Countries change in many ways in culture, institutions, economic conditions and these factors are likely related to variables of the model. Fixed effects account for these factors directly, making the estimates more reliable. The Hausman test is therefore reported for transparency, but fixed effects were selected as safer option despite Hausman test results suggesting that random effects could be valid as well.

In pursuance to address these differences in country specific factors as well as potential confounding variables, four estimations are conducted. Firstly, simple OLS (without fixed effects) which ignores country specifics as well as any common shocks between the countries. Secondly, OLS (with fixed effects) which introduces country fixed effects and year fixed effects to control for differences between countries and common shocks. The latter OLS model isolates the within country variation over time and provides more credible estimates of the relationship assessed. Furthermore, the analysis is extended by adding socio-economic control variables (unemployment, GEI, GDP per capita, education) to both OLS with and without FE. This allows for a more comprehensive assessment of the relationship between women in managerial positions and informal markets.

Table 13

OLS estimation for the Effect of Women's Managerial Representation on Female Informal Employment

Variable	OLS 1	OLS 2	OLS 3	OLS 4
		+ FE	*+ Confounders*	*+ FE & Confounders*
Constant	(***) 4.221	-	7.087	-
women_mgmt	(*) -0.030	-0.0241	-0.027	-0.026
Unemployment	-	-	(***) 1.429	0.006
GEI	-	-	0.610	(collinear) -
GDP_per_capita	-	-	(**) -0.003	-0.000016
Education	-	-	(***) 5.956	0.043
R^2	0.009	-	0.131	-
Adjusted R^2	0.007	-	0.122	-
Within R^2	—	0.008	-	0.017

Source: Compiled by author using R studio

OLS 1 presents statistically significant negative relationship between women in managerial positions and female informal markets (coefficient = - 0.02957, SE = 0.01378, p = 0.0324). The small standard error and p-values as well as t-statistics suggest a precise and strong relationship. However, the model does not account for country and year shock specifics which are likely to bias the estimate. The low R squared further indicates that the majority of variation remains unexplained by the model.

After including country and year fixed effects in OLS 2, the coefficient becomes small and statistically insignificant (coefficient = –0.02414, SE = 0.02613, p = 0.364). The increase in standard error reveals a more realistic level of uncertainty. The model explains almost none of the within-country variation in the dependent variable (Within R^2=0.008), suggesting that changes in women's managerial representation does not meaningfully predict changes in informal market employment by women.

As additional controls have been added, the OLS 3 coefficient becomes slightly smaller and statistically insignificant (β = –0.0266, p = 0.083). The significance in unemployment, education and GDP per capita variables indicate that these conditions play a more significant role in explaining women's participation in informal markets than women in managerial positions.

In the fixed-effects specification with controls of OLS 4, the coefficient remains small and insignificant (coefficient = –0.0266, p = 0.083). This further supports conclusions that after accounting for both – socioeconomic factors as well as unobserved country heterogeneity – women's representation in management does not explain within-country changes in female informal markets participation.

For additional robustness tests, leave-one-country-out test has been performed to evaluate whether the effects are driven by a single country. Detailed results are provided in Annex 4. Leave-One-Out Summary of Coefficients of OLS 4 (Including Controls and Fixed Effects). The results indicate that no one country has had a single significant I mpact on informal female employment. Removing any single country produces coefficient estimates in a narrow range (approximately -0.013 to -0.043) meaning no one country's exclusions lead to a large magnitude change. In conclusion, the results suggests that the relationship identified in the main model is robust and not sensitive to the inclusion or exclusion of any individual country.

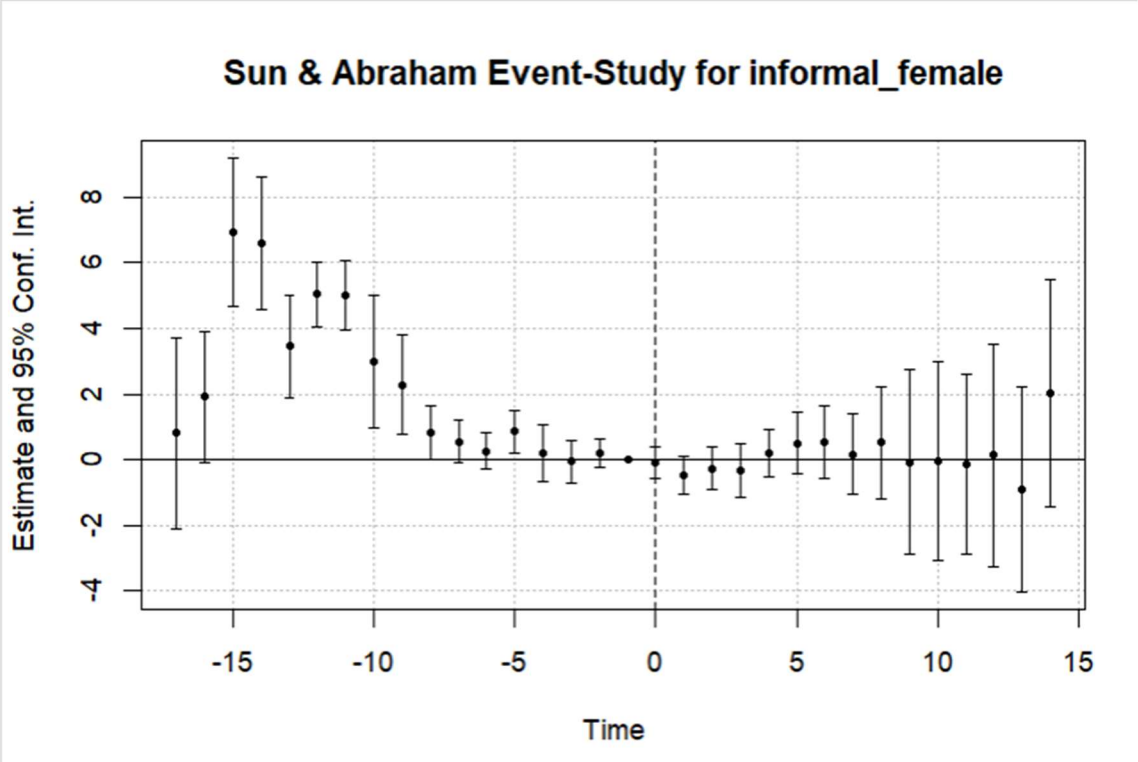
Overall, the results indicate that the significant negative relationship found in OLS 1 model was driven by cross-country differences rather than a causal effect within countries. Once proper fixed effects and controls are introduced, the relationship becomes small and insignificant. In addition, the robustness check has provided proof that the model is not driven by one country specifications. However, the OLS model solely provides baseline associations between the dependent and independent variables. Further models of DiD should be run to identify a more empirically strong relationship between the variables

3.3 Staggered Difference-in-Difference Results: Estimator of Sun & Abraham

Figure 9 presents the Sun & Abraham (2021) event-study estimates for staggered Difference-in-Differences. The figure displays the dynamic (before and after treatment event) coefficients and their 95% confidence intervals for each event time relative to the year of treatment adoption. The estimator allows to assess the assumptions of the estimator as well as identify the dynamic patterns of the treatment effect. For more detailed information on the results please refer to Annex 2. Sun & Abraham Event-Study and Placebo Estimates for Female Informal Employment.

Figure 9

Sun & Abraham Event-Study results for informal_female



Source: Author's elaboration

To ensure the staggered Difference-in-Differences design is valid, some key assumptions must hold. First of all, the parallel trends assumption requires in the absence of treatment, the treated and untreated groups should follow similar trends. Figure 9 results provide support for parallel trends assumption. In the pre-treatment period (event times -4 to -1), all coefficients are close to zero and their 95% confidence levels include zero, meaning the treated and untreated countries were following similar path before the policy was introduced. Some earlier years (before -10) show higher levels of informal female employment in treated countries compared to control countries. However, these differences do not consistently increase or decrease thus there is no trend. Having in mind that pre-treatment results do not show trend, the parallel trends assumption is not violated. Furthermore, no anticipation assumption is checked. As Figure 9 indicates, lead coefficients in the event-study (even times -4 to -1) are close to zero, indicating that treated countries did not adjust their informal female employment prior the treatment. This supports the no anticipation rule. The design also requires that the effect of treatment is not the same for all units (heterogeneity). The requirement is met considering that different countries have adopted gender – quotas in different years. Please see more in Annex 1. Treatment and Control Classification of Countries with Placebo Treatment Years. In addition, the institutional nature of gender-quota adoption implies that the treatment is irreversible. The dataset also includes both

treated and untreated groups. Finally, the estimation relies on treatment being as-good-as-random after conditioning on country and year fixed effects.

It should be noted that the model identifies variable GEI as collinear with the fixed effects and therefore excludes it automatically. This outcome may be expected in fixed-effects specifications, especially for variables that show little within-country variation or follow common global trends. In such cases the fixed-effects absorb most of the relevant variation. This does not affect the model treatment and simply means that GEI does not independently contribute to in this specification because the effect overlaps with fixed effects. The DiD estimation remains valid and interpretable.

When it comes to the interpretation of the Sun & Abraham (2021) estimator results, Figure 9 reveals that there is no meaningful treatment effect of gender-quota adoption on female informal employment. The effect in the treatment year (t=0) is small and statistically insignificant, indicating no immediate effect of the policy adoption. Having in mind that the gender-quota adoption is not expected to have an impact in the treatment year, the results are considered valid. Further, the post-treatment periods (t= 1 to 14) the coefficients remain close to zero and none are statistically significant. The coefficient intervals are wide and centered around zero, showing no evidence of a sustained decrease or increase in informal female employment after the policy's introduction. The findings suggest that the implementation of gender quotas does not have a significant effect in the share of informal employment among women in the years following adoption.

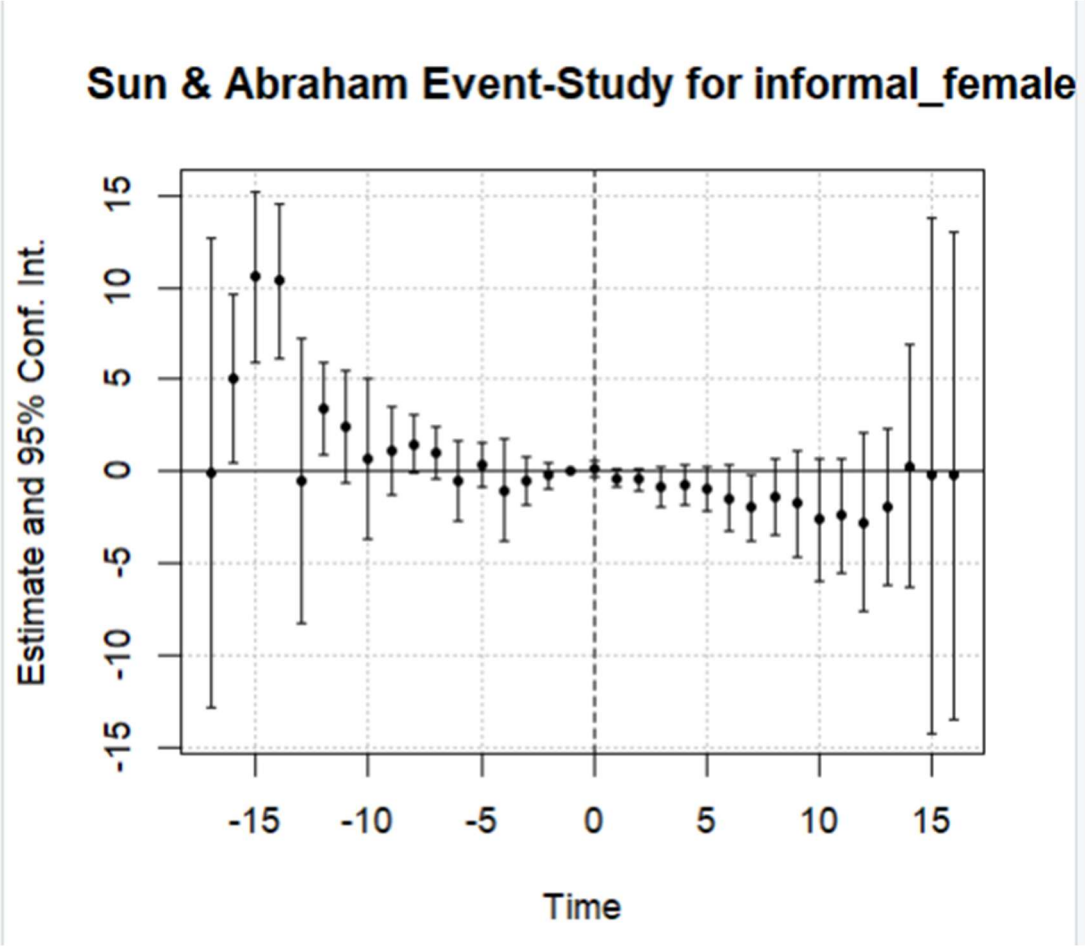
Overall, the staggered DiD estimator designed by Sun & Abraham (2021) show that the post-treatment coefficients are small and statistically insignificant concluding that there are no evidence of a treatment effect of gender-quota adoption on female informal employment.

A placebo event-study has been additionally performed by assigning fictitious dates to countries that were never treated. The placebo data can be found in Annex 2. Sun & Abraham Event-Study and Placebo Estimates for Female Informal Employment. As the placebo treatment never actually happened, the estimator should find no real effects of the fake gender quota adoption on informal employment on women. Figure 10 presents the results of the placebo study run.

It is worth mentioning that in placebo specification, all countries are treated meaning that there are no untreated countries in the dataset. As the model relies on comparability of control and treated group, the design of placebo estimator was altered. As the treatment eventually applies to all units, many event-time coefficients no longer have comparable counterparts. As a result, the estimator automatically eliminates these cells and thus the placebo estimator contains fewer or more event-time points than the real results. The change is expected and simply reflects limited number of periods where valid comparisons exist under the placebo setup.

Figure 10

Sun & Abraham Placebo Event-Study Results for informal_female



Source: Author's elaboration

The results show that some very early pre-treatment year show large coefficient with wide confidence intervals which happens because very few countries have data dating that far away leading to unstable predictions. The main focus however should be drawn towards near zero periods that are close to the placebo treatment years. The figure shows that the coefficients are close to zero and statistically insignificant (the confidence intervals cross the zero line), which is exactly what could be expected when no real treatment exists. This means that the model does not falsely detect policy effects when treatment is made up. Overall, the placebo test supports the reliability of the main findings and shows that the estimated results in the real analysis are unlikely to be driven by flaws in the model. More details on the results can be found in Annex 2. Sun & Abraham Event-Study and Placebo Estimates for Female Informal Employment.

For additional robustness tests, leave-one-country-out test has been performed to evaluate whether the dynamic treatment effects are driven by a single country. Detailed results are provided

in Annex 5. Leave-One-Out Summary of Coefficients of Sun & Abraham. For more generalized data and interpretation please see Table 14 below.

Table 14

Generalized Event-Time Summary Table (Leave-One-Out Sun & Abraham)

Period Group	Event Times	Mean Coefficient	SD	Min	Max
Early Pre-Treatment	−17 to −10	2.90	1.10	0.19	7.54
Late Pre-Treatment	−9 to −2	0.67	0.22	−0.29	2.95
Treatment Window	−1 to +1	−0.27	0.12	−0.64	−0.03
Early Post-Treatment	2 to 6	0.25	0.32	−1.15	0.87
Late Post-Treatment	7 to 14	0.18	0.62	−1.82	3.04

Source: Author's elaboration

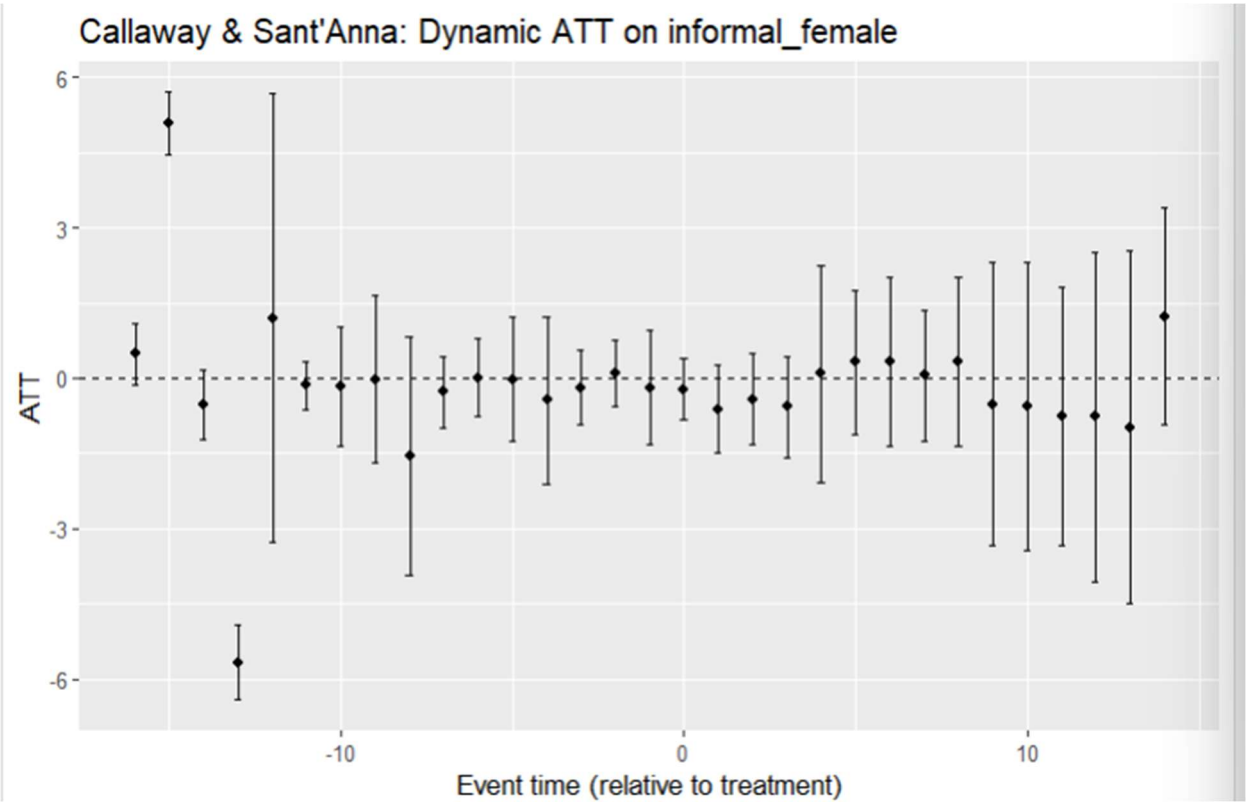
The results above show that in early pre-treatment periods the estimates are large and highly variable which is expected as not a lot of countries contribute their observations for this far. These coefficients do not reflect any significant trends and instead are just noise. Late pre-treatment period are much smaller and less variable. Values close to the treatment most importantly are close to zero (refer to Annex 5. Leave-One-Out Summary of Coefficients of Sun & Abraham) confirming that even on leave-one-country-out specifications pre-treatment assumption holds. The treatment window shows that no one country is pushing the results towards the false effect in short-term and no anticipation or sudden change is also observed. In early post-treatment period, the effect remains small and stable, fluctuating around zero. Meaning that removing one country does not produce large shifts. Late post-treatment period finds greater variation however the pattern remains centred around zero which indicates no one country draws significant results. Overall, the results indicate that no one country drives the event-study estimates.

3.4 Staggered Difference-in-Difference Results: Estimator of Callaway & Sant'Anna

Figure 11 represents the dynamic average treatment effect on the treated (ATT) estimated using Callaway & Sant'Anna (2021) staggered Difference-in-Differences estimator. The plot displays event-time coefficients relative to each country's treatment year, along with simultaneous 95% confidence intervals. Each point represents the estimated effect before or after the treatment. For more detailed numbers please refer to Annex 3. Dynamic ATT and Placebo Estimates from Callaway & Sant'Anna Estimator.

Figure 11

Callaway & Sant'Anna: Dynamic ATT on informal_female



Source: Compiled by author

Figure 11 represents that pre-treatment coefficients fluctuate and display wide confidence intervals, especially in early years, indicating considerable noice and no stable pattern of trends prior treatment. However, the pre-treatment trends closer to zero suggests no systematic pre-treatment divergence between treated and not treated countries. Thus, parallel trends assumption is not violated. The estimator also relies on no anticipation assumption which is also confirmed by the fact that pre-treatment (closer to zero) trends show no prior significant adjustments. The irreversibility assumption is met having in mind the nature of the treatment – once country adopts gender quotas, the quotas remain adopted. Finally, the comparability between treated and untreated groups is also met having in mind the dataset used.

As far as estimation results are concerned, at treatment time (even time zero) the estimated effect is close to zero and statistically insignificant indicating no immediate effects. In the post-period, the ATT estimates remain small with wide confidence intervals that consistently include zero. This indicates that the adoption of gender quotas does not have a significant effect on the share of informal employment among women in the years following the adoption.

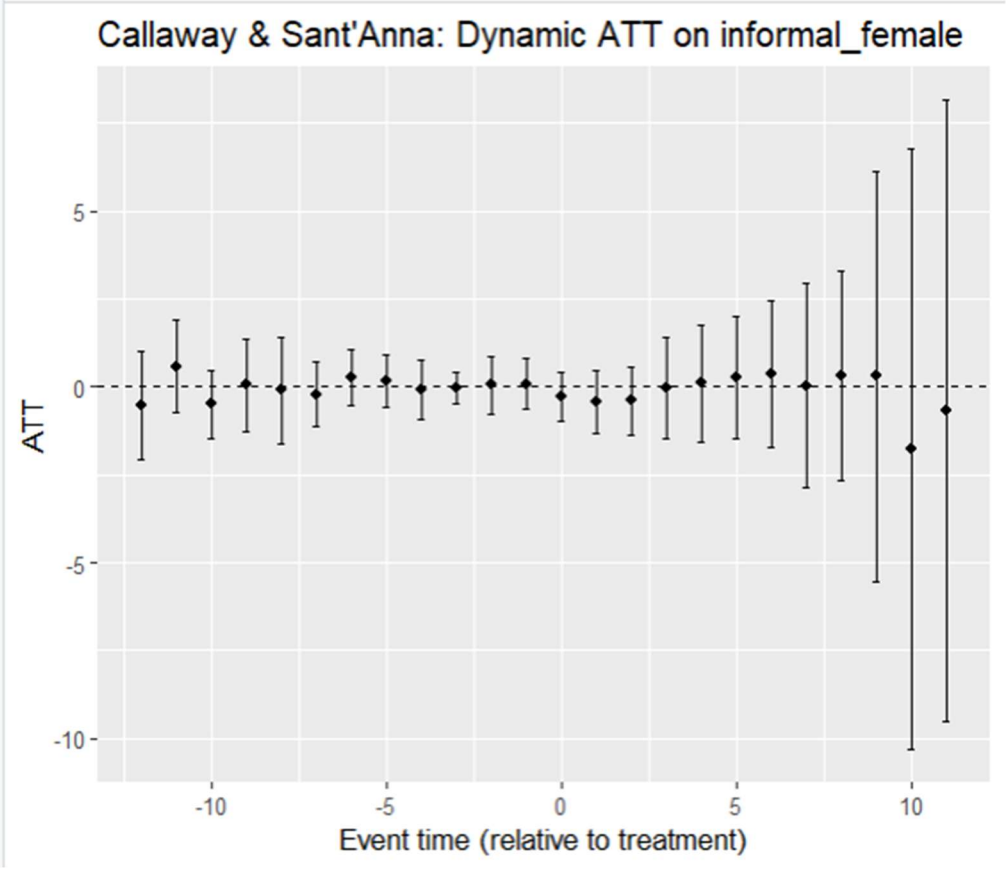
Overall, the results align with results of Sun & Abraham (2021) specification, suggesting that the policy does not generate measurable and significant effects on female informal employment.

A placebo dynamic ATT estimates using Callaway & Sant'Anna (2021) has been additionally performed by assigning fictitious dates to countries that were never treated. The placebo data can be found in Annex 3. Dynamic ATT and Placebo Estimates from Callaway & Sant'Anna Estimator. As the placebo treatment never actually happened, the estimator should find no real effects of the fake gender quota adoption on informal employment on women. Figure 12 presents the results of the placebo study run.

It is worth mentioning that in placebo specification, all countries are treated meaning that there are no untreated countries in the dataset. As the model requires never treated countries for comparison, the model was re-specified using "not-yet-treated" comparison group. This change alters the structure of available comparisons: once all countries eventually become treated, many group ATT cells no longer have suitable not-yet-treated countries to be compared to. As a result, the estimator automatically eliminates these cells and thus the placebo estimator contains fewer event-time points than the real results. The reduction is expected and simply reflects limited number of periods where valid comparisons exists under the placebo setup.

Figure 12

Callaway & Sant'Anna: Dynamic Placebo ATT on informal_female



Source: Author's elaboration

The results in Figure 12 show that estimated coefficients fluctuate around zero in both pre-treatment and post-treatment periods. The results are exactly the ones expected from a placebo

study: the model does not falsely predict policy effectiveness when no treatment actually exists. More details on results can be found in Annex 3. Dynamic ATT and Placebo Estimates from Callaway & Sant'Anna Estimator.

For additional robustness tests, leave-one-country-out test has been performed to evaluate whether the dynamic treatment effects are driven by a single country. Detailed results are provided in Annex 6. Leave-One-Out Summary of Coefficients of Callaway & Sant'Anna. For more generalized data and interpretation please see Table 16 below.

Table 15

Generalized Event-Time Summary Table (Leave-One-Out Calloway & Sant'Anna)

Period Group	Event Times	Mean Coefficient	SD	Min	Max
Early Pre-Treatment	–16 to –10	1.65	0.36	–1.25	3.55
Late Pre-Treatment	–9 to –2	–0.23	0.11	–2.00	0.55
Treatment Window	–1 to +1	–0.35	0.06	–0.81	0.10
Early Post-Treatment	2 to 6	–0.06	0.14	–0.73	0.54
Late Post-Treatment	7 to 14	–0.18	0.33	–1.64	1.48

Source: Compiled by author

The results above show that in early pre-treatment periods the estimates are large and highly variable which is expected as not a lot of countries contribute their observations for this far. These coefficients do not reflect any significant trends and instead are just noise. Late pre-treatment period is much smaller and less variable. Values close to the treatment most importantly are close to zero (refer to Annex 5. Leave-One-Out Summary of Coefficients of Sun & Abraham) confirming that even on leave-one-country-out specifications pre-treatment assumption holds. The treatment window shows that no one country is pushing the results towards the false effect in short-term and no anticipation or sudden change is also observed. In early post-treatment period, the effect remains small and stable, fluctuating around zero. Meaning that removing one country does not produce large shifts. Late post-treatment period finds greater variation however the pattern remains centred around zero which indicates no one country draws significant results. Overall, the results indicate that no one country drives the event-study estimates.

Overall, the descriptive statistics and econometric analyses provide a comprehensive view of the relationship between women's representation in management positions and female participation in informal labor markets across EU countries. The descriptive statistics highlight the differences between treated and untreated countries, showing that treated countries are institutionally and economically more advanced and exhibit steeper rise in women's managerial representation over time. While the initial OLS model suggests a significant negative association

between women in management and informal market size, the relationship disappears once fixed effects and socio-economic confounders are introduced. The staggered DiD models further support that no significant evidence is present while analyzing whether the gender-quota introduction has an effect on informal female employment. Overall, the combined analyses indicate that the policy of gender equality which influences the change in women's managerial representation does not have a measurable causal effect on female informal employment.

CONCLUSIONS AND RECOMMENDATIONS

Gender equality has gained increasing attention in social and economic discourse due to persistent disparities in labor market outcomes. From early childhood, individuals are socialized into gender-specific roles that prescribe distinct responsibilities and behavioral expectations (Eliot et al., 2023; Rexrode et al., 2022). With this in mind, the chosen topic aimed to examine women's participation in management and informal labor markets, while also assessing whether government policies aimed at promoting gender equality influenced or mitigated the long-term effects of socially constructed gender roles on labor market outcomes.

The extant literature has provided a glance at feministic theories, human capital theory, phenomena of glass ceiling and glass cliff and a relationship between gender diversity and firm performance, and institutional frameworks addressing gender inequality. Collectively, these strands suggested that addressing gender inequality requires cultural as well as institutional changes. Furthermore, the review highlights the complexity of that informal economy which is difficult to measure accurately. Although several methodological approaches exist to estimate its size, their reliability is highly sensitive to data availability. The relationship between women in informal markets have been explored from multiple perspectives: formal and informal employment point, corruption and women's freedom, rights etc. (DiRienzo & Das, 2021; Njoya et al., 2022). While prior studies indicate that greater female representation in management positions may reduce informality, they do not account for more recent regulatory developments, particularly gender quota policies. Accordingly, the novelty of this study lies in updated post-gender-quota data from the European Union and a new analytical perspective on the relationship between female leadership and the informal economy.

The master is not without limitations. Firstly, the empirical research is based on country-level panel data which may not fully capture sector-specific informal market dynamics. As a result, the trends represent the aggregate results rather than micro-level causal mechanisms. Secondly, informal markets are inherently difficult to measure and cross-country differences in definitions, reporting practices, and data quality across European Union member states may affect the comparability results. Lastly, while study applies econometrical methods to evaluate the effects, the causal relationship may be limited by potential unobserved confounding factors. Although fixed effects and time controls are used to mitigate these concerns, endogeneity cannot be fully ruled out.

From a methodological perspective, to achieve the stated research aim, the research employs both qualitative and quantitative approaches. The research begins with a comprehensive

literature review, including systematic analysis and comparison of existing studies. In the empirical section, descriptive statistical analysis is employed to examine trends in women's participation in management positions as well as developments in informal market activity. Furthermore, Ordinary Least Squares (OLS) regression is applied. To enhance the robustness of the results, fixed effects models are also employed to account for unobserved heterogeneity., Staggered Difference-in-Differences (DiD) approach is additionally implemented to evaluate the treatment effects of gender quota policies. The empirical research uses data for treated (countries that had gender-quota policies accepted) and untreated group (countries that have not accepted gender-quota regulations).

The descriptive statistics measures taken together provided a preliminary view of the differences between treated and untreated countries across socio-economic, gender-related and economic dimensions. Time-series analysis showed that treated countries initially had higher levels of female informality which stabilized over the years. As far as women in management are concerned, data indicated that treated countries began the period with lower representation, however, a steep upward trend emerged with creating a big gap in 2024 comparing to the untreated group. Socio-economic indicators further indicate that treated countries are generally more advanced in gender equality, education and income per capita dimensions. Overall, the results highlight the importance of careful empirical analysis when evaluating gender quota regulations effect on labor market.

Furthermore, OLS regression model has been estimated. The results suggested that significant negative relationship between women in management and women in informal markets was driven by cross-country differences rather than within-country causal effects. Once fixed effects were adopted and appropriate controls introduced, the relationship became small and statistically insignificant. However, OLS captures only baseline associations between the variables, thus Difference-in-Differences models were introduced to estimate relationship between the women in management and women in informal markets after the treatment – gender quota regulations introduction. The results of staggered DiD models indicated that no significant evidence was present while analyzing the relationship. Overall, the combined empirical analysis concluded that the policy of gender equality (addressing women in management) does not have a statistically significant causal effect on female informal employment.

Based on the findings of this study, several policy- and research- oriented recommendations can be proposed. Firstly, the results indicated that the gender quota policies, while did effective job on women's representation in management, did not have effect on informality. This suggests that gender quotas are insufficient in addressing informal markets reduction. Policymakers should therefore complement gender quota tools with other measures

targeting formal employment creation, and access to social protection for women. As far as research-oriented recommendations go, the study has highlighted the importance of causal analysis when evaluating policy effects, since simple comparisons between countries can give misleading results. Future research could improve the empirical methodology by using longer time periods after policy implementation or more detailed data.

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SUMMARY IN ENGLISH

WOMEN'S PARTICIPATION IN MANAGEMENT AND INFORMAL MARKETS. AN EMPIRICAL EXPLORATION

DIANA ČEPULYTĖ

Master thesis

Strategic Economics Study Programme

Vilnius University, Faculty of Economics and Business Administration

Supervisor: Dr. Martina Dal Molin

Vilnius, 2025

SUMMARY

The main purpose of this master thesis is to evaluate the relationship between the women in management and women in informal markets after gender-quota policies have been accepted by the government. The work has three main parts: literature analysis, methodology and empirical results. The literature analysis reviews gender equality related topics such as feminism, human capital theories, phenomena of glass ceiling and glass cliff, informal markets definition complexity and lastly, the relationship between women in management and women in informal markets. As the prior research has been identified to be lacking updated data and comprehensive analysis of the gender-quota policy effect on informal markets, the author is determined to fill in the empirical gap. Further, the author has listed the methodological approach used in the study. The methods used include descriptive statistics, OLS regression model with and without fixed effects, and Difference-in-Differences estimators evaluating the treatment effect of gender quotas policy introduction. OLS regression model has suggested negative relationship between women in management and women in informal markets which disappeared once proper controls and fixed effects were introduced. However, while OLS capture the relationship between women's participation in informal markets and participation in management, it does not capture the treatment effect of gender-quota policies on informal market participation of women. Thus, staggered DiD estimators were used by the author. The results indicated that there were no significant results indicating that the gender-quota policy introduction had a significant effect on women in informal markets. Lastly, after summarising the main concepts from the literature review and the results of the performed research, the author believes that policymakers should adopt broader and more comprehensive policy measures when addressing informal labor markets

of women, rather than relying solely on gender quota regulations. In addition, it is suggested that the research would be updated with more post-treatment data once it is available for more reliable results.

SUMMARY IN LITHUANIAN

MOTERŲ DALYVAVIMAS VALDYME IR NEFORMALIOSE RINKOSE. EMPIRINIS TYRIMAS

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SANTRAUKA

Šio magistro darbo pagrindinis tikslas – įvertinti ryšį tarp moterų užimamų vadovaujančių pareigų kiekio ir moterų dalyvavimo neformalioje ekonomikoje kiekio po to, kai valstybėse buvo įgyvendintos lyčių kvotų politikos. Darbą sudaro trys pagrindinės dalys: literatūros apžvalga, metodologija ir empirinė analizė. Literatūros apžvalgoje nagrinėjamos su lyčių lygybe susijusios temos, tokios kaip feminizmo teorijos, žmogiškojo kapitalo teorija, „stiklo lubų“ ir „stiklo uolos“ reiškiniai, neformalios ekonomikos apibrėžimo kompleksiškumas bei ryšys tarp moterų vadovaujančiose pareigose ir moterų dalyvavimo neformalioje ekonomikoje. Kadangi ankstesni tyrimai pasižymėjo ribotais duomenimis ir išsamios analizės, vertinančios lyčių kvotų politikos poveikį neformaliai ekonomikai, trūkumu, šiuo darbu siekiama užpildyti šią empirinę spragą.

Toliau darbe pristatomas taikytas metodologinis požiūris. Tyrime naudojami aprašomosios statistikos metodai, Ordinary Least Squares regresijos modeliai su fiksuotaisiais efektais ir be jų bei Staggered Difference-in-Differences (DiD) metodas, skirtas įvertinti lyčių kvotų politikos įgyvendinimo poveikį. OLS regresijos rezultatai parodė neigiamą ryšį tarp moterų vadovaujančiose pareigose ir moterų dalyvavimo neformalioje ekonomikoje, tačiau šis ryšys išnyko įtraukus tinkamus kontrolinius kintamuosius ir fiksuotuosius efektus. Vis dėlto, kadangi OLS metodas neleidžia įvertinti priežastinio lyčių kvotų politikos poveikio, buvo taikomi DiD įverčiai. Gauti rezultatai parodė, kad lyčių kvotų politikos įvedimas neturėjo statistiškai reikšmingo poveikio moterų dalyvavimui neformalioje ekonomikoje.

Apibendrinant literatūros analizę ir empirinius rezultatus, daroma išvada, kad politikos formuotojai, siekdami spręsti moterų užimtumo neformalioje ekonomikoje problemas, turėtų taikyti platesnes ir labiau kompleksines priemones, o ne pasikliauti vien tik lyčių kvotų

reguliavimu. Taip pat siūloma ateityje atnaujinti tyrimą, naudojant ilgesnio laikotarpio duomenis po politikos įgyvendinimo, siekiant gauti patikimesnius rezultatus.

ANNEXES

Annex 1. Treatment and Control Classification of Countries with Placebo Treatment Years

Table 16

Treatment and Control Classification of Countries with Placebo Treatment Years

Country	Treatment year	Treated / Control	Treatment year_Placebo
Austria	2017	Treated	2017
Belgium	2011	Treated	2011
Bulgaria	-	Control	2008
Croatia	-	Control	2016
Cyprus	-	Control	2013
Czechia	-	Control	2020
Denmark	2024	Treated	2024
Estonia	-	Control	2011
Finland	2010	Treated	2010
France	2011	Treated	2011
Germany	2016	Treated	2016
Greece	2020	Treated	2020
Hungary	-	Control	2017
Ireland	2012	Treated	2012
Italy	2011	Treated	2011
Latvia	-	Control	2020
Lithuania	-	Control	2011
Luxembourg	-	Control	2013
Malta	-	Control	2018
Netherlands	2013	Treated	2013
Poland	-	Control	2017
Portugal	2017	Treated	2017
Romania	-	Control	2007
Slovakia	-	Control	2008
Slovenia	-	Control	2010
Spain	2007	Treated	2007
Sweden	-	Control	2011

Source: (Buckley, 2025; Klingsten, n.d.; Martinez-garcia, Terjesen, & Gomez-anson, 2024; Smith & Essen, 2025)

Annex 2. Sun & Abraham Event-Study and Placebo Estimates for Female Informal Employment

Table 17.

Sun & Abraham Event-Study and Placebo Estimates for Female Informal Employment

Event Time (k)	Estimate	Std. Error	Significance	Estimate_ Placebo	Std. Error_ Placebo	Significance_ Placebo
-17	0.807	1.415		-0.105	6.222	
-16	1.921	0.973	.	5.044	2.218	*
-15	6.927	1.105	***	10.587	2.254	***
-14	6.596	0.981	***	10.354	2.060	***
-13	3.448	0.760	***	-0.500	3.759	
-12	5.037	0.475	***	3.384	1.220	*
-11	5.016	0.508	***	2.458	1.493	
-10	3.003	0.988	**	0.686	2.105	
-9	2.274	0.740	**	1.118	1.188	
-8	0.834	0.400	*	1.485	0.780	.
-7	0.551	0.315	.	0.998	0.696	
-6	0.267	0.268		-0.479	1.059	
-5	0.859	0.321	*	0.367	0.570	
-4	0.200	0.413		-1.036	1.365	
-3	-0.063	0.318		-0.541	0.649	
-2	0.186	0.213		-0.226	0.329	
0	-0.110	0.234		0.136	0.237	
1	-0.475	0.273	.	-0.365	0.257	
2	-0.262	0.309		-0.463	0.305	
3	-0.326	0.396		-0.821	0.525	
4	0.211	0.348		-0.736	0.535	
5	0.501	0.463		-0.953	0.561	
6	0.544	0.542		-1.462	0.879	
7	0.167	0.602		-1.971	0.872	*
8	0.526	0.832		-1.409	1.016	
9	-0.082	1.371		-1.751	1.409	
10	-0.031	1.470		-2.634	1.621	
11	-0.138	1.333		-2.416	1.515	
12	0.141	1.651		-2.764	2.361	
13	-0.912	1.529		-1.931	2.090	
14	2.038	1.684		0.291	3.220	

Source: Compiled by author

Annex 3. Dynamic ATT and Placebo Estimates from Callaway & Sant'Anna Estimator

Table 18

Dynamic ATT and Placebo Estimates from Callaway & Sant'Anna Estimator

Event Time	Estimate	Std. Error	95% CI Lower	95% CI Upper	Estimate _Placebo	Std. Error _Placebo	95% CI Lower _Placebo	95% CI Upper _Placebo
-16	0.4807	0.2382	-0.1353	1.0967				
-15	5.0740	0.2427	4.4465	5.7015*				
-14	-0.5351	0.2704	-1.2345	0.1642				
-13	-5.6727	0.2894	-6.4210	-4.9244*				
-12	1.2008	1.7350	-3.2860	5.6877	-0.5202	0.5824	-2.0459	1.0055
-11	-0.1466	0.1809	-0.6145	0.3214	0.5832	0.4959	-0.7158	1.8821
-10	-0.1651	0.4606	-1.3561	1.0259	-0.4975	0.3681	-1.4616	0.4667
-9	-0.0257	0.6465	-1.6976	1.6462	0.0584	0.4990	-1.2486	1.3653
-8	-1.5405	0.9191	-3.9174	0.8364	-0.0884	0.5807	-1.6094	1.4326
-7	-0.2750	0.2781	-0.9942	0.4442	-0.2089	0.3564	-1.1425	0.7248
-6	0.0029	0.3015	-0.7768	0.7827	0.2576	0.3041	-0.5391	1.0542
-5	-0.0199	0.4789	-1.2584	1.2185	0.1678	0.2855	-0.5800	0.9157
-4	-0.4445	0.6416	-2.1036	1.2147	-0.0824	0.3144	-0.9058	0.7411
-3	-0.1938	0.2890	-0.9413	0.5536	-0.0534	0.1716	-0.5028	0.3960
-2	0.0972	0.2610	-0.5778	0.7721	0.0661	0.3132	-0.7543	0.8864
-1	-0.1951	0.4395	-1.3317	0.9416	0.0857	0.2763	-0.6382	0.8095
0	-0.2230	0.2379	-0.8383	0.3923	-0.2723	0.2599	-0.9532	0.4086
1	-0.6212	0.3362	-1.4905	0.2482	-0.4197	0.3406	-1.3120	0.4726
2	-0.4211	0.3492	-1.3241	0.4818	-0.4012	0.3754	-1.3845	0.5821
3	-0.5660	0.3897	-1.5738	0.4417	-0.0344	0.5583	-1.4967	1.4280
4	0.0839	0.8343	-2.0738	2.2415	0.0922	0.6368	-1.5759	1.7603
5	0.3160	0.5519	-1.1112	1.7432	0.2756	0.6632	-1.4616	2.0128
6	0.3357	0.6499	-1.3450	2.0164	0.3420	0.7959	-1.7428	2.4269
7	0.0493	0.5028	-1.2510	1.3496	0.0350	1.1048	-2.8589	2.9289
8	0.3372	0.6486	-1.3401	2.0146	0.3183	1.1417	-2.6723	3.3089
9	-0.5224	1.0943	-3.3522	2.3075	0.2997	2.2259	-5.5311	6.1304
10	-0.5580	1.1135	-3.4375	2.3216	-1.7682	3.2640	-10.3181	6.7818
11	-0.7614	0.9981	-3.3426	1.8197	-0.6682	3.3790	-9.5192	8.1829
12	-0.7729	1.2687	-4.0539	2.5080				
13	-0.9880	1.3600	-4.5050	2.5290				
14	1.2263	0.8356	-0.9347	3.3872				

Source: Compiled by author

Annex 4. Leave-One-Out Summary of Coefficients of OLS 4 (Including Controls and Fixed Effects)

Table 19

Leave-One-Out Summary of Coefficients of OLS 4 (Including Controls and Fixed Effects)

Country	Estimate
Austria	-0.0288
Belgium	-0.0250
Bulgaria	-0.0360
Croatia	-0.0243
Cyprus	-0.0268
Czechia	-0.0220
Denmark	-0.0229
Estonia	-0.0195
Finland	-0.0261
France	-0.0129
Germany	-0.0326
Greece	-0.0327
Hungary	-0.0295
Ireland	-0.0296
Italy	-0.0425
Latvia	-0.0234
Lithuania	-0.0168
Luxembourg	-0.0267
Malta	-0.0289
Netherlands	-0.0261
Poland	-0.0272
Portugal	-0.0216
Romania	-0.0235
Slovakia	-0.0217
Slovenia	-0.0258
Spain	-0.0254
Sweden	-0.0259

Source: Compiled by author

Annex 5. Leave-One-Out Summary of Coefficients of Sun & Abraham

Table 20

Leave-One-Out Summary of Coefficients of Sun & Abraham

Coefficient	Mean	SD	Min	Max
Time: -17	0.8084	0.2615	0.1868	1.5949
Time: -16	1.9252	0.1865	1.4449	2.4328
Time: -15	6.9335	0.2210	6.4538	7.5447
Time: -14	6.6039	0.2097	6.1690	7.2799
Time: -13	3.4512	0.7128	0.9256	5.9625
Time: -12	5.0407	0.1675	4.5332	5.5340
Time: -11	5.0194	0.1777	4.4847	5.5396
Time: -10	2.9760	0.3397	2.0214	4.2243
Time: -9	2.2500	0.2655	1.2972	2.9549
Time: -8	0.8086	0.1360	0.3674	1.1090
Time: -7	0.5251	0.0991	0.2903	0.7262
Time: -6	0.2452	0.1107	-0.1629	0.4980
Time: -5	0.8383	0.1853	0.2208	1.3187
Time: -4	0.1860	0.1115	-0.1996	0.4136
Time: -3	-0.0789	0.0848	-0.2910	0.0534
Time: -2	0.2157	0.0858	0.0229	0.3607
Time: 0	-0.1228	0.0515	-0.2313	-0.0344
Time: 1	-0.4877	0.0725	-0.6355	-0.3411
Time: 2	-0.2752	0.0877	-0.4625	-0.1113
Time: 3	-0.3407	0.1136	-0.5954	-0.0769
Time: 4	0.1964	0.1580	-0.3948	0.4594
Time: 5	0.4884	0.1615	0.1362	0.8674
Time: 6	0.5254	0.1900	0.0711	0.8703
Time: 7	0.1495	0.1651	-0.2257	0.4208
Time: 8	0.5191	0.2256	-0.0400	0.8454
Time: 9	-0.0925	0.3669	-0.9964	0.9143
Time: 10	-0.0428	0.4136	-1.1478	1.0155
Time: 11	-0.1483	0.3640	-1.0391	0.7636
Time: 12	0.1292	0.4792	-1.1325	1.3937
Time: 13	-0.9051	0.3720	-1.8232	0.4228
Time: 14	2.0605	0.3319	1.3195	3.0365

Source: Compiled by author

Annex 6. Leave-One-Out Summary of Coefficients of Callaway & Sant'Anna

Table 21

Leave-One-Out Summary of Coefficients of Callaway & Sant'Anna

Coefficient	Mean	SD	Min	Max
Time: -16	0.481	0.0472	0.344	0.573
Time: -15	5.07	0.0498	4.94	5.19
Time: -14	−0.535	0.0574	−0.635	−0.395
Time: -13	−5.67	0.0587	−5.78	−5.56
Time: -12	1.20	0.651	−1.14	3.55
Time: -11	−0.147	0.0386	−0.256	−0.0560
Time: -10	−0.165	0.303	−1.25	0.921
Time: -9	−0.0257	0.137	−0.270	0.555
Time: -8	−1.54	0.171	−2.00	−1.06
Time: -7	−0.275	0.0639	−0.475	−0.0906
Time: -6	0.00292	0.0652	−0.210	0.203
Time: -5	−0.0199	0.110	−0.317	0.342
Time: -4	−0.444	0.119	−0.889	−0.0735
Time: -3	−0.194	0.0572	−0.338	−0.0624
Time: -2	0.0972	0.0537	−0.0276	0.249
Time: -1	−0.195	0.0767	−0.414	0.0993
Time: 0	−0.223	0.0490	−0.347	−0.125
Time: 1	−0.621	0.0704	−0.811	−0.450
Time: 2	−0.421	0.0730	−0.560	−0.259
Time: 3	−0.566	0.0794	−0.725	−0.350
Time: 4	0.0839	0.156	−0.527	0.448
Time: 5	0.316	0.113	−0.0827	0.531
Time: 6	0.336	0.136	−0.114	0.540
Time: 7	0.0493	0.109	−0.280	0.214
Time: 8	0.337	0.135	−0.0115	0.594
Time: 9	−0.522	0.234	−1.09	0.314
Time: 10	−0.558	0.243	−1.07	0.307
Time: 11	−0.761	0.209	−1.17	−0.0333
Time: 12	−0.773	0.286	−1.30	0.183
Time: 13	−0.988	0.318	−1.64	0.177
Time: 14	1.23	0.169	0.59	1.48

Source: Compiled by author