Moving beyond the gender pay gap: an investigation of gender inequalities across European countries

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MOVING BEYOND THE GENDER PAY GAP: AN INVESTIGATION OF GENDER INEQUALITIES ACROSS EUROPEAN COUNTRIES.

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Abstract

The Gender Pension Gap refers to the persistent disparity in pension income between men and women, highlighting significant financial inequalities in retirement across Europe. This research aims to analyse the key factors contributing to this gap, providing insights into its underlying causes and the extent of pension disparities among European countries. While related to the Gender Pay Gap, which reflects income disparities during an individual's working life, the Gender Pension Gap is influenced by a broader range of factors, including career interruptions, part-time employment, differences in pension system structures, and significant life events.

Using data from the Survey of Health, Ageing and Retirement in Europe, specifically waves 1 to 7 spanning 2004 to 2017, this study focuses on retirees aged 65 and older across multiple European countries. It examines trends in pension disparities over time and explores contributing factors such as pension system structures, employment histories, income streams, and individual characteristics. The analysis also investigates the role of discrimination in the unexplained portion of the Gender Pension Gap and evaluates the effects of secondary income sources—such as rental income, investment returns, and long-term savings—on pension outcomes.

The methodology integrates descriptive statistics, regression models, and Cohen's d effect size—an innovative approach not previously applied in studies of pension disparities in Europe—to measure the magnitude of gender inequalities. The Blinder-Oaxaca Decomposition further quantifies the extent to which these disparities can be attributed to observable factors.

The results reveal significant variation in pension disparities across Europe. Although progress has been made in narrowing the Gender Pension Gap over time, advancements differ considerably by country and demographic group. The findings underscore the complex interplay of factors such as marital status, age cohort, employment patterns, pension system design, and secondary income streams in shaping pension outcomes. Notably, women consistently receive lower pension incomes than men across all categories. Although discrimination remains a factor contributing to these disparities, its extent varies from one country to another. Additionally, while rental income shows promise in reducing pension disparities, the impacts of financial returns and long-term savings are less predictable.

This research advances understanding of gender-based pension disparities by offering a comprehensive analysis and applying innovative quantitative methodologies. The findings deepen empirical insight into the persistence and variability of pension inequalities across Europe, emphasizing systemic and structural factors driving these disparities and underscores practical implications by highlighting the urgent need for targeted policy interventions to reform pension systems and effectively address gender-based disparities.

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Country Abbreviations	
AT: Austria	**IS:** Iceland
BE: Belgium	**IT:** Italy
BG: Bulgaria	**LT:** Lithuania
CY: Cyprus	**LU:** Luxembourg
CZ: Czech Republic	**LV:** Latvia
DE: Germany	**MT:** Malta
DK: Denmark	**NL:** Netherlands
EE: Estonia	**NO:** Norway
ES: Spain	**PL:** Poland
FI: Finland	**PT:** Portugal
FR: France	**RO:** Romania
GR: Greece	**SE**: Sweden
HR: Croatia	**SI:** Slovenia
HU: Hungary	**SK:** Slovak Republic
IE: Ireland	**SW:** Switzerland
ISR: Israel	
UK: United Kingdom	

List Abbreviations	
ANOVA	Analysis of Variance
CLT	Central Limit Theorem
ELSA	United Kingdom's Longitudinal Study of Ageing
EU	European Union
Eurostat	European Statistics Bureau
F	Females
FCS	Fully Conditional Specification
GGP-H	Intra-household GG in Pensions
GPG	Gender Pension Gap
HRS	United States' Health and Retirement
HDI	Hot Deck Imputation
M	Males
MI	Multiple Imputation
NHI	Net Household Income
NPI	Net Pension Income
NII	Net Individual Income
NIIW	Net Individual Income from Work (Present & Past)
NRPs	Nonresponding Partners
SHARE	Survey on Health Ageing and Retirement in Europe
THI	Total Household Income
TII	Total Individual Income
UNDESA	United – Nations - Department of Economic and Social Affairs program on ageing
YAOHM	Income from other Household Members
W	Wave

Chapter 1: Framing the Research: Context, Goals, and Structure.

1.1 Introduction

The Gender Pension Gap (GPG), defined as the difference in pension income between men and women, reflects deep-rooted economic and social inequalities that persist into retirement. While significant attention has been given to gender disparities in wages over recent decades, the uneven distribution of retirement income remains an underexplored yet critical issue. Factors contributing to these inequalities extend beyond earnings disparities to include differences in employment patterns, pension system designs, caregiving responsibilities, and life events that disproportionately impact women. These cumulative effects often lead to financial insecurity for women in older age, even in regions with well-developed pension systems like Europe. The persistence of the GPG raises important questions about the effectiveness of current policies aimed at addressing gender inequalities. Despite ongoing efforts to reduce wage disparities and enhance women's participation in the workforce, retirement income gaps remain notably wide. This issue is further complicated by the diversity of pension systems across European countries, which vary significantly in their reliance on public, occupational, and private pension schemes. A nuanced analysis is required to understand how structural, economic, and social factors interact over an individual's life course to drive these disparities. This research utilizes data from the Survey of Health, Ageing, and Retirement in Europe (SHARE), covering waves 1 to 7 from 2004 to 2017. By focusing on retirees aged 65 and older across various European countries, this study investigates the GPG through a cross-sectional lens. It examines how employment histories, pension system structures, income sources, and individual characteristics—such as marital status and age cohort—shape pension outcomes. Additionally, it aims to differentiate between explainable factors contributing to the

GPG and those that may indicate systemic biases or discrimination. The methodological approach combines established statistical techniques—such as regression models and Blinder-Oaxaca Decomposition—with an innovative application of Cohen's d effect size to quantify disparities' magnitude. This multi-faceted analytical framework allows for a comprehensive understanding of how gender-based inequalities manifest within European pension systems. The relevance of this research extends beyond academia; addressing pension disparities is crucial for ensuring financial security in retirement, a matter of economic justice and a fundamental component of social stability and gender equality. By illuminating persistent inequalities in pension income, this study aims to provide valuable insights that can inform policy debates and contribute to ongoing efforts toward creating fairer and more inclusive retirement systems.

Thesis Structure Overview

This thesis is organized into seven chapters, each addressing a distinct aspect of the research on the GPG and its implications across Europe. Understanding the GPG is crucial for addressing systemic inequalities that affect women's financial security in retirement. This research aims to provide valuable insights into the factors contributing to these disparities, utilizing innovative methodologies to analyse empirical data. The following sections outline the content and focus of each chapter, providing a roadmap for understanding the complexities of gender-based pension disparities.

- **Chapter 1: Introduction and Background of Study**: This chapter sets the stage for the research by providing historical, social, and economic context. It introduces the research aims, objectives, and questions, and outlines the conceptual framework guiding the study.

- **Chapter 2: Literature Review & Theoretical Framework. The Blinder-Oaxaca Decomposition Method**: This chapter explores existing research on gender inequalities in pension systems, critiques theoretical perspectives, and discusses methodological approaches. It introduces the Blinder-Oaxaca Decomposition method as a key analytical tool.
- **Chapter 3: Research Methodology and Data Collection**: This chapter details the research design, including data sources, sample selection, and variable definitions. It also explains the analytical techniques used to examine the GPG.
- **Chapter 4: Analysis and Findings**: This chapter presents empirical findings, exploring gender disparities in pension income across European countries and examining variations across pension income categories and demographic groups.
- **Chapter 5: Multivariate Regression Model**: This chapter applies regression analysis to assess the impact of gender on pension income while addressing limitations and contextual differences across European countries.
- **Chapter 6: Blinder-Oaxaca Decomposition Method**: This chapter conducts a decomposition analysis to quantify the extent to which gender disparities in pension income can be explained by observable factors versus unobserved biases.
- **Chapter 7: Conclusion**: The final chapter synthesizes the key findings, discusses their implications for policy and research, highlights contributions, and identifies areas for future investigation.

1.2 Research context and background

Over 25 years have passed since the United Nations adopted the Beijing Declaration, a pivotal framework to advance gender equality globally (European Parliament, 2020). In Europe, governments and private organizations have taken significant steps to narrow the GPG. These measures include promoting equal pay and career opportunities for women, encouraging retirement savings, and supporting caregivers. However, despite these efforts, substantial gender-based disparities persist. These inequalities reflect broader financial and social challenges that affect women disproportionately, both in developed and developing countries. Economic disparities remain pronounced among older adults, leaving many—especially women—without adequate access to wealth, resources, or stable employment opportunities (UNDESA, 2016).

The GPG represents the difference in retirement savings accumulated by men and women. Across Europe, the GPG remains substantial, with pensions for women aged 65 and older in the European Union (EU) on averaging 30% lower than those of men in 2018, compared to a 34% gap in 2010 (Eurostat, 2018). Measuring and analysing the GPG, however, is not straightforward. Researchers face challenges due to the variety of theoretical frameworks and computational methods used to assess this disparity (Posadas et al., 2017). Despite these challenges, the persistence of the GPG underscores the structural inequalities embedded within labor markets and retirement systems.

Globally, many individuals strive for sufficient retirement income to achieve a secure and comfortable old age. Yet, this remains an unattainable goal for most. Only a minority of the population accumulates enough savings or assets to ensure economic security in later life, with many depending on family support or public pensions, where such systems exist (UNDESA, 2016).

In Europe, the GPG is primarily driven by the gender pay gap, which refers to the disparity in average earnings between men and women. Women's lower incomes reduce their capacity to save for retirement, compounding over time into significant disparities. Additionally, women are more likely to work part-time or occupy lower-paying roles. Caregiving responsibilities, such as caring for children or elderly relatives, often force women to leave the workforce temporarily, further limiting their earning potential and retirement savings.

Addressing the GPG requires targeted policies to tackle these root causes. Strategies such as enhancing caregiver credits in pension systems, ensuring equal pay, and creating pathways for women to access higher-paying roles can contribute to reducing disparities. Bridging the GPG is not just a matter of financial equity but a crucial step toward achieving gender equality and ensuring a secure and dignified retirement for all.

1.3 Problem Statement, Research Aims, Objectives, Questions, and Hypotheses

1.3.1 Problem Statement

Despite decades of progress toward gender equality in employment and earnings, women across Europe continue to face substantial disadvantages in retirement income. The GPG, the disparity in pension income between men and women, remains a persistent form of economic inequality that reflects the cumulative effects of gendered life-course patterns, unequal labour market participation, and institutional pension design. While the gender pay gap has received widespread attention in both policy and academic circles, the GPG has been comparatively overlooked, even though the disparities it captures are often greater in magnitude and longer lasting.

In the European Union, women's average pension income is approximately 30–40% lower than that of men, with even higher gaps in some member states such as Luxembourg, Malta, and the Netherlands (European Parliament, 2017; EIGE, 2023). This inequality cannot be explained by pay differences alone. It is shaped by a combination of factors, including women's greater likelihood of part-time work, lower lifetime earnings, career breaks due to caregiving responsibilities, and longer life expectancy. Yet these are only part of the story. The design of pension systems themselves—how benefits are accrued, who qualifies, and how entitlements are calculated—plays a significant role in reproducing gendered outcomes.

Existing research on the GPG has provided important descriptive insights, particularly in relation to public pension systems. However, much of the literature remains narrowly focused. Analyses often concentrate on state pensions while overlooking the growing role of occupational schemes, private savings, and non-labour income sources in shaping financial security in retirement (Plan.be, 2018; Nolan, 2019). These sources can either amplify or help mitigate gender disparities, yet they are rarely considered in mainstream pension inequality research.

A further limitation lies in the lack of longitudinal, cross-national analysis. Pensions reflect long-term processes—earnings, contributions, employment breaks—and are not easily understood through snapshot data. Although datasets such as SHARE and ELSA provide the tools for life-course analysis, few studies have taken advantage of their full potential to explore how pension inequalities evolve over time or vary across institutional settings (Dekkers, 2022). This leaves important questions unanswered about how policies and systems either reinforce or alleviate gender-based disadvantage in retirement.

Moreover, there has been insufficient attention to the institutional logic of pension systems themselves. Many European pension schemes remain rooted in male-breadwinner models, rewarding continuous full-time employment and penalising fragmented or part-time careers—patterns that are more common among women (Bettio et al., 2013; Haitz, 2015). Even when women accumulate similar working years to men, differences in earnings histories and pension formulas can result in significantly lower entitlements.

From a broader societal perspective, these gaps have far-reaching implications. Women’s lower pension income increases their risk of poverty in old age, especially among those who are widowed, divorced, or living alone (European Commission, 2019). This not only limits access to healthcare, secure housing, and financial independence, but also contributes to increased reliance on family support and public welfare systems.

The GPG also has intergenerational effects: older women with limited financial means are less able to support children or grandchildren, compounding economic vulnerability across generations (Foster, 2020). Ultimately, the GPG is not only a matter of fairness—it raises fundamental questions about the sustainability, equity, and inclusiveness of pension systems in an ageing Europe.

This thesis responds to these gaps by offering a cross-national analysis of the GPG across 27 European countries and Israel, using SHARE data from 2004 to 2017. Unlike many prior studies, it disaggregates pension income into public, occupational, private, and household-derived sources, and incorporates secondary income streams such as rental income and savings. This allows for a more comprehensive picture of gendered financial security in retirement. It also applies Cohen's d effect size—a technique not used in pension research—to better quantify the magnitude of observed disparities, and uses the Blinder-Oaxaca decomposition to explore the extent to which pension gaps are explained by observable factors versus residual, potentially structural elements.

In doing so, this research offers new empirical evidence on the structural and institutional drivers of the GPG, while also broadening the analytical lens typically applied to pension inequality. It contributes to a growing but still fragmented literature on gender and ageing and provides practical insights for policymakers seeking to design more inclusive and gender-sensitive pension systems.

1.3.2 Aims of Research

Given the complex and multi-dimensional nature of gender-based pension disparities across Europe and Israel, this study is structured around two overarching aims. These aims reflect the dual intention of the research: first, to deepen theoretical and empirical understanding of the GPG, and second, to generate meaningful insights that can inform future policy interventions and promote greater equity in retirement systems. The use of cross-national data allows for a comparative and dynamic perspective that goes beyond static national analyses.

1. **To investigate the structural and systemic drivers of the GPG across Europe and Israel**, focusing on how pension system features, labor market dynamics, and secondary income sources shape gender disparities in retirement income.
2. **To contribute robust empirical evidence that supports equitable pension reform**, using cross-national, longitudinal data and innovative statistical tools to inform both academic debate and policy development on gender inequality in retirement systems.

These aims have been fully addressed through the empirical analyses and discussions presented across the thesis, particularly by applying established and novel methods—such as the Blinder-Oaxaca decomposition and Cohen's *d* effect size—to assess both the extent and underlying causes of the GPG. The study's broad geographical and temporal coverage enhances the generalisability of its conclusions while also providing targeted insights for national-level reform.

1.3.3 Objectives and Hypotheses

This research aims to provide valuable insights into how gender-based inequalities in pensions evolve and how they are influenced by labor market dynamics, pension system structures, and secondary income sources. These aims are articulated through four core objectives, each corresponding to a hypothesis.

Objectives of the Research:

To achieve these aims, the study pursues the following objectives:

- To quantify the magnitude of the GPG across 27 European countries and Israel from 2004 to 2017, identifying temporal trends and country-specific variations using harmonised data from SHARE.
- To examine the impact of gendered labor market trajectories—such as part-time work, interrupted careers, and occupational segregation—on pension accumulation and retirement outcomes.
- To assess the role of pension system features (e.g. accrual formulas, eligibility conditions, survivors' benefits, redistributive rules) in amplifying or mitigating gender-based disparities.
- To explore whether the GPG can be fully explained by observable socio-economic and demographic characteristics, or whether a residual unexplained gap persists, potentially signalling systemic discrimination.
- To evaluate the contribution of secondary income sources (e.g. rental income, financial assets, private savings) in closing or widening the GPG, accounting for household-level financial diversity.

- To apply Cohen's *d* effect size to pension income data, offering an additional lens for interpreting the magnitude and practical significance of gender differences in retirement outcomes.
- To offer comparative insights and policy recommendations for designing more inclusive pension systems that promote financial security and gender equity in retirement.

These objectives form the basis of the thesis structure and guide its methodological approach. All have been empirically examined and are revisited in the discussion and conclusion chapters.

Hypotheses of Research

This research is guided by four hypotheses, which form the basis of statistical and theoretical analysis. These hypotheses are presented in Table 1.1 below:

Table 1.1. Hypotheses of Research.

Hypothesis ID	Null Hypothesis (H_0)	Alternative Hypothesis (H_1)
1	Pension income is distributed equally between men and women.	Women receive lower retirement income than men, indicating a GPG.
2	The GPG has remained unchanged over the past 16 years (2004–2017) across 27 European countries.	The GPG has narrowed between 2004 and 2017 across 27 European countries.
3	There is no gender-based difference in how various socio-economic and demographic factors affect net pension income.	Socio-economic and demographic factors have a differential impact on NPI between genders, with women experiencing more adverse effects.
4	Women and men are equally valued within the same pension system, with no evidence of discrimination.	Women are less valued than men in the same pension system, indicating systemic discrimination.
5	Secondary income sources (e.g., property rentals, financial assets, and savings) have no impact on narrowing the GPG.	Secondary income sources significantly influence the GPG.

Source: Author's Own research hypothesis.

1.3.4 Key Research Questions

The research is guided by the following questions:

- What is the magnitude and variation of the GPG across Europe and Israel between 2004 and 2017?
- How do pension system structures and labor market histories influence the accumulation of pension rights and outcomes for men and women?
- To what extent can observed disparities in pension income be explained by measurable factors, and what remains unexplained?
- Do secondary income sources mitigate or reinforce the pension gap between genders?
- What is the practical (economic) significance of gender differences in pension income as measured by Cohen's *d*?

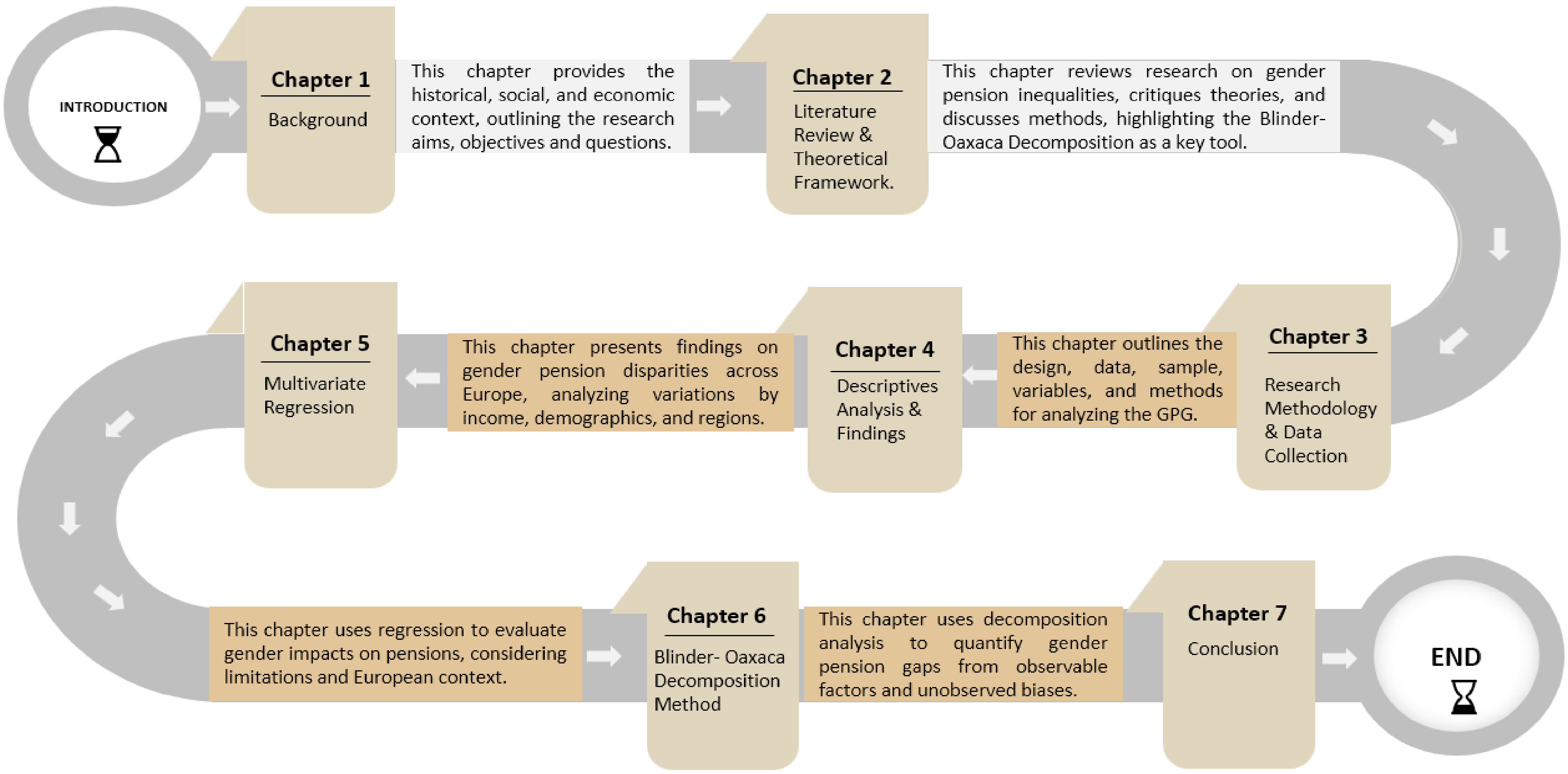
These questions underpin the analytical chapters of the thesis and are systematically addressed through the empirical results. Chapter 7 explicitly discusses how each of the research questions and hypotheses has been answered.

1.4 Structure of the Thesis

The roadmap below illustrates the journey of the research, starting with the historical, social, and economic context and progressing through key analytical steps to address the GPG. The study builds on the framework set by global efforts, such as the Beijing Declaration, to highlight persistent disparities in pension outcomes between men and women. Despite significant advancements in promoting equal pay, supporting caregivers, and encouraging retirement savings, substantial inequalities persist.

The chapters guide readers through an exploration of the GPG, presenting the aims, objectives, and theoretical frameworks, followed by empirical analyses using advanced methodologies such as regression and decomposition techniques. Each chapter is designed to provide insights into the structural and systemic factors driving the GPG, including labor market inequalities, pension system rules, and the role of secondary income sources. The study emphasizes the need for targeted policies and reforms to achieve greater gender equality in retirement outcomes, ensuring a secure and equitable future for all.

Figure 1.1: A Research Road Map



Source: Author's own research roadmap.

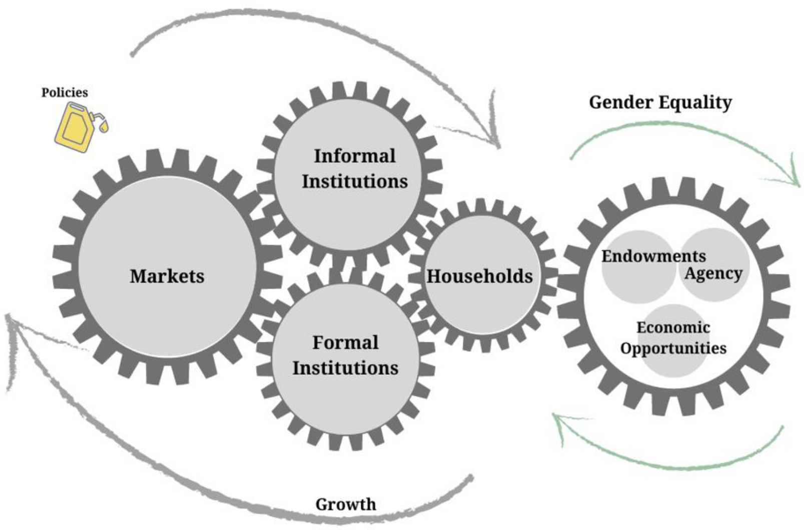
Additionally, the framework presented below in Figure 1.2 illustrates a comprehensive approach to understanding and analysing gender equality through the interconnected roles of markets, institutions (formal and informal), and households. These components collectively influence both growth dynamics and policy outcomes, with their interactions forming the foundation for the achievement of gender equality.

At its core, the framework emphasizes the critical role of endowments, agency, and economic opportunities. Endowments refer to foundational assets such as education, health, and financial resources that shape individuals' capacity to participate in society. Agency reflects the ability of individuals—especially women—to make decisions and act independently, while economic opportunities focus on addressing structural barriers to workforce and economic participation. The framework highlights that progress in these areas is deeply intertwined, and any advancement requires an integrated approach across all levels of the system.

Policies are positioned as key drivers, feeding into markets and institutions to align societal and economic systems with the overarching goal of achieving gender equality. Meanwhile, growth is depicted not merely as an outcome but as a factor that both influences and is influenced by progress toward equality, emphasizing the reciprocal nature of this relationship.

Further analysis of the framework reveals its adaptability to various contexts, particularly in understanding the persistent gender pension gap. By considering the unique roles played by formal and informal institutions, markets, and household dynamics, this framework serves as a valuable tool for dissecting the root causes of economic disparities. It also provides a lens to explore the influence of policies and societal structures in either perpetuating or reducing inequality. This deeper analysis underscores the importance of targeted interventions and a multidimensional strategy to design equitable systems that empower women economically and socially.

Figure 1.2: Framework for analysing Gender Equality.



Source: Own Graph, based on World Bank 2012b.

1.5 Contributions and Value-Added by the Empirical Analysis.

This study makes several key empirical contributions to the field of gender inequality and pension economics across European Countries & Israel, most important of which are as follows:

- **Innovative use of Cohen's d effect size:** This thesis is one of the first to apply Cohen's d to the context of gender pension disparities in Europe. By doing so, it moves beyond the traditional reliance on statistical significance alone and introduces a clearer interpretation of the *economic importance* of observed differences in pension outcomes. This shift aligns with the policy orientation of gender analysis and adds meaningful depth to comparisons across countries.

- **Cross-national dataset usage:** This research draws on many years of data (2004–2017) from the SHARE survey, covering 27 EU countries and Israel. This rich, multi-country dataset allows for an in-depth examination of both temporal trends and cross-national variation in the gender pension gap (GPG). By analysing changes over time and across borders, the study identifies which countries have made progress in reducing the gap and where persistent disparities remain. In contrast to studies focusing on a single pension metric, this thesis considers four distinct types of pensions—public, private, work-related, and household-influenced sources—each derived from variables aggregated across multiple dimensions. This approach not only enables a clearer view of annual improvements or declines in pension equality but also allows for a more granular understanding of how different pension types behave over time. The analysis provides a robust foundation for cross-country comparisons and contributes to a more comprehensive understanding of how various income sources interact to shape gendered pension outcomes.
- **Integration of secondary income factors:** The analysis uniquely incorporates non-pension income sources such as rental income, financial assets, and long-term savings. By doing so, it expands the analytical scope of traditional pension inequality studies, recognizing that gender-based financial security in old age is shaped not only by labor market participation but also by differential access to wealth accumulation and asset ownership.

- **Empirical validation through the Blinder-Oaxaca Decomposition:** While the Blinder-Oaxaca decomposition is a well-established method in gender economics, this thesis contributes by confirming its continued relevance and applicability to contemporary pension inequality research. The analysis replicates and reinforces earlier findings using a cross-national dataset and an updated timeframe, encompassing diverse pension systems across Europe and Israel. Despite applying model specifications in line with previous studies, the results consistently show that a considerable share of the gender pension gap remains unexplained by observable characteristics. This alignment with the existing literature strengthens the credibility of prior conclusions and reaffirms the presence of structural inequities in pension outcomes. By situating these findings within a multi-country context, the study enhances the robustness and generalizability of the decomposition method's insights.
- **Methodological rigor with real-world policy relevance:** The quantitative methods employed in this research—particularly the decomposition analysis and use of effect sizes—offer more than statistical insight; they highlight how specific pension system rules and policy structures may contribute to widening or reinforcing gender disparities. By comparing outcomes across diverse institutional settings, the thesis identifies patterns that are not just theoretically important but directly relevant to policy design. The findings inform targeted recommendations aimed at both EU and national levels, supporting efforts to improve fairness and inclusivity in retirement systems. These policy considerations are grounded in the data and are intended to help shape practical reforms that address the needs of groups most at risk of financial insecurity in later life, especially women.

Together, these contributions address significant gaps in the literature and enhance the practical value of empirical research for addressing gender-based financial disparities in later life.

1.6 Summary of the Chapter

This chapter has provided a foundation for the study by introducing the context and rationale for investigating the Gender Pension Gap (GPG) in Europe. It began by exploring the socio-economic background and persistent gender inequalities in retirement income, despite longstanding policy interventions aimed at achieving gender equality.

The chapter framed the GPG as a complex, multi-dimensional issue shaped by structural, institutional, and demographic factors—such as occupational segregation, unequal caregiving burdens, labour market dynamics, and pension system design. It presented the research problem, aims, objectives, and hypotheses, each carefully linked to the empirical strategy employed throughout the thesis.

Key research questions were outlined to guide the analysis, focusing on the extent and drivers of the GPG, its progression over time, and the roles of systemic discrimination and secondary income sources. A conceptual framework was introduced to illustrate the interplay between market forces, institutional design, and household-level dynamics in shaping gendered pension outcomes.

The chapter concluded with an outline of the analytical tools, data coverage, and empirical depth of the study—highlighting how the research contributes to the literature through innovative methodological choices and cross-national analysis, and how it offers insights that are both academically robust and relevant for public policy.

In summary, Chapter 1 establishes the analytical and conceptual groundwork for the thesis. It defines the scope, significance, and originality of the research, setting the stage for the empirical chapters that follow.

Chapter 2: Literature Review and Theoretical Framework: The Blinder-Oaxaca Decomposition Method

2.1 Introduction

The GPG represents a critical and persistent indicator of economic inequality, reflecting the cumulative disadvantages women face throughout their working lives. Rooted in deeply embedded structural inequalities within pension systems and labor market dynamics, the GPG is shaped by a combination of social, economic, and institutional factors. These disparities extend beyond individual career decisions, encompassing systemic issues such as occupational segregation, unpaid caregiving labor, and the design of pension systems that often fail to account for women's non-linear career paths.

This literature review critically examines the limitations of European pension systems in addressing these disparities, with a particular focus on the shift from defined benefit to defined contribution schemes and the insufficiencies of pension credits for caregiving. It evaluates how existing systems reinforce inequalities, leaving many women at a significant financial disadvantage in retirement.

The chapter also challenges traditional theoretical frameworks, such as Human Capital Theory, which often attribute gender disparities to differences in education, skills, and career interruptions. By critiquing these models, the review highlights their inadequacy in capturing the broader structural barriers and systemic discrimination that perpetuate pension inequalities.

Furthermore, the role of the gender pay gap is explored as a precursor to the GPG, emphasizing how wage disparities during working life translate into compounded financial disadvantages in retirement. Women’s overrepresentation in lower-paying sectors, higher likelihood of part-time employment, and interruptions for caregiving responsibilities are examined as key drivers of this phenomenon.

In addition to dissecting these issues, the review considers their broader implications and potential policy interventions. It highlights the need for comprehensive reforms, such as enhanced caregiver credits, promotion of women’s participation in higher-paying industries, and the development of pension systems that recognize and compensate for unpaid labor.

Through this critical analysis, the chapter provides a nuanced understanding of the GPG and lays the groundwork for the empirical analysis to follow. It underscores the importance of addressing systemic and structural barriers to achieve gender equality in pension outcomes, ensuring economic security for future generations.

2.2 Gender Inequalities in Pension Systems in European Countries

2.2.1 The Shift from Defined Benefit to Defined Contribution Pension Schemes

The shift from Defined Benefit (DB) to Defined Contribution (DC) pension schemes represents one of the most significant structural changes in European pension systems over the past few decades. While this transition was primarily driven by financial sustainability concerns and demographic ageing, it has also had profound implications for gender equality in retirement income. Crucially, this shift is not gender-neutral—it has disproportionately disadvantaged women and contributed to the widening of the GPG.

In DB schemes, retirement benefits are typically calculated based on a formula that considers years of service and final (or average) salary, offering a degree of income security and risk pooling. These schemes provide predictable income streams and tend to protect against volatility in individual earnings or investment markets. By contrast, DC schemes tie pension income directly to individual contributions and investment returns over the life course, transferring the financial risk from the employer or state to the individual (Ginn, 2004; OECD, 2021).

This individualisation of pension outcomes inherently disadvantages women, who are more likely to experience interrupted employment, lower lifetime earnings, and part-time work due to disproportionate caregiving responsibilities (Jefferson, 2009; Bettio et al., 2013). In DB systems, the use of averaging or final salary-based calculations and collective risk-sharing somewhat cushions the effects of lower earnings or non-linear careers. In DC systems, however, each contribution gap or reduction directly reduces the final pension pot, with no built-in redistribution or protection.

Consequently, the cumulative effect of gendered work patterns is magnified in DC environments.

Empirical evidence across European countries supports these theoretical concerns. In **Germany**, the gradual shift toward greater reliance on DC-type occupational and private pensions has been linked to growing gender disparities in retirement income. Hammerschmid and Rowold (2019) found that women in Germany, particularly those who took time out of the workforce for caregiving, accumulated significantly less pension capital than men, even when controlling for education and occupational level. This was largely due to the actuarial neutrality of DC schemes, which offer no compensation for time spent out of the labour market.

The **Netherlands** provides another illustrative example. Although the Dutch pension system is often considered one of the most generous and efficient in Europe, its occupational pension schemes—while quasi-mandatory and DC in nature—are strongly earnings-related and actuarially neutral. This means that women who work part-time or have career interruptions for caregiving accumulate significantly lower supplementary pensions than men. Research by Bosch, Deelen, and Euwals (2018) shows that even with near-universal pension coverage, Dutch women’s second-pillar pension rights are, on average, 40% lower than men’s due to persistent differences in earnings and career patterns. The Dutch system highlights that high coverage alone is insufficient; the structure and rules of pension accumulation matter greatly in reproducing or mitigating gender inequalities.

Sweden offers a partial contrast. While it has moved toward a Notional Defined Contribution (NDC) model for public pensions, it also maintains strong redistributive features, including a guaranteed pension floor and pension credits for childcare and caregiving periods. These mechanisms have mitigated, but not eliminated, the gender gap. According to the OECD (2021), while Swedish women still receive lower pensions than men, the gap is narrower than in countries with weaker redistributive measures.
In addition to exacerbating the effects of interrupted employment, DC schemes tend to disadvantage individuals who are less financially literate or more risk-averse—traits disproportionately observed among women due to historical exclusion from financial decision-making and gendered social norms (Sierminska et al., 2022). As a result, women are less likely to invest in higher-return assets, and their pension outcomes may suffer not only from lower contributions but also from more conservative investment strategies.

Moreover, the design of DC schemes often fails to account for gendered differences in life expectancy. Since women tend to live longer, their pension capital must stretch over more years. In systems without gender-specific annuitisation or appropriate longevity protection, this leads to lower annual payouts for women, even when they have saved similar amounts (OECD, 2021).

From a policy perspective, the shift toward DC schemes has increased the need for gender-sensitive pension design. Redistribution mechanisms, such as minimum pensions, contribution top-ups for low earners, or credits for caregiving, become crucial in offsetting the regressive tendencies of purely actuarial DC systems. However, as Jefferson (2009) and D'Addio (2012) argue, these features are either weak or inconsistently applied across most European systems, leaving many women exposed to poverty risks in old age.

In sum, the transition from DB to DC pension schemes has fundamentally altered the way pension wealth is accumulated and distributed, with negative consequences for gender equity. While DB systems partially insulated women from labour market inequalities through built-in redistributive mechanisms, DC systems amplify those inequalities by making pension outcomes more sensitive to each euro earned and each week worked. As such, this structural shift has become a key contributor to the persistence and growth of the Gender Pension Gap across Europe.

2.2.2 The Role of Caregiving and Unpaid Labor

Caregiving continues to play a central role in shaping pension inequality across Europe and Israel. While policies promoting gender equality in the labour market have gained traction in recent decades, unpaid care—whether for children, elderly parents, or other dependents—remains disproportionately carried out by women. These responsibilities often lead to career interruptions, part-time employment, or delayed re-entry into the workforce, all of which have long-term implications for pension accumulation.

Importantly, the pension system's treatment of unpaid care is neither consistent nor comprehensive. In some countries, pension credits are offered to recognise caregiving periods, but the extent to which these provisions actually offset lost earnings and missed contributions varies considerably. Even where these credits exist, they rarely address the full scale of financial disadvantage that accumulates over a woman's working life.

In **Germany**, for example, caregivers are credited with up to three years per child, calculated at a standard rate. While this offers some protection, it does not compensate for lower subsequent earnings, missed career advancement, or pension losses tied to occupational schemes. The system also does not cover time spent caring for elderly or disabled family members, despite the increasing significance of this form of care (D'Addio, 2012).

Austria applies a similar approach. Credits for early childhood years exist, but they are modest and expire after a short duration. The structure assumes short-term breaks and does little to accommodate long-term or recurrent caregiving over the life course, particularly for those caring for frail or ageing relatives. This narrow framing reinforces existing inequalities among women with different caregiving patterns (OECD, 2021).

France provides more extensive birth-related credits, especially for mothers with multiple children. However, these benefits are not always earnings-related and are more accessible to women in formal, stable employment. Women in part-time or precarious roles—who are disproportionately caregivers—often benefit less from such measures, meaning the GPG persists despite generous headline policies (Bettio et al., 2013).

In contrast, **Sweden** offers a more inclusive approach. Pension credits are earnings-based and granted for up to four years per child. They are designed to maintain pension rights during caregiving and can be claimed by either parent, though women still use them more frequently. The system also includes a guaranteed minimum pension for low contributors. While these measures have helped reduce pension inequality, differences still emerge in private and occupational pension outcomes (Bettio and Verashchagina, 2020).

Israel presents a more limited case. Although maternity leave is partially recognised in social insurance, there is no comprehensive system of pension credits for unpaid caregiving beyond this. The high rate of part-time work among women, coupled with weak redistributive elements in the pension system, contributes to significant gender gaps in retirement income (Stier and Herzberg-Druker, 2017).

What these examples reveal is that while caregiving credits are a useful tool, they are not a solution on their own. In most cases, they apply narrowly to early childcare, overlook eldercare, and do not reflect the long-term opportunity costs associated with caregiving careers. Moreover, credits tend to be flat rate, failing to account for differences in earnings levels, job quality, or cumulative career effects.

There is also a deeper issue: many pension systems still view caregiving as a deviation from the standard employment path, rather than as a form of essential, productive labour. As long as care continues to be treated as secondary or private, policies will remain piecemeal, and their effectiveness in closing the GPG will be limited.

In summary, unpaid caregiving significantly contributes to gendered pension outcomes, and while crediting mechanisms exist in many systems, they are often narrow, short-term, and insufficient. More comprehensive reforms are needed—ones that recognise the full range of caregiving, account for its lifetime impact, and integrate care more fully into pension entitlement frameworks.

2.2.3 Occupational Segregation and Part-Time Work

Occupational segregation and part-time employment are two of the most persistent and empirically documented contributors to the GPG in Europe. Both are shaped by gendered labour market structures that constrain women's lifetime earnings and, by extension, their pension entitlements.

Occupational segregation—defined as the unequal distribution of women and men across sectors and roles—limits women's access to high-income occupations and more generous pension schemes. Across Europe, women are overrepresented in care-related and public sector jobs such as healthcare, education, and administration, which tend to be lower paid and offer more modest occupational pensions (Bettio et al., 2015). In contrast, male-dominated sectors like finance, engineering, and ICT not only offer higher salaries but also provide more robust employer-sponsored pension plans, especially under DB systems.

This segregation is not purely the result of personal choice. It is reinforced by social norms, gendered expectations, and labour market policies that have historically undervalued feminised work (Rubery & Tavora, 2017). Importantly, in DC schemes—now widespread across Europe—lower salaries and limited bonuses result in lower contributions, directly reducing pension wealth. Moreover, career progression in these sectors is often limited, compounding the disadvantage over time.

Part-time work amplifies this inequality. Women are significantly more likely to work part-time than men, often due to caregiving responsibilities and insufficient state-supported care services. In 2021, nearly 30% of employed women in the EU worked part-time, compared to just 8% of men (Eurostat, 2022). Part-time contracts typically offer lower hourly wages, limited career development, and reduced pension contributions. In some cases, part-time workers are even excluded from occupational pension schemes altogether due to contribution thresholds (EIGE, 2020).

Evidence from Austria illustrates these dynamics: despite statutory pension reforms, women's reliance on part-time jobs and their overrepresentation in low-income sectors has led to a persistent and large GPG, particularly under the notional DC structure of the second pillar (Fink, 2014). In the Netherlands, where occupational pensions are widespread, gender gaps in accrual rates remain substantial because women are more likely to be in lower-tier jobs with minimal employer contributions (Keune, 2021).

A cross-national study by Dessimirova and Bustamante (2019) found that two of the strongest determinants of the GPG across Europe were women's greater participation in part-time work and shorter working careers. The authors argue that policies focused solely on increasing retirement age or improving financial literacy are unlikely to close the gap without also addressing labour market segmentation.

Furthermore, the pension penalties of occupational segregation and part-time work are cumulative and systemically embedded. Even where pension rights are technically equal, gendered employment patterns translate into unequal outcomes—a point often obscured in traditional actuarial approaches. Theoretical perspectives such as *structural discrimination theory* help frame these disparities as consequences of institutional design, rather than personal shortcomings (Lewis & Giullari, 2005).

These insights reinforce the value of empirical approaches—like those in this thesis—that combine longitudinal labour histories with pension outcomes. Using SHARE data, this study is well positioned to trace how sectoral employment patterns and part-time work histories contribute to gendered pension outcomes across different European institutional settings.

2.2.4 Gender Pay Gap as a Precursor to Pension Disparities

The gender pay gap is a well-established and foundational driver of long-term pension inequality. Although frequently analysed in isolation, its role as a precursor to the GPG is increasingly recognised in European studies. Lower earnings during a woman's working life led to lower pension contributions, particularly under defined contribution (DC) schemes where final pension wealth is directly tied to individual income histories (Bettio et al., 2015; OECD, 2021).

The GPG compounds over time: not only are women paid less on average, but their earnings tend to peak earlier, rise more slowly, and are more frequently interrupted by unpaid caregiving or part-time work. Consequently, their accumulated pension wealth is substantially reduced by retirement age. As Frericks and Maier (2020) note in their analysis of German and Dutch pension systems, even moderate wage inequalities at early career stages can lead to significant pension shortfalls decades later due to compounding effects.

Research by Arulampalam, Booth, and Bryan (2007) shows that even in countries with relatively narrow gender wage gaps, pension disparities remain significant highlighting the multiplier effect of long-term pay inequality. Similarly, a study by Tinios et al. (2015)

found that countries with fragmented labour markets and limited pension redistribution mechanisms (e.g. Austria, Luxembourg) experience particularly high pension gaps despite average wage gaps that are not always the largest.

The 2019 report by the European Parliament underscores that men's average pensions in the EU are over 30% higher than women's. While part of this reflects differences in employment duration and sector, a significant portion stems directly from the cumulative effect of lower female wages. Moreover, the wage gap itself often reflects occupational segregation, care-related career breaks, and discriminatory practices—factors that are compounded within pension formulas (European Parliament, 2019; EIGE, 2020).

The theoretical framework of cumulative disadvantage (Dannefer, 2003) is especially relevant here. It suggests that small disparities at the start of working life (e.g. initial wage differences) widen into major inequalities over time, particularly in institutional systems that lack compensatory mechanisms. Most European pension systems—especially those moving toward DC models—do not adequately redistribute to offset these wage-related disadvantages, which disproportionately affects women.

Empirical studies further support this. In Israel, despite high female labour force participation, persistent wage gaps have translated into a widening gender pension gap, particularly in private pension accounts where returns depend on contribution levels and investment choices (Stier and Herzberg-Druker, 2017). Without targeted interventions that address both pay and pension structures simultaneously, wage inequality will continue to drive retirement insecurity among women.

This thesis contributes to the literature by empirically tracing these compounding effects using SHARE data across 27 European countries and Israel. By incorporating both income history and pension outcomes, the analysis reveals how early-career wage inequality reverberates across the life course—ultimately shaping gendered financial outcomes in retirement.

2.2.5 Discrimination in Pension Outcomes

While observable factors—such as education, working hours, or employment sector—explain part of the GPG, a significant portion remains unexplained even after controlling for these variables. This residual disparity is widely interpreted in the literature as a sign of **systemic or institutional discrimination**, rooted not in individual choices but in the ways pension systems are structured and operated (Bettio et al., 2015; OECD, 2021).

One of the most prominent tools for revealing this discrimination is the **Blinder-Oaxaca decomposition method**, which disaggregates income differentials into "explained" and "unexplained" components. Research using this method across European countries consistently finds that a considerable share of the GPG cannot be attributed to measurable characteristics. For instance, in Austria and Belgium, studies show that over 30% of the pension gap remains unexplained even after accounting for education, tenure, and work patterns—suggesting that gendered institutional design is at play (Chłoń-Domińczak et al., 2018; Dessimirova and Bustamante, 2019).

Structural discrimination is particularly apparent in how pension eligibility rules and benefit formulas intersect with gendered life courses. Many European pension systems are implicitly designed around uninterrupted, full-time careers—an employment trajectory more common among men. Women, who are more likely to work part-time or take career breaks for caregiving, often fail to meet contribution thresholds or face reduced benefits. This is especially visible in systems like Germany's, where the formula penalizes gaps in employment despite the presence of limited pension credits for caregiving (Frericks and Maier, 2020).

Indirect discrimination also surfaces through actuarial assumptions. While some private or occupational pension schemes apply gender-neutral contribution rules, they often use life expectancy-based adjustments that result in lower annual benefits for women due to their longer average life spans. Although actuarially 'fair' on paper, such adjustments disproportionately reduce women's pension income and worsen post-retirement inequality (OECD, 2021).

Moreover, **survivor benefits**—a key redistributive tool—vary significantly across countries. In many systems, widows may inherit only a fraction of their deceased spouse's pension, and remarriage can lead to forfeiture of rights. These rules often reflect outdated gender roles and penalize women for life decisions over which they have limited control (EIGE, 2020).

Even in countries with strong welfare states, such as Sweden and Finland, research has found that **normative pension design**—favouring lifelong, linear employment—is slow to adapt to gender-equalizing policy reforms (Ylöstalo and Attil, 2022). The persistence of unexplained gaps in these contexts further supports the view that discrimination is embedded within institutional norms, not just wage-setting or labour market behavior.

This study seeks to quantify the **unexplained component** of the GPG using the Blinder-Oaxaca decomposition across 27 European countries and Israel. By applying this method at scale and incorporating disaggregated income sources, the thesis aims to provide robust evidence of how discrimination—both direct and institutional—continues to shape pension outcomes even when observable factors are held constant.

2.2.6 Secondary Income Streams and Pension Outcomes

Secondary income streams, such as rental income and investment returns, have mixed effects on the GPG. Research by Jefferson (2009) suggests that while rental income has the potential to narrow pension disparities, the unpredictable nature of financial returns and long-term savings limits their ability to consistently reduce the gap.

A study examining the gender wealth gap in Europe found that differences in pension wealth are a major contributor to overall wealth disparities between men and women. The study highlighted that women's lower participation in financial markets and lower levels of financial literacy contribute to less favorable investment outcomes, thereby limiting the effectiveness of secondary income streams in mitigating the GPG (Sierminska et al., 2022).

2.3 Critiquing the Human Capital Theory

Human Capital Theory (Becker, 1964) has traditionally been used to explain gender disparities in wages and pensions by attributing differences in earnings to varying levels of investment in education, skills, and work experience. According to this theory, women’s lower pension outcomes can be explained by their reduced investment in human capital, often due to career interruptions for childbirth and caregiving (Blau & Kahn, 2017). However, this framework oversimplifies the issue, as it fails to address the broader structural and societal factors that drive gender inequality.

Critics of Human Capital Theory argue that the model overlooks key issues such as workplace discrimination, occupational segregation, and the societal norms that limit women's opportunities for advancement, even when they have equivalent levels of education and experience to their male counterparts (England & Folbre, 2005). Women often find themselves overrepresented in lower-paying sectors and underrepresented in leadership positions, compounding their financial disadvantages over a lifetime.

Furthermore, Human Capital Theory does not account for occupational segregation, where women are clustered in industries like healthcare, education, and social services—sectors characterized by lower wages and less favourable pension schemes compared to male-dominated fields such as finance and engineering (Folbre, 2013). This occupational sorting is not solely the result of individual choice but reflects societal expectations and systemic barriers that steer women toward lower-paid work. By focusing on personal agency, Human Capital Theory neglects these broader structural inequalities, making it an incomplete framework for understanding the GPG.

Understanding the limitations of Human Capital Theory is crucial for interpreting the findings of this analysis on the GPG across European countries. While the theory provides valuable insights into how differences in education, work experience, and career interruptions affect pension outcomes, it falls short in explaining the persistent disparities observed in our data, even after controlling for these factors. The structural and societal factors highlighted by critics—such as occupational segregation, workplace discrimination, and gendered expectations around caregiving—align closely with the unexplained portion of the pension gap identified in our statistical models. This analysis seeks to move beyond the individual-level explanations of Human Capital Theory by incorporating these broader systemic factors, offering a more nuanced understanding of how gender inequalities in pensions are perpetuated across diverse European contexts. In doing so, this research contributes to policy discussions by underscoring the need for structural reforms that address not only women's individual career choices but also the institutional and societal barriers they face throughout their working lives.

2.4 The Gender Pay Gap and Its Impact on Pension Inequalities

Beyond pension system design, the gender pay gap shapes pension inequalities. In the EU, women earned on average 12.7% less per hour than men in 2021 (European Commission, 2021). This wage disparity widens significantly over a lifetime, contributing to a nearly 30% GPG in the EU (European Parliament, 2023). The root of this issue lies not only in wage inequality but in broader structural forces, such as women's overrepresentation in lower-paying sectors, higher rates of part-time work, and career interruptions due to caregiving responsibilities, which limit women's earning potential throughout their careers.

A key contributor to the gender pays gap is occupational segregation, where women are overrepresented in lower-paying sectors like education, healthcare, and social services. These sectors offer limited opportunities for career advancement and less generous pension benefits compared to higher-paying, male-dominated industries such as engineering and finance (Bettio et al., 2015). This sectoral imbalance locks women into career paths that offer limited pension-building opportunities.

Moreover, women are more likely to engage in part-time work or take career breaks for caregiving, further reducing their lifetime earnings and pension contributions. While some European countries offer pension credits for periods spent on caregiving, these credits are often insufficient to make up for the financial disadvantages women face during their careers. The cumulative impact of unpaid caregiving labor, interrupted careers, and part-time work reduces women's financial security in retirement, perpetuating pension inequality.

To address these deeply rooted inequalities, policy interventions must go beyond wage equity. Policymakers must focus on structural reforms that recognize and compensate for unpaid caregiving labor, encourage women's participation in higher-paying sectors, and offer flexible work arrangements for both men and women. Without addressing these systemic barriers, efforts to close the GPG will remain incomplete.

2.5 Policy Implications and Recommendations

The GPG is not merely a reflection of current income disparities; it is the result of accumulated disadvantages over a woman's entire working life. To reduce this gap, policymakers must adopt a holistic approach that addresses wage disparities, unpaid labor, occupational segregation, and pension system design.

- **Recognizing Unpaid Labor:** Pension systems should provide more substantial credits for caregiving periods to ensure women are not penalized for fulfilling essential social roles.
- **Promoting Sectoral Shifts:** Policies should encourage and incentivize women's participation in higher-paying, traditionally male-dominated industries, such as engineering and finance.
- **Flexible Work Policies:** Introducing and promoting policies that allow for flexible work arrangements, without penalizing part-time workers in pension schemes, will help both men and women balance career and caregiving responsibilities more effectively.

Addressing these multifaceted issues will not only help reduce the GPG but also contribute to greater financial security and equity for future generations of women.

2.6 Introduction to the Blinder - Oaxaca decomposition

The Blinder-Oaxaca decomposition method is a widely recognized statistical technique used to analyse disparities between groups by separating differences into explained and unexplained components (Blinder, 1973; Oaxaca, 1973). This method is particularly relevant for understanding the GPG, as it allows researchers to identify the extent to which pension disparities can be attributed to observable characteristics (such as years of work, education, or employment sector) versus unobservable or systemic factors, including discrimination. This section expands on the theoretical underpinnings, methodological applications, and implications of this approach in the context of gender pension inequality across European countries.

At its core, the Blinder-Oaxaca decomposition technique is rooted in the principles of regression analysis and labor economics. By comparing two groups—in this case, men and women—it decomposes the observed difference in an outcome variable (e.g., pension income) into:

1. **Explained Differences**: These arise from differences in observable characteristics such as education, job tenure, or full-time vs. part-time work. For instance, if men work in higher-paying sectors or have longer careers, these factors can partially explain their higher pension incomes.
2. **Unexplained Differences**: These capture disparities not accounted for by observable characteristics, which may reflect systemic discrimination, institutional bias, or unmeasured factors.

In the context of pensions, the unexplained portion of the GPG often aligns with structural barriers in labor markets and pension systems. For example, women's contributions are frequently interrupted by caregiving responsibilities, but pension systems often fail to account for this through equitable credit schemes (D'Addio, 2012). This residual component is critical, as it highlights areas where policy intervention may be necessary to address systemic inequities.

Interpreting the Unexplained Component

The unexplained component of the Blinder-Oaxaca decomposition represents disparities that cannot be accounted for by observed variables such as education, work experience, or employment sector. This portion is critical for understanding the systemic and structural inequities embedded in labor markets and pension systems, as it highlights factors that lie beyond the measurable attributes of individuals or their employment histories. While this component is often interpreted as evidence of gender discrimination, it encompasses a wider range of influences that are unobservable or difficult to quantify within the available data.

One key aspect of the unexplained component is its potential to reflect **structural biases** in pension systems. These biases include the penalization of non-linear career trajectories, such as career interruptions for caregiving responsibilities or transitions to part-time work, which disproportionately affect women. Many pension systems are designed to reward continuous, uninterrupted employment, inadvertently disadvantaging women who bear a greater share of unpaid caregiving duties. This systemic design flaw reinforces the cumulative financial disadvantages women face over their lifetimes.

Additionally, the unexplained component may capture the impact of **cultural and societal norms** that shape women's participation in the labor market and their long-term financial security. For instance, cultural expectations around caregiving and domestic responsibilities often lead women to prioritize family obligations over career progression. These norms, while deeply embedded in society, are not directly measurable but have profound implications for women's earnings and pension outcomes.

Differences in financial literacy and risk preferences may also contribute to the unexplained component. Research indicates that women are less likely than men to engage in financial planning or invest in higher-yield financial products, often due to a lack of access to financial education or societal norms that discourage women from taking financial risks. These disparities can further exacerbate the gender pension gap, as they limit women's ability to maximize their retirement savings.

Moreover, the unexplained portion reflects the cumulative effect of **intersectional inequalities** that interact with gender. Factors such as ethnicity, migration status, and disability, which are often unmeasured in pension studies, can amplify vulnerabilities and create unique challenges for achieving financial security in retirement. These intersectional factors may exacerbate the disadvantages faced by women, making the unexplained component even more significant for understanding disparities within specific subgroups.

In the context of this study, the unexplained component underscores the need to address **broader systemic barriers** to achieving gender equity in pensions. While observable factors like education or years of work experience explain part of the Gender Pension Gap (GPG), they do not capture the full picture. The unexplained portion serves as a reminder of the hidden, structural, and systemic forces at play, many of which require targeted policy interventions to address. For example, policies aimed at improving pension credits for caregiving periods, reducing occupational segregation, or promoting financial literacy could help mitigate the unexplained disparities.

By examining the unexplained component, this research not only quantifies the extent of disparities that go beyond observable factors but also highlights the importance of qualitative approaches in understanding the lived experiences of individuals affected by systemic inequities. Ultimately, this focus on the unexplained component helps to inform more comprehensive and inclusive policy reforms that target the root causes of gender-based inequalities in pension outcomes.

2.6.1 Advantages of the Blinder-Oaxaca Decomposition in GPG Analysis

The strength of the Blinder-Oaxaca decomposition lies in its ability to:

- Quantify the contribution of each explanatory factor to the observed disparity. For instance, it can measure how much of the GPG is due to differences in full-time employment rates versus occupational segregation.
- Distinguish between structural and individual-level factors, providing insights into whether disparities are driven by systemic issues or individual choices.
- Offer a transparent framework for evaluating the impact of policy reforms. For example, by examining changes in the explained and unexplained components over time, researchers can assess whether new policies (e.g., caregiving credits or equal pay initiatives) are reducing the GPG.

Additionally, the decomposition is flexible and can be extended to multivariate settings, allowing for interaction effects between variables (Jann, 2008). This makes it a particularly robust tool for analysing complex phenomena such as pension inequality, where multiple factors intersect.

2.6.2 Application of the Method in Pension Studies

While previous studies such as Bettio et al. (2015) and Boll et al. (2017) have applied the Blinder-Oaxaca decomposition to analyse the GPG, this thesis extends their work in several meaningful ways.

First, the sample selection has been designed with clear inclusion criteria to minimise potential biases and enhance comparability across countries. The analysis is limited to fully retired individuals aged 65 and over, with complete pension data and valid responses across key variables. This sampling strategy aligns with practices in prior comparative studies (e.g. Boll et al., 2017; Grech, 2013) but improves transparency by explicitly justifying the exclusion of partial retirees or those with missing income components. A detailed discussion of the sample criteria and its implications is provided in the methodology chapter.

Second, this thesis adds empirical value by incorporating secondary income sources, such as rental income, investment returns, and financial assets, into the decomposition model. These variables are often excluded in previous GPG decompositions, which tend to focus narrowly on public pensions or aggregated pension income (e.g. Bettio et al., 2015; Frericks et al., 2009). Including secondary income streams offers a richer and more realistic picture of post-retirement financial well-being and highlights overlooked avenues through which gender inequalities persist.

Finally, by linking decomposition outcomes to institutional features, such as pension accrual formulas or eligibility criteria, this study strengthens the policy relevance of its findings and advances the understanding of how systemic design choices contribute to the unexplained component of the GPG.

2.6.3 Challenges and Limitations of the Method

Despite its strengths, the Blinder-Oaxaca decomposition method has several limitations:

1. **Dependence on Observable Variables**: The method can only account for disparities linked to variables included in the model. Unobserved factors, such as informal caregiving roles or cultural norms, remain unquantified.
2. **Residual Interpretation**: While the unexplained component is often attributed to discrimination, it may also include unmeasured variables that are difficult to capture, such as differences in risk preferences or financial literacy (Lundahl & Wadensjö, 2015).
3. **Choice of Reference Group**: The results of the decomposition can vary depending on whether men or women are used as the reference group. Scholars such as Reimers (1983) and Cotton (1988) have proposed alternative weighting schemes to address this issue.

These challenges underscore the importance of complementing the decomposition method with qualitative insights and robust data collection to ensure a comprehensive understanding of the GPG.

2.6.4 Policy Implications of the Decomposition Findings

The insights provided by the Blinder-Oaxaca decomposition are invaluable for shaping policy interventions aimed at reducing the GPG. By identifying the relative contributions of different factors, policymakers can prioritize reforms that address the root causes of pension disparities. Key policy recommendations include:

- **Enhancing Caregiving Credits**: Increasing the generosity and coverage of pension credits for caregiving periods can help mitigate the financial penalties associated with career interruptions (D’Addio, 2012; Bettio et al., 2015).

- **Addressing Occupational Segregation**: Encouraging women's participation in higher-paying, male-dominated sectors such as engineering and finance can reduce lifetime earnings gaps and, by extension, the GPG.
- **Reforming Pension Systems**: Transitioning toward more gender-sensitive pension systems that reward unpaid labor and provide flexibility for non-linear career paths is essential for achieving equity (Hammerschmid & Rowold, 2019).

2.7 Theoretical Approach, Blinder-Oaxaca decomposition method

First, it is essential to note that the analysis of the decomposition method will be based on the Blinder-Oaxaca Decomposition Method, a theoretical approach (Ospino et al., 2010), and will be practically applied based on similar research conducted by Rahimi and Hashemi (2021), titled "A detailed explanation and graphical representation of the Blinder-Oaxaca decomposition method with its application in health inequalities." This study adapts and applies those approaches to the context of pensions.

To determine the factors contributing to differences in pension outcomes between males and females, this study applies the Blinder-Oaxaca decomposition method. This approach decomposes the mean difference in an outcome variable (Y) between two groups (males and females) into explained and unexplained components. If K explanatory variables (x1...xk) adequately describe the outcome Y, the group-wise predicted means can be represented as follows:

Where:

$$\bar{Y}\hat{}g = \beta_0\hat{}g + \sum(j = 1\ to\ k)\ \beta_j\hat{}g * \bar{x}_j\hat{}g$$

Where:

- $\bar{Y}\hat{}g$ is the mean predicted outcome for group g (male or female)

- $\beta_j\hat{}g$ is the estimated coefficient of variable j for group g
- $\bar{x}_j\hat{}g$ is the meaning value of variable j for group g

The mean difference in outcome between males and females can be written as:

$$\Delta\bar{Y} = \bar{Y}\hat{}male - \bar{Y}\hat{}female \quad (1)$$

This overall gap $\Delta\bar{Y}$ can be decomposed into three primary components:

- A component due to differences in the levels of observable characteristics (endowments).
- A component due to differences in the returns to those characteristics (coefficients).
- A component due to unobservable or omitted variables (captured in the constant term).

Substituting the group means into the decomposition and using the male group as the reference, the decomposition becomes:

$$\Delta\bar{Y} = (\beta_0\hat{}male - \beta_0\hat{}female) + \sum(j = 1\ to\ k)\ \beta_j\hat{}female * (\bar{x}_j\hat{}male - \bar{x}_j\hat{}female) + \sum(j = 1\ to\ k)\ \bar{x}_j\hat{}male * (\beta_j\hat{}male - \beta_j\hat{}female) \quad (2)$$

This formulation interprets the pension gap from the female group's perspective, with the male group as the reference. Based on this, the contribution of each component can be explained as follows:

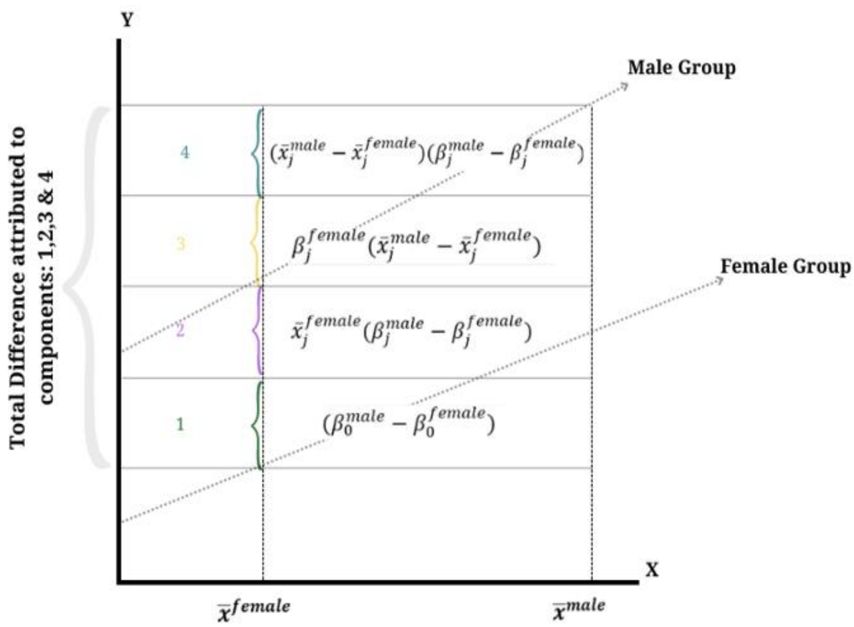
- The first component $(\beta_0\hat{}male - \beta_0\hat{}female)$: This is attributed to fundamental differences and includes the effects of unobservable or omitted variables.

- The second component $\sum \beta_j\text{^}female * (\bar{x}_j\text{^}male - \bar{x}_j\text{^}female)$: This portion of the pension gap is explained by gender differences in observed characteristics. It is known as the "endowments effect" (Rahimi et al., 2021).
- The third component $\sum \bar{x}_j\text{^}male * (\beta_j\text{^}male - \beta_j\text{^}female)$: This part of the gap is due to differences in the returns to characteristics, reflecting structural and institutional inequalities. It is known as the "coefficients effect" (Rahimi et al., 2021).

  • A fourth, interaction component (if explicitly included): This accounts for the simultaneous interaction between differences in characteristics and differences in coefficients (Jones & Kelley, 1984).

The figure below (Figure 2.1) visually presents the decomposition of the gender gap in predicted pension outcomes from the perspective of the female group, using the male group as the reference, based on the above formulation (Equation 2).

Figure 2. 2 Decomposition of the gender group difference in mean predicted outcome by selecting male group as the reference (from the perspective of females).



Source: Author's own graph. **Note:** The Graph is based on the theoretical approach of Blinder- Oaxaca Method (Neumak 1988; Oaxaca et. Al, 1944 and Rahimi et. Al, 2021)

Based on the preceding and using female groups as a reference, the expected change in mean predicted outcome can be described as follows from the male group's perspective:

$$\Delta\overline{\mathrm{Y}} = (\beta_0^{male} - \beta_0^{female}) + \sum_{j=1}^{k} \beta_1^{female} (\overline{x}_j^{male} - \overline{x}_j^{female}) + \sum_{j=1}^{k} \overline{x}_j^{male} (\beta_j^{male} - \beta_j^{female}) - \sum_{j=1}^{k} (\overline{x}_j^{male} - \overline{x}_j^{female})(\beta_j^{male} - \beta_j^{female}) \quad (3)$$

To obtain the equation above, the level of variables and regression coefficients for the female group is reformulated as follows from the male group's perspective:

$$\beta_j^{female} = \beta_j^{male} - (\beta_j^{male} - \beta_j^{female})$$

$$\overline{x}_j^{female} = \overline{x}_j^{male} - (\overline{x}_j^{male} - \overline{x}_j^{male})$$

And then replace their equivalent values in Equation 1. Thus, the difference (Equation 3) can be decomposed into 4 components.

- The first and the fourth component respectively, $[(\beta_0^{male} - \beta_0^{female})$ & $\sum_{j=1}^{k} [\overline{x}_j^{male} - \overline{x}_j^{female})(\beta_j^{male} - \beta_j^{female})\,]$ *is* attributed to fundamental differences and includes the effects of unobservable variables that were not considered and the interaction due to simultaneous effect of differences in endowments and coefficients (Jones F. & Kelley J.,1984).

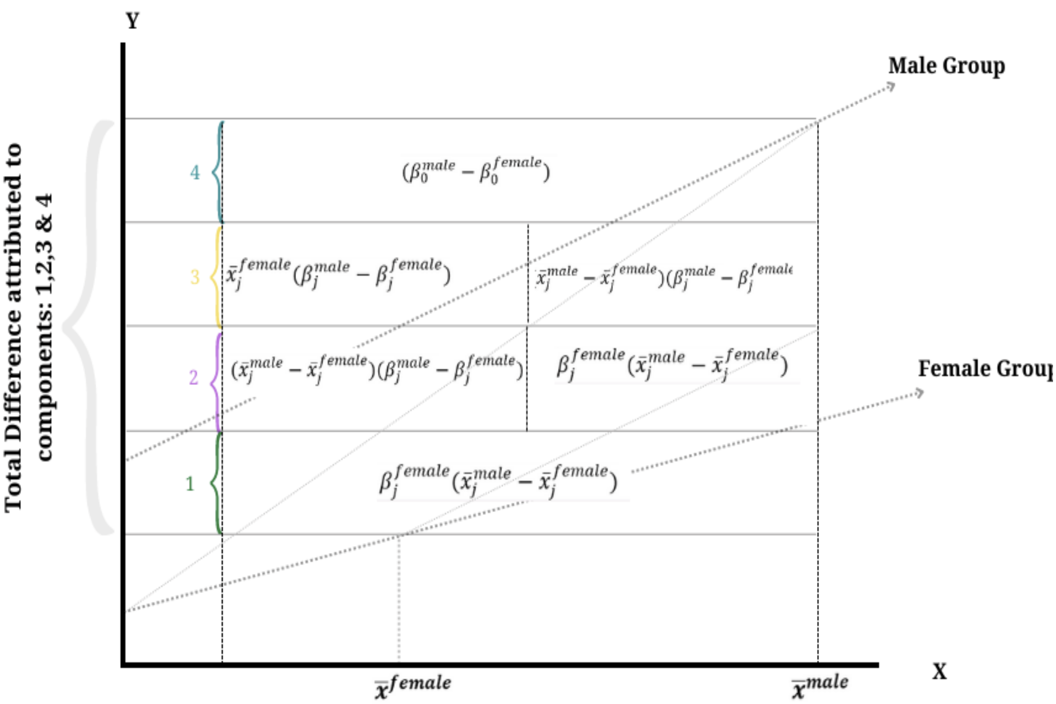
- The second component $\sum_{j=1}^{k} [\beta_j^{female} (\overline{x}_j^{male} - \overline{x}_j^{female})$ is a portion of Pension Gap that is explained by the gender group differences in the level of observable explanatory variables (explained component). This portion is known as "endowments effect" (Rahimi et.al, 2021).

- The third component $\sum_{j=1}^{k}[\bar{x}_j^{female}(\beta_j^{male}-\beta_j^{female})$ is a part of difference representing a change in female's group mean predicted outcome when it meets the regression coefficients of the male group.

$$\sum_{j=1}^{k}[\bar{x}_j^{female}(\beta_j^{male}-\beta_j^{female}) = \sum_{j=1}^{k}(\beta_j^{male}\bar{x}_j^{female}-\beta_j^{female}\bar{x}_j^{female})$$

This portion of the difference (Pension Gap) is known as the "coefficients effect" (Rahimi et al., 2021) and is the difference caused by the differential effect of the observable variables on outcome across the male and female groups. The following figure illustrates the equations above:

Figure 2. 3 Decomposition of the gender group difference in mean predicted outcome by selecting female group as the reference (from the perspective of males).



Source: Author's own graph**. Note:** The Graph is based on the theoretical approach of Blinder- Oaxaca Method (Neumak 1988; Oaxaca et. Al, 1944 and Rahimi et. Al, 2021)

According to Figures above and Equations 2 and 3, the first component $(\beta_0^{male} - \beta_0^{female})$ is attributed to gender differences that cannot be explained by observed covariates (x) but are generated by unobserved variables. Furthermore, the coefficient component

$(\sum_{j=1}^{k}[\overline{x}_j^{female}(\beta_j^{male} - \beta_j^{female})$ is also unexplained by those differences. As a result, these two can be combined (Unexplained Part), and the decomposition is reduced from four to three components.

$$\Delta\overline{\mathrm{Y}} = \sum_{J=1}^{k}\beta_j^{female}(\overline{x}_j^{male} - \overline{x}_j^{female}) + \sum_{j=1}^{k}\overline{x}_j^{female}(\beta_j^{male} - \beta_j^{female})$$
$$+\sum_{j=1}^{k}(\overline{x}_j^{male} - \overline{x}_j^{female})(\beta_j^{male} - \beta_j^{female}) \quad (4)$$

$$\Delta\overline{\mathrm{Y}} = \sum_{J=1}^{k}\beta_j^{male}(\overline{x}_j^{male} - \overline{x}_j^{female}) + \sum_{j=1}^{k}\overline{x}_j^{male}(\beta_j^{male} - \beta_j^{female})$$
$$-\sum_{j=1}^{k}(\overline{x}_j^{male} - \overline{x}_j^{female})(\beta_j^{male} - \beta_j^{female}) \quad (5)$$

That is to say that if we assume that there are no relevant unobservable explanatory variables, the total unexplained part $\sum_{j=1}^{k}\overline{x}_j^{female}(\beta_j^{male} - \beta_j^{female})$ in equation 4 and $\sum_{j=1}^{k}\overline{x}_j^{male}(\beta_j^{male} - \beta_j^{female})$ in equation 5 respectively will be equal to the components

$\sum_{j=1}^{k}\overline{x}_{j}^{female}(\beta_{j}^{male}-\beta_{j}^{female})$ and $\sum_{j=1}^{k}\overline{x}_{j}^{male}(\beta_{j}^{male}-\beta_{j}^{female})$ in equation 2 and equation 3 respectively.

So based on the above approach, the difference in mean predicted outcome ($\Delta\overline{Y}$) contains the three components below:

- $\sum_{J=1}^{k}\beta_{j}^{female}(\overline{x}_{j}^{male}-\overline{x}_{j}^{female})$ & $\sum_{J=1}^{k}\beta_{j}^{male}(\overline{x}_{j}^{male}-\overline{x}_{j}^{female})$ which is explained by the difference in the level of the covariates.

- $\sum_{j=1}^{k}\overline{x}_{j}^{female}(\beta_{j}^{male}-\beta_{j}^{female})$ & $\sum_{j=1}^{k}\overline{x}_{j}^{male}(\beta_{j}^{male}-\beta_{j}^{female})$ arises from the differential effect of all those covariates (unexplained part mentioned above).

- $\sum_{j=1}^{k}(\overline{x}_{j}^{male}-\overline{x}_{j}^{female})(\beta_{j}^{male}-\beta_{j}^{female})$ That involves an interaction caused by

the simultaneous group differences in the covariates level and their coefficients.

Until now, in this research, we had postulated that one of the groups, the group of males or the group of females, respectively, has the best possible outcome and that the other group should strive to get it. Another method is to suppose that there is a nondiscriminatory condition (represented by a nondiscriminatory vector of coefficients) to which both groups (males and females) should reach (Rahimi et al., 2021). As a result, this strategy necessitates the establishment of nondiscriminatory criteria or reference coefficients.

Suppose $\beta*$ is the nondiscriminatory condition or reference coefficient, the overall equation for decomposition of ($\Delta\overline{Y}$) will be:

$$\Delta\overline{Y} = \sum_{j=1}^{k} \beta_j^* (\overline{x}_j^{male} - \overline{x}_j^{female}) + [\sum_{j=1}^{k} \overline{x}_j^{male} (\beta_j^{male} - \beta_j^*)$$

$$+\sum_{j=1}^{k} \overline{x}_j^{female} (\beta_j^* - \beta_j^{female})] \tag{6}$$

Where, $\sum_{j=1}^{k} \beta_j^* (\overline{x}_j^{male} - \overline{x}_j^{female})$ is the endowments effect and

$[\sum_{j=1}^{k} \overline{x}_j^{male} (\beta_j^{male} - \beta_j^*) + \sum_{j=1}^{k} \overline{x}_j^{female} (\beta_j^* - \beta_j^{female})]$ is this is the discrimination effect (Rahimi et. al, 2021).

Based on the above equation we can see that the GG can be decomposed into two components:

- The first component is the part of the GPG that is explained by the differences in the observed characteristics such as year of experience, level of education, etc. This is also called the “endowments effect.” (Rahimi et al., 2021).
- The second component of the GPG is the part that accounts for differences in the levels of unobservable factors and their differential (discriminating) impacts. This component identifies the portion of the disparity that is unexplained. This part is occasionally referred to as "discrimination effects" (Rahimi et al., 2021).

β^* is always between β^{male} and β^{female}, or equal to both or one of them

$$\beta^{male} \geq \beta^* \geq \beta^{female} or \beta^{male} \leq \beta^* \leq \beta^{female}$$

- If we have, $\beta^{male} \succ \beta^* \succ \beta^{female}$ we have discrimination “in favor of” males and negative discrimination “against” females.
- If we have, $\beta^{male} \prec \beta^* \prec \beta^{female}$, then we have discrimination “in favor of” females and negative discrimination “against” males.

There is also a case that one of the two groups' experiences discrimination and the non-discriminating β^{male} will simply be the coefficients from the other group. in such case.

- If we replace β^{*} with β^{male} in equation 6 we reach the equation below:

$$\Delta\overline{Y} = \sum_{j=1}^{k} \beta_j^{male} (\overline{x}_j^{male} - \overline{x}_j^{female}) + \sum_{j=1}^{k} \overline{x}_j^{female} (\beta_j^{male} - \beta_j^{female}) \quad (7)$$

- If we replace β^{*} with β^{female} in equation 6 we reach to the equation below:

$$\Delta\overline{Y} = \sum_{j=1}^{k} \beta_j^{female} (\overline{x}_j^{male} - \overline{x}_j^{female}) + \sum_{j=1}^{k} \overline{x}_j^{male} (\beta_j^{male} - \beta_j^{female}) \quad (8)$$

Where:

$\sum_{j=1}^{k} \overline{x}_j^{female} (\beta_j^{male} - \beta_j^{female})$ & $\sum_{j=1}^{k} \overline{x}_j^{male} (\beta_j^{male} - \beta_j^{female})$ in equation 7 & 8 is similar to $\sum_{j=1}^{k} \overline{x}_j^{female} (\beta_j^{male} - \beta_j^{female})$ in equation 4 and $\sum_{j=1}^{k} \overline{x}_j^{male} (\beta_j^{male} - \beta_j^{female})$ in equation 5 and arises from the differential effect of observable variables and also differential effect (β) and level of unobservable variables. This determines the unexplained portion of the GG.

The Explained Component $\sum_{j=1}^{k} \beta_j^{male} (\overline{x}_j^{male} - \overline{x}_j^{female})$ & $\sum_{J=1}^{k} \beta_j^{male} (\overline{x}_j^{male} - \overline{x}_j^{female})$ in the equation 7 & 8 is similar to the combination of $\sum_{J=1}^{k} \beta_j^{female} (\overline{x}_j^{male} - \overline{x}_j^{female})$ & $\sum_{j=1}^{k} (\overline{x}_j^{male} - \overline{x}_j^{female})(\beta_j^{male} - \beta_j^{female})$ and $\sum_{J=1}^{k} \beta_j^{male} (\overline{x}_j^{male} - \overline{x}_j^{female})$ & $\sum_{j=1}^{k} (\overline{x}_j^{male} - \overline{x}_j^{female})(\beta_j^{male} - \beta_j^{female})$ in the equation 4 and 5 respectively.

Although this component is sometimes referred to as the explained component in two-fold decomposition, part of it (the interaction component) is really the simultaneous difference in coefficients and covariates levels between males and females.

Thus, equations 7 and 8 can be considered a particular case of equations 4 and 5, in which components:

$$\sum_{j=1}^{k} \beta_j^{female} (\overline{x}_j^{male} - \overline{x}_j^{female})$$

$$\sum_{j=1}^{k} \beta_j^{male} (\overline{x}_j^{male} - \overline{x}_j^{female})$$

$$\sum_{j=1}^{k} (\overline{x}_j^{male} - \overline{x}_j^{female})(\beta_j^{male} - \beta_j^{female})$$

Have been integrated. Thus:

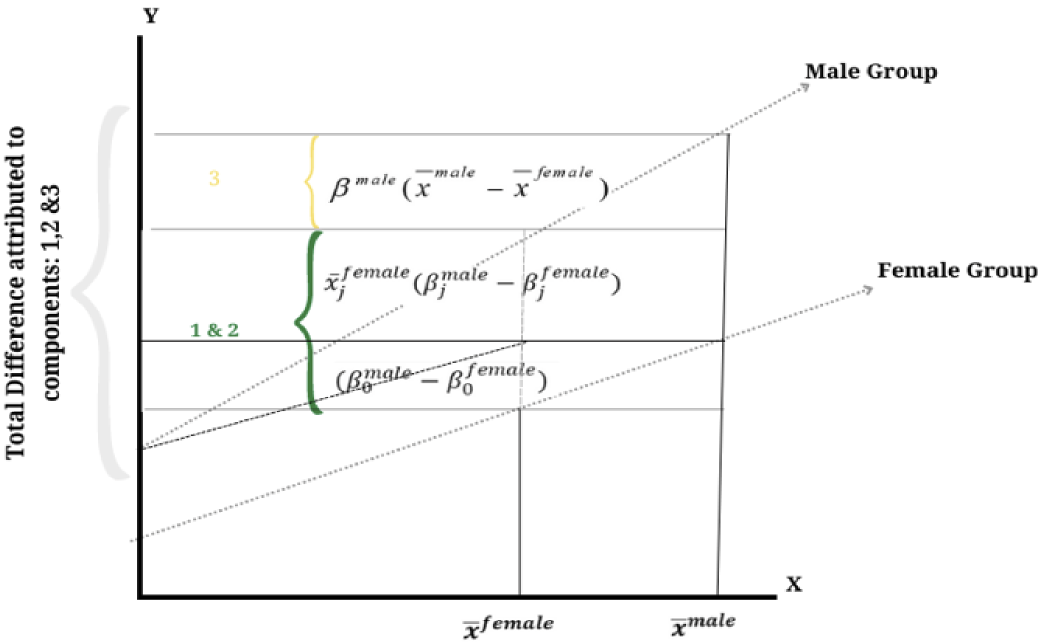
$$\sum_{j=1}^{k} \beta_j^{female} (\overline{x}_j^{male} - \overline{x}_j^{female}) + \sum_{j=1}^{k} (\overline{x}_j^{male} - \overline{x}_j^{female})(\beta_j^{male} - \beta_j^{female})$$
$$= \sum_{j=1}^{k} \beta_j^{male} (\overline{x}_j^{male} - \overline{x}_j^{female})$$

And

$$\sum_{j=1}^{k} \beta_j^{male} (\overline{x}_j^{male} - \overline{x}_j^{female}) - \sum_{j=1}^{k} (\overline{x}_j^{male} - \overline{x}_j^{female})(\beta_j^{male} - \beta_j^{female})$$
$$= \sum_{j=1}^{k} \beta_j^{female} (\overline{x}_j^{male} - \overline{x}_j^{female})$$

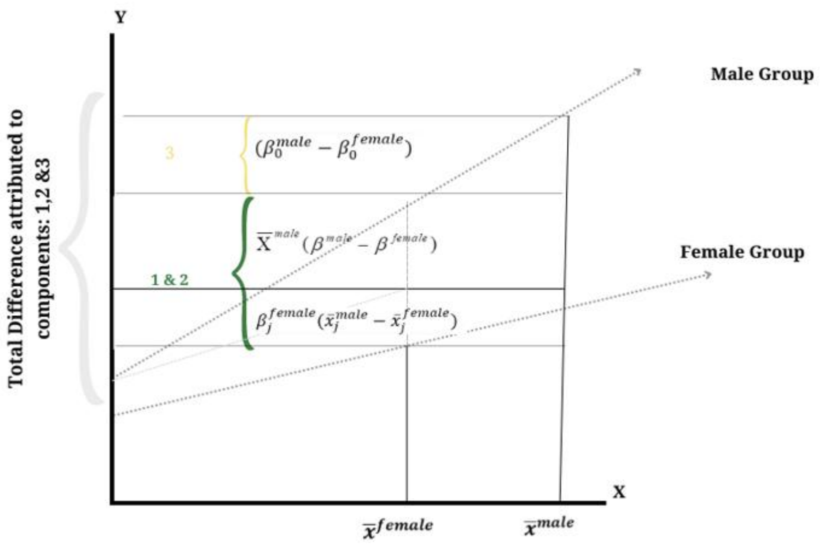
The equations above are demonstrated in the following figures:

Figure 2. 4 Decomposition of Pension Gap (outcome difference) using males' coefficients as the reference.



Source: Author's own graph**. Note:** The Graph is based on the theoretical approach of Blinder- Oaxaca Method (Neumak 1988; Oaxaca et. Al, 1944 and Rahimi et. Al, 2021).

Figure 2. 5 Decomposition of Pension Gap (outcome difference) using females' coefficients as the reference.



Source: Author's own graph**. Note:** The Graph is based on the theoretical approach of Blinder- Oaxaca Method (Neumak 1988; Oaxaca et. Al, 1944 and Rahimi et. Al, 2021).

According to the analysis above, it is not clear which of the two groups (males - females) should be used as a reference group. Below, based on previous research and theoretical approaches will be analysed:

- According to Reimers (1983) should be used the average regression coefficients over males – females: $\frac{\beta_i^{male} + \beta_i^{female}}{2}$

- According to Cotton (1988), b_j^* is the sum of coefficients weighted by group (males – females) size: $\frac{n^{male} * \beta_i^{male} + n^{female} * \beta_i^{female}}{N}$

- Neumark (1988) recommends the use of regression coefficients from a pooled model over both males and females as an estimate for nondiscriminatory conditions (Neumak 1988; Oaxaca et al., 1944 and Rahimi et al., 2021).

2.8 Summary of the Chapter

The second chapter provides a comprehensive review of existing research on the GPG and introduces the Blinder-Oaxaca Decomposition Method as the primary analytical method for this study. It examines the multifaceted nature of pension inequalities, critiques traditional theoretical models, and discusses structural, systemic, and socio-economic factors contributing to the persistence of gender-based pension disparities in Europe.

The literature review begins by analysing gender inequalities in European pension systems, emphasizing how shifts from defined benefit (DB) to defined contribution (DC) schemes have disproportionately disadvantaged women. Women’s career interruptions, part-time employment, and caregiving responsibilities exacerbate these disadvantages, resulting in lower lifetime pension contributions. The analysis highlights how even policies aimed at compensating caregiving periods, such as pension credits, often fall short in addressing the financial penalties women face over their lifetimes.

The chapter then critiques Human Capital Theory, a traditional framework often used to explain wage and pension disparities. While the theory attributes gender disparities to differences in education, skills, and career choices, critics argue that it oversimplifies complex structural barriers, such as occupational segregation, workplace discrimination, and societal norms. Women are frequently concentrated in lower-paying sectors and face limited opportunities for career progression, highlighting the inadequacy of Human Capital Theory in explaining persistent pension disparities.

Next, the discussion shifts to the gender pay gap and its impact on pension inequalities, emphasizing how wage disparities during working life are a significant precursor to pension disparities. Women's overrepresentation in lower-paying sectors, higher likelihood of part-time employment, and frequent career interruptions due to caregiving responsibilities limit their earning potential and pension contributions. While pension credits for caregiving exist in some European countries, they often fail to fully compensate for the cumulative financial disadvantages women face over their careers. The policy implications and recommendations section explore strategies for reducing the GPG. Key recommendations include enhancing caregiver credits, promoting sectoral shifts to encourage women's participation in higher-paying industries, and implementing flexible work policies that do not penalize part-time workers in pension calculations. These strategies highlight the need for a multi-dimensional policy response to address systemic inequalities embedded within pension systems and labor markets.

The second half of the chapter introduces the Blinder-Oaxaca Decomposition Method, a quantitative tool used to analyse and decompose gender disparities in pension outcomes. This method breaks down observed disparities into explained components, which arise from measurable differences such as income and employment history, and unexplained components, which often indicate systemic discrimination or unobserved factors. The chapter provides a detailed explanation of how the method will be applied in this study, including key theoretical equations and graphical representations.

Finally, the chapter outlines different approaches to using reference groups within the Blinder-Oaxaca framework, referencing contributions from scholars such as Reimers (1983), Cotton (1988), and Neumark (1988). These approaches guide the methodological choices in subsequent chapters, ensuring a robust and nuanced analysis of the GPG.

In summary, Chapter 2 lays the theoretical and empirical foundation for the study by critically analysing existing literature, challenging traditional theoretical perspectives, and introducing a robust methodological tool for analysing pension disparities. This chapter sets the stage for the empirical investigation that follows, providing both context and a clear analytical framework for examining the GPG across European countries.

Chapter 3: Research Methodology and Data Collection

3.1 Introduction

This chapter outlines the data sources, analytical tools, and methodological decisions underpinning the analysis of the GPG. It begins by introducing the dataset and its key features, followed by a description of the data preparation process, sample restrictions, and imputation methods. The chapter concludes by detailing the analytical strategy, including the application of regression models and the Blinder-Oaxaca decomposition.

The empirical analysis draws on data from the Survey of Health, Ageing and Retirement in Europe (SHARE), a multidisciplinary, cross-national panel study conducted since 2004 across 28 European countries and Israel (Börsch-Supan et al., 2013). SHARE offers harmonised microdata on health, socioeconomic status, and family structures of individuals aged 50 and above, aligning with other major international ageing surveys such as the U.S. Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA) (Mencia & Prieto, 2020).

This research uses data from Waves 1 to 7 (2004–2017). Waves 8 and 9 were deliberately excluded to avoid the confounding influence of retrospective-only data (Wave 8) and pandemic-specific disruptions (Wave 9), which could introduce bias when analysing systemic pension disparities. The primary unit of analysis is individuals aged 65 and older with reported positive pension income, ensuring comparability across countries and over time. A detailed breakdown of wave coverage and country participation is provided in Appendix 2.1.

The analysis is based on fully imputed SHARE datasets, which address item nonresponse through established procedures. Missing values are handled using hot-deck imputation for variables with low nonresponse and Fully Conditional Specification (FCS) for monetary variables, following protocols developed by De Luca et al. (2015, 2021). These multiple imputation methods enhance data reliability while preserving the structure of the original distributions.

Data preparation and descriptive statistics are conducted in SPSS, while the Blinder-Oaxaca decomposition is implemented in R, using the Oaxaca package. This approach separates the GPG into explained and unexplained components, distinguishing differences in characteristics (e.g. work history, education) from structural or unobserved factors. The use of bootstrapped standard errors ensures robustness and comparability with similar methods used in Stata (Jann, 2008).

By combining robust data sources, rigorous imputation methods, and advanced decomposition techniques, this chapter establishes a clear methodological foundation for examining the structural drivers of the GPG across Europe.

3.2 SHARE: A Data Foundation for GPG Analysis

The SHARE is one of the most comprehensive and widely recognized longitudinal panel studies globally, focusing on individuals aged 50 and older across European countries and Israel. Launched in 2004, SHARE was designed to address the critical need for high-quality, harmonized microdata on public health, socioeconomic conditions, and living situations of the aging population. It aligns with other international aging studies, such as the U.S. Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA), enabling cross-national comparisons on aging, retirement, and socio-economic disparities (Börsch-Supan et al., 2013).

SHARE is coordinated by the Munich Center for the Economics of Aging (MEA) at the Max Planck Institute for Social Law and Social Policy, with funding from the European Commission and national sources. It adheres to strict methodological and ethical standards, ensuring its reputation as a reliable and essential resource for academic research, policy-making, and social analysis (SHARE, 2021).

The dataset’s availability stems from its mission to foster evidence-based policies addressing the challenges of aging populations in Europe. By providing publicly accessible and harmonized data, SHARE empowers researchers and policymakers to investigate critical issues, including labor market participation, retirement planning, health outcomes, and intergenerational transfers (Börsch-Supan & Jürges, 2005).

Significant Research Based on SHARE

SHARE data have been instrumental in numerous groundbreaking studies across disciplines. Key research includes:

1. **Economic Inequalities in Aging:** SHARE data have been used to explore the financial well-being of retirees, with studies highlighting disparities in income, wealth, and pension outcomes (Börsch-Supan et al., 2020).
2. **Health and Retirement Decisions:** Research has examined how health conditions influence retirement decisions, demonstrating the interplay between labor market participation and health inequalities (Avendano et al., 2009).
3. **Intergenerational Transfers:** SHARE data have shed light on family dynamics, including caregiving responsibilities, financial support, and inheritance patterns across generations (Albertini et al., 2007).

4. **Gender Disparities:** Many studies have focused on the gender pay and pension gaps, leveraging SHARE’s detailed data on work histories, incomes, and pensions (Bettio et al., 2015).
5. **Policy Evaluations:** SHARE data have been used to evaluate the effectiveness of social policies, such as pension reforms, caregiver credits, and healthcare systems, in mitigating inequalities (Angelini et al., 2009).

The studies above underscore SHARE's value in addressing complex societal challenges, particularly those related to aging populations and economic inequalities.

3.2.1 SHARE Data Consolidation and Imputation Procedures

SHARE has conducted nine waves of data collection to date, each with unique features and contributions. The study’s longitudinal design tracks individuals over time, capturing changes in health, socio-economic status, and retirement outcomes. An overview of the key waves and their significance is presented below and detailed further in Appendix 2.1:

1. Wave 1 (2004-2005): The inaugural wave established SHARE’s foundation, covering 11 European countries and collecting data on demographics, health, employment, and income. It provided a baseline for analysing aging and retirement across Europe.
2. Wave 2 (2006-2007): Expanded the scope to include more countries and added modules on healthcare utilization, social networks, and expectations about the future.
3. Wave 3 (2008-2009): Known as SHARELIFE, this wave focused on life histories, collecting retrospective data on respondents’ family, employment,

and health trajectories. It provided insights into the long-term effects of early-life events on later-life outcomes.

4. Wave 4 (2010-2011): Reintroduced core modules and expanded the dataset to include more countries, enabling cross-national comparisons of aging and retirement systems.
5. Wave 5 (2013): Added questions on financial literacy, economic shocks, and social participation, reflecting the impact of the global financial crisis on older populations.
6. Wave 6 (2015): Focused on physical and mental health, adding biomarkers and cognitive tests to enhance the understanding of health inequalities.
7. Wave 7 (2017): Collected data on respondents' current circumstances while complementing Wave 3 with additional SHARELIFE modules for those who missed the earlier life history survey.
8. Wave 8 (2019-2020): Primarily focused on retrospective data, such as life history information, and did not cover all countries, making it less suitable for cross-country comparisons.
9. Wave 9 (2021-2022): Designed to assess the socio-economic and health impacts of the COVID-19 pandemic. It introduced unique variables that captured pandemic-specific disruptions, such as changes in income, employment, and health.

Waves Used in This Research

This study relies on data from Waves 1 to 7 of SHARE, spanning from 2004 to 2017. The decision to focus on these waves was made deliberately to align with the research objectives, which aim to analyse long-term systemic trends in the GPG. Waves 8 and 9 were excluded for the following reasons:

1. Wave 8 Limitations: Wave 8 primarily focuses on retrospective data, such as the Life History Module, which falls outside the scope of this research. Additionally, it does not provide data for all countries required for comprehensive cross-national comparisons, a key aspect of this study.
2. Wave 9 Limitations: Wave 9, while offering recent data, centres on the impact of the COVID-19 pandemic. The inclusion of pandemic-specific variables introduces contextual biases that are not aligned with the study’s objectives, which focus on pre-pandemic systemic trends in pension disparities.

The exclusion of Waves 8 and 9 does not constitute a limitation but rather reflects a methodological choice to ensure data relevance and consistency. Waves 1 to 7 offer a robust and uninterrupted dataset for analysing long-term trends in the GPG, providing historical depth and methodological rigor.

SHARE datasets are provided in fully imputed versions, which were used throughout this study to ensure consistency across countries and variables. Imputation in SHARE is performed using hot-deck methods for categorical variables and Fully Conditional Specification (FCS) for continuous ones, as outlined by De Luca et al. (2015, 2021). This imputation strategy is designed and validated centrally by SHARE, allowing researchers to focus on analysis rather than reprocessing missing data. As a result, only minimal data cleaning was required, such as restricting the sample to retirees aged 65+ with positive pension income and removing duplicates or outliers.

The SHARE team provides extensive documentation and syntax files for reproducibility and standardization. The consolidation of Waves 1–7 was based on harmonized variables available across all selected waves. These included key socio-demographic variables (age, gender, education), pension income (gv_imputations), and health status. The unit of analysis is the individual, with data being reshaped from wide to long format where needed to ensure longitudinal consistency.

SHARE's imputation approach is especially relevant for monetary variables, which often suffer from high non-response rates due to sensitivity and recall difficulty. SHARE addresses this using two core methods: the hot-deck technique for variables with low missingness (under 5%), and the Fully Conditional Specification (FCS) method for monetary items with more complex missing patterns. FCS uses Gibbs sampling across iterative regressions to ensure the internal consistency of responses and retain statistical relationships among variables. For each wave, five separate imputations are created, allowing researchers to account for imputation uncertainty by pooling results. The process ensures comparability over time and between countries, which is vital for cross-national pension analysis. By relying on these centrally-validated imputations (De Luca, 2015; 2021), this study avoided extensive manual data cleansing and could proceed confidently with robust, harmonized inputs across countries and time.

3.2.2 Data Justification and Context

SHARE's data provide unparalleled insights into the socio-economic and demographic factors influencing the GPG. The decision to utilize Waves 1 to 7, spanning from 2004 to 2017, is grounded in both methodological and practical considerations, ensuring the relevance, depth, and reliability of the research. This selection aligns with the study's objectives and avoids potential biases introduced by later waves. Below are the key reasons and advantages for using this dataset:

1. Historical Continuity: The selected waves cover a 13-year period, offering a long-term perspective on systemic trends in pension disparities across Europe. This period predates the COVID-19 pandemic, ensuring that the findings are not influenced by the pandemic-specific disruptions that characterize Wave 9 data. By focusing on this historical timeframe, the analysis captures structural and systemic inequalities as they existed under normal socio-economic conditions, providing a stable foundation for cross-country comparisons and longitudinal analysis.

2. Cross-National Comparability: SHARE includes up to 28 countries across its waves, offering unparalleled opportunities for cross-national analyses. Each wave adheres to harmonized data collection methodologies, ensuring consistency and comparability across countries and time. This comparability is essential for identifying commonalities and divergences in the GPG across diverse pension systems, labor markets, and cultural contexts. By focusing on countries that participated consistently across Waves 1 to 7, the research maximizes the reliability and validity of its cross-country findings.

3. Rich Multidimensional Data: SHARE’s detailed modules allow for a comprehensive examination of the complex factors contributing to the GPG. These include:

- **Occupational Segregation:** The dataset captures respondents’ employment histories, enabling an analysis of gendered differences in industries, job roles, and career trajectories.

- **Caregiving Responsibilities:** SHARE provides data on time spent caring for children, elderly family members, and other dependents, offering insights into the impact of caregiving on women's career interruptions and pension outcomes.
- **Secondary Income Sources:** The inclusion of variables on property rentals, financial returns, and long-term savings allows for an exploration of how supplementary income streams influence pension disparities.
- **Health and Retirement Decisions:** SHARE links health status with retirement timing, enabling an analysis of how gendered health inequalities intersect with pension outcomes.

This multidimensional approach ensures that the study accounts for a wide range of contributory factors, providing a nuanced understanding of the GPG.

4. Robust Methodological Foundation: The use of SHARE data ensures high methodological standards due to its rigorous survey design. SHARE employs random sampling techniques, face-to-face interviews, and advanced methods such as the Life History Calendar to ensure data accuracy and reliability. Additionally, its alignment with international aging studies, such as the U.S. Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA), further enhances the credibility and generalizability of findings.

5. Suitability for Research Objectives: The selected waves align directly with the study's goals of analysing long-term trends in the GPG. By excluding Waves 8 and 9, the analysis avoids data that are either retrospective (Wave 8) or pandemic-specific (Wave 9), which do not align with the research's focus on systemic, pre-pandemic trends. This intentional methodological choice reinforces the robustness and relevance of the findings, ensuring they are reflective of underlying structural inequalities rather than short-term disruptions.

6. Policy Relevance: The data span a period of significant pension reforms and labor market changes across Europe, making it possible to evaluate the effectiveness of these reforms in addressing gender disparities. By leveraging SHARE's historical depth, the research contributes valuable insights into the evolution of the GPG and the policy interventions needed to address it.

By leveraging the historical continuity, cross-national comparability, and multidimensional richness of SHARE data from Waves 1 to 7, this research ensures that its findings are grounded in robust and relevant evidence. The methodological rigor and comprehensive scope of SHARE make it an indispensable resource for studying the GPG, offering insights that are critical for both academic inquiry and policy development. This approach enables a deeper understanding of systemic inequalities in European pension systems and lays the groundwork for targeted interventions to promote gender equity in retirement outcomes.

3.3 Data Preparation and Sample Selection

The dataset used in this study underwent a rigorous cleaning process to ensure relevance and accuracy for analysing the GPG. Specific criteria were applied to refine the sample and focus on individuals whose data contribute meaningfully to the study's objectives (For additional details on data selection relevant to Hypothesis 4, please refer to Appendix 3.6). The cleaning process involved removing the following categories of respondents:

1. **Respondents Born After 1956**: The research focuses on individuals aged 65 and older, as this age group represents most retirees in most European countries. During the study period, many countries increased their statutory pension age, particularly for women. For each country analysed, details regarding the age threshold and specific data selection criteria will be outlined. This ensures consistency in the treatment of retirement age variations across countries.
2. **Respondents with No Pension Income**: Individuals without any reported pension income were excluded, as their inclusion would distort the percentage of the Gender Gap in Pensions. The focus is on pensioners with measurable pension incomes to ensure that the analysis accurately captures income-related disparities.
3. **Respondents with Specific Exclusions**: Respondents were excluded if they were incarcerated, hospitalized, out of the country, unable to speak the local language(s), or had moved to an unknown address during the survey period. These exclusions ensure that the sample reflects individuals whose data are complete and comparable across demographic and geographic contexts.

3.3.1 Sample Focus and Justification

The final sample consists of individuals aged 65 and older, with a "retired" work status and a pension income greater than zero. This focus aligns with the research objective of examining disparities in pension income among retirees while ensuring the sample is representative of individuals actively participating in pension systems.

The decision to focus on this age group is supported by demographic and economic trends. European countries face significant challenges associated with ageing populations, characterized by declining fertility rates and increasing life expectancy (Rechel et al., 2013). This demographic shift has profound implications for pension systems, as the proportion of working-age individuals who support retirees is steadily decreasing. Consequently, state pensions face mounting financial pressure, highlighting the need for equitable and sustainable retirement systems (Auer et al., 2000).

Additionally, the size of pension fund markets varies significantly across European countries when compared to their GDP, further complicating cross-country analyses. These differences reflect variations in national policies, pension system structures, and economic conditions, all of which influence the GPG.

The unit of analysis is the individual respondent. To ensure data integrity and relevance, the sample was cleaned by restricting the dataset to individuals with complete demographic and pension income information, excluding those without pension income, and removing duplicates and statistical outliers. This ensures that the analysis captures only those actively engaged in retirement systems across countries and allows for consistent application of the decomposition techniques discussed in later chapters.

3.3.2 Broader Implications of Sample Selection

Focusing on individuals aged 65 and older enables a comprehensive exploration of the demographic, economic, and policy-related factors that drive the GPG. This research approach captures a wide array of influences, providing insights into systemic disparities and their broader implications. Below, key aspects of this focus are elaborated upon to address the complexity of the issue:

- **Impact of Prolonged Life Expectancy:** As life expectancy increases across Europe, particularly among women, the reliance on pensions as a primary income source in retirement becomes more pronounced. Women tend to live longer than men, and this longevity amplifies the financial strain on limited pension incomes. Longer retirement periods disproportionately affect women, who already face reduced pension savings due to lower lifetime earnings. This analysis emphasizes the economic vulnerability that arises from these intersecting factors, highlighting the urgent need for pension systems to account for gendered differences in longevity.
- **Effects of Delayed Retirement Ages:** In response to demographic pressures, many European countries have raised statutory retirement ages, often aligning the retirement ages of men and women. While this policy change aims to improve pension system sustainability, it also affects gender equity. Women, who are more likely to take career breaks and work in part-time roles due to caregiving responsibilities, may find it challenging to meet the extended contribution requirements for pensions. This analysis captures how delayed retirement ages intersect with gendered labor market patterns, providing insights into the unintended consequences of these policies on pension equity.
- **Variability of Pension Systems Across Countries:** Europe's diverse pension systems, ranging from defined benefit to defined contribution schemes, create significant variations in how pensions are calculated and distributed. These structural differences have profound implications for the GPG. For example, pension systems with redistributive mechanisms, such as caregiver credits or survivor benefits, tend to mitigate gender disparities. Conversely, systems that rely heavily on individual contributions often exacerbate inequalities. By

comparing individuals across multiple European countries, this research identifies best practices and structural shortcomings, contributing to a nuanced understanding of how pension system design affects the GPG.

- **Labor Market Dynamics and Their Long-Term Impacts:** The sample focuses on individuals who have completed their working lives, allowing for an examination of how historical labor market inequalities manifest in pension outcomes. Women’s overrepresentation in lower-paying industries, occupational segregation, and systemic barriers to career advancement have cumulative effects on their pension entitlements. This analysis captures the long-term implications of these inequalities, providing a valuable perspective on how past employment patterns shape current disparities in retirement income.
- **Interplay of Secondary Income Sources:** In addition to primary pension incomes, secondary income sources such as rental income, investment returns, and family support significantly influence retirees' financial security. However, access to these supplementary resources often varies by gender, with women typically having fewer financial assets or opportunities for secondary income. The dataset allows for an analysis of how these factors interact with pension systems, offering insights into the role of secondary income in narrowing or widening the GPG.
- **Economic and Social Consequences of Pension Disparities:** The focus on older individuals highlights the broader implications of the GPG, which extend beyond individual financial security to societal impacts. Gendered pension disparities increase the risk of poverty among older women, leading to greater dependence on social welfare programs. These inequalities also have

intergenerational consequences, as financial insecurity among older women may limit their ability to support younger family members. By analysing these dynamics, this study sheds light on the societal costs of gender-based pension inequalities and underscores the need for targeted policy interventions.

- **Cross-Country Comparisons and Policy Insights:** The dataset's cross-national scope allows for meaningful comparisons between countries with varying demographic profiles, labor market structures, and pension systems. This enables the identification of trends and outliers, providing a clearer understanding of how different policy approaches impact the GPG. For instance, countries with strong social safety nets and gender-sensitive policies often report lower pension disparities, offering valuable lessons for other nations. These insights support the development of tailored, evidence-based policies to address systemic inequities.
- **Methodological Robustness and Longitudinal Perspective:** The inclusion of individuals aged 65 and older ensures that the dataset reflects a mature population with complete pension histories, enabling robust longitudinal and cross-sectional analyses. This approach allows for the tracking of trends over time and the evaluation of policy changes, such as the introduction of caregiver credits or adjustments to retirement ages. By focusing on retirees, the study avoids the confounding effects of career-stage variability, ensuring a clearer analysis of systemic factors influencing the GPG.

This refined dataset, focusing on individuals aged 65 and older, provides a robust foundation for examining the GPG through a multidimensional lens. By capturing the intersection of demographic, economic, and policy-related factors, this research offers actionable insights into the systemic drivers of pension disparities. The findings aim to inform policymakers and stakeholders, contributing to the design of equitable and sustainable pension systems that address the unique challenges faced by women in retirement.

3.3.3 Handling of Missing Data and Imputation in SHARE

A critical challenge in large-scale surveys is the treatment of missing values, arising from item non-response, attrition, or inconsistencies across waves. In this research, no independent imputation or additional data cleansing was undertaken. Instead, the analysis relied on the imputed datasets provided by the SHARE, which are specifically designed to ensure comparability and robustness in cross-national research.

The SHARE project applies rigorous, standardised procedures to address missing data and potential inconsistencies in survey responses. As detailed in De Luca and Rossetti (2010) and De Luca (2015), two main imputation techniques are employed:

- Hot-Deck Imputation (HDI): Missing values are replaced with observed responses from “donor” individuals who share similar socio-demographic characteristics with the respondent. This method maintains the internal consistency of the dataset within each wave and across related variables, while avoiding distortions introduced by arbitrary substitutions.
- Fully Conditional Specification (FCS) / Multiple Imputation (MI): For variables with more complex structures—particularly those within the financial, income, and consumption modules—SHARE implements an iterative regression-based procedure. This draws on multiple predictors in a chained-equations

framework, generating multiple plausible values for each missing observation. The process produces multiply imputed datasets that preserve both the variance structure of the data and the uncertainty associated with missingness.

The outcome of these procedures is the provision of five multiply imputed datasets for sensitive modules such as income, assets, and consumption, which are distributed as part of the official SHARE data release. The use of multiply imputed files is strongly recommended in SHARE's methodological documentation and has become standard practice in the empirical literature drawing on these data (Malter & Börsch-Supan, 2015).

Because of these procedures, missing data have already been systematically addressed within SHARE prior to public release. Further cleansing or ad hoc imputation at the analysis stage would not only be redundant but could also introduce bias or undermine the comparability of results across studies. Reliance on the official imputed datasets therefore ensures methodological consistency with established practices in the field and aligns the present analysis with the recognised gold standard for SHARE-based research.

3.3.4 Addressing Potential Selection Effects

The exclusion of non-pensioners from the sample is a deliberate methodological choice aimed at focusing on individuals with measurable pension incomes. This ensures that the analysis captures income-related disparities directly tied to pension systems. However, it is important to acknowledge the potential selection effects of this decision. Specifically, individuals without pension income may represent systematically disadvantaged groups, such as those with limited or interrupted labor market participation, informal sector employment, or insufficient contribution histories, many of which disproportionately affect women.

Although this research does not include an analysis of the excluded group, future studies could explore the characteristics and circumstances of non-pensioners to provide a more comprehensive understanding of the broader gender disparities in retirement income. Such an analysis could offer valuable insights into systemic barriers to pension access and inform policy interventions to address these gaps.

To further strengthen the validity of this study, it would be beneficial to perform a sensitivity analysis in subsequent research to assess the potential impact of excluding non-pensioners on the GPG estimates. For example, alternative calculations or imputation techniques could be explored to estimate hypothetical pension incomes for the excluded group, providing a more nuanced understanding of the gap's overall magnitude.

While these steps are beyond the scope of the current research, acknowledging these limitations underscores the need for continued investigation into both pension income disparities and access inequalities. This recognition highlights the broader societal implications of pension system design and the importance of ensuring equitable access for all individuals, particularly those at risk of exclusion.

3.4 Research Strategy

As previously mentioned, two critical theories form the theoretical framework of this thesis: Human Capital Theory (Bowles and Gintis, 1975; Becker, 1985; Thai et al., 2016) and the Theory of Discrimination (Becker, 1957; Lundahl and Wadensjö, 2015). The general analysis focuses on the pension earnings received by elderly individuals, reflecting their experiences and skills as former workers. This study will examine whether pension gaps are solely the fair outcome of these experiences and skills or whether discrimination against women is also a contributing factor.

A variety of methods have been employed to study the GPG, and no single statistical approach is definitive. This research adopts a quantitative methodology, utilizing data from reputable sources such as SHARE (discussed in detail below). The study ranks and compares pension gaps across European countries and across different waves (2004–2017) using descriptive statistics. Furthermore, it applies a linear regression model to analyse the structural variables (independent variables) that significantly affect pension income (the dependent variable). As Neuman (2014) suggests, the linear regression approach is logical, simple, and effective. It enables us to examine the impact of gender on pension income while controlling for other measurable variables. Additionally, it disaggregates the pension gap into components attributable to human capital characteristics, personal traits, and gendered occupational distributions (analysed further below). In summary, this research identifies and evaluates the factors associated with the pension gap, while also determining whether discrimination—either currently or during individuals’ working years—has contributed to disparities in pension income.

3.5 Research Methodology: Quantitative Approach

To achieve the thesis's objectives, a quantitative research approach will be employed. Quantitative research is widely recognized for its ability to collect and analyse numerical data, offering insights into specific phenomena with a high degree of statistical precision. It is particularly well-suited for addressing research questions that require robust measurement, objective analysis, and reproducible outcomes (Ezzy, 2013). The approach enables the identification of patterns, trends, and relationships, making it ideal for the study of systemic inequalities such as the GPG. Quantitative research is defined in various ways, but two notable definitions provide valuable context:

- **Cohen (2002)** defines quantitative research as social research grounded in empirical methods and descriptive statements about what "is," rather than what "ought" to be in the real world.
  This approach emphasizes measurable, observable phenomena, enabling the evaluation of whether specific policies, programs, or systems meet predefined standards.
- **Creswell (2014)** describes quantitative research as a method for explaining phenomena through the mathematical analysis of numerical data. It is distinguished by its structured design, reliance on large datasets, and focus on testing hypotheses or theories.

Quantitative research encompasses various methodologies, including survey research, correlational studies, experimental designs, and causal-comparative research (Sukamolson, 2007). For this study, survey research has been selected as the most appropriate method. Survey research employs scientific sampling techniques and well-designed questionnaires to measure population characteristics with statistical accuracy. It is particularly suited for analysing large datasets like SHARE, which captures demographic, economic, and social variables across multiple European countries.

3.5.1 Survey Design and Sampling Strategy

The survey methodology in this study focuses on pensioners aged 65 and older across Europe, enabling a gender-based comparison of pension incomes. A 95% confidence level ensures statistical rigor, minimizing the likelihood of errors in the findings. The respondents are selected randomly, ensuring that each individual in the population has a known probability of inclusion in the sample. This randomization enhances the generalizability of the findings and eliminates potential biases that could distort the analysis. The dataset used in this research is derived from SHARE (Survey of Health, Ageing and Retirement in Europe), a longitudinal panel study that has been collecting data on individuals aged 50 and older since 2004. The SHARE dataset offers an extensive range of demographic, socioeconomic, and health-related variables, making it a cornerstone for comparative analyses of pension systems and labor market disparities across European countries.

3.5.2 Data Collection Instrument: SHARE Questionnaire

The SHARE primary questionnaire, consisting of 20 modules, serves as the key data collection instrument. This comprehensive questionnaire gathers detailed information on various aspects of respondents' lives, including:

- Employment history and retirement planning.
- Pension income and other sources of financial support.
- Health outcomes and caregiving responsibilities.
- Family dynamics, housing, and intergenerational transfers.

The data collection process utilizes face-to-face interviews or computer-assisted personal interviews (CAPI), supplemented by self-completed paper-and-pencil questionnaires. These methods ensure the accuracy and reliability of the data while accommodating respondents with different levels of comfort and literacy in using technology. SHARE's rigorous data collection process adheres to international standards for ethical research and survey design, ensuring the credibility of the dataset.

3.5.3 Advantages of the SHARE Dataset

The SHARE dataset's multidimensional scope offers significant advantages for analysing the GPG:

1. **Comprehensive Coverage**: SHARE includes data from up to 28 countries, enabling cross-national comparisons of pension outcomes and labor market disparities.
2. **Harmonized Data**: The dataset aligns with other major aging studies, such as the U.S. Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA), allowing for global contextualization of findings.
3. **Rich Data Modules**: SHARE's modules provide a nuanced view of factors influencing the GPG, such as occupational segregation, caregiving responsibilities, and secondary income sources.

4. **Longitudinal Perspective**: SHARE's repeated surveys over time allow for the analysis of trends and changes in pension disparities, providing insights into the long-term effects of policy interventions and demographic shifts.

3.5.4 Data Completeness and Challenges

While SHARE's comprehensive approach offers numerous benefits, certain challenges must be acknowledged. Not all respondents complete every module of the questionnaire, as some sections are designed specifically for respondents in particular financial, family, or housing situations. These variations require careful handling during data preparation to ensure the dataset's validity and comparability.

To address these challenges, the study employs data cleaning and imputation techniques to manage missing values. Respondents without pension income or incomplete demographic data are excluded from the analysis to ensure that the findings are both accurate and representative. Detailed information on how missing data were handled is provided in Appendix 2.2.

The adoption of a quantitative research approach, coupled with the use of SHARE's comprehensive dataset, ensures a robust and systematic analysis of the GPG across European countries. By leveraging survey research, this study can provide statistically precise insights into the factors driving gender-based pension disparities, laying a strong foundation for evidence-based policy recommendations.

Table 3. 1 Features of Quantitative & Qualitative Research.

Quantitative Research	Qualitative Research
Focuses on classifying characteristics, quantifying them, and building statistical models to interpret observations.	Aims to provide a detailed and comprehensive description of phenomena.
The researcher has a clear understanding of the objective before starting the study.	The researcher may have only a general idea of what they aim to explore initially.
Typically employed in the later stages of a research project.	Often utilized during the early stages of research to explore concepts.
The study's design is carefully planned prior to data collection.	The research design evolves as the study progresses.
Utilizes tools such as surveys or technical equipment to gather numerical data.	The researcher collects data directly through interviews, observations, or other immersive methods.
Data is represented as numerical values and statistical metrics.	Data is expressed in the form of text, images, or artifacts.
Objective: Aims to measure and analyse specific concepts with precision, often using structured tools like surveys and questionnaires.	Subject: Prioritizes the interpretation of individual experiences and perceptions, relying on methods like interviews and participant observations.
Quantitative approaches are efficient for testing hypotheses but may overlook contextual nuances.	Qualitative methods provide richer insights but are time-intensive and less generalizable.
The researcher remains detached and objective throughout the study.	The researcher is deeply involved and subjectively engaged with the subject matter.

Source: Miles & Huberman (1994), Qualitative data analysis: An expanded sourcebook.

3.5.5 Rationale for Using Quantitative Data

This research adopts a quantitative approach due to the nature of its objectives, which aim to measure and analyse gender-based disparities in pension outcomes across multiple European countries. The study focuses on identifying trends, testing hypotheses, and quantifying systemic and structural factors contributing to the GPG. Quantitative methods are particularly suited for this purpose as they provide the statistical precision, generalizability, and large-scale analysis necessary to address the research questions effectively.

Qualitative methods, such as interviews or focus groups, while valuable for exploring individual experiences, are less appropriate for this study. These methods are inherently limited in scope and lack the statistical generalizability required for cross-country comparisons. The SHARE dataset, spanning 28 European countries and Israel, includes nearly 530,000 participants, offering unparalleled breadth and depth for examining systemic trends. Such a large-scale dataset requires quantitative analysis to ensure the findings are representative and robust.

Additionally, qualitative research methods would struggle to address the primary aim of this study, which is to measure pension disparities numerically and identify statistically significant contributing factors. The need for cross-national comparability and the ability to evaluate policy impacts further justify the choice of a quantitative approach. This study aims to provide evidence-based recommendations for policymakers, which require actionable insights grounded in numerical data.

Quantitative research offers other advantages critical to this study. First, it allows for precise statistical analysis of variables such as pension income, labor market participation, and caregiving responsibilities. Second, it enables historical and longitudinal analyses, which are essential for examining trends over the 13-year period covered by Waves 1 to 7 of the SHARE dataset. Third, quantitative methods facilitate the use of advanced analytical tools like regression analysis and the Blinder-Oaxaca decomposition, which isolate and quantify the contributions of different factors to the GPG.

While the strengths of qualitative methods are acknowledged, particularly their ability to provide contextual depth, this research mitigates such limitations by integrating insights from prior qualitative studies into the interpretation of the quantitative findings. Ultimately, the decision to adopt a quantitative approach ensures that the study can effectively address its objectives, provide generalizable results, and contribute meaningfully to the discourse on gender equality in European pension systems.

3.5.6 Note on the Use of AI Assistance

In preparing and refining the text for this research, ChatGPT—a large language model developed by OpenAI—was employed to ensure correct English usage, refine grammar, and enhance the overall formality of initial drafts. This included rephrasing simpler expressions into a more rigorous academic style. All AI-generated suggestions were reviewed and edited to maintain accuracy, scholarly standards, and coherence with the research objectives. The final content remains entirely the responsibility of the researcher, as ChatGPT served only to expedite language-related adjustments rather than replace critical analysis or academic rigor.

3.6 Variables Definitions

In the academic literature, gender discrepancies in other forms of income, such as wages and pensions, have been thoroughly researched. Still, the gender differences in Net Income have received somewhat less attention. This research aims to quantify gender-based differences in Net Household Income (NHI), Net Individual Income(NII), Net Total Pensions (NPI) and Net Individual Income from work (NIIW) across European nations, and seeks to determine whether countries with the highest levels of GG in NHI,NII and NIIW also have the highest levels of GG in NPI; whether these percentages of GG are related; whether a possible supplementary income, income from other household members (Yaohm)[1] that pensioners may receive, balances the GG in NHI and whether is motherhood penalty in retirement.

As stated previously[2], the analysis will utilise multiple Waves of data (main release) and the EasySHARE data. This chapter will analyse the NPI, the NHI, NII and the NIIW based on Waves 1,2,4,5 6, and 7[3]. It is essential to note that W3 (main release) is not included in the analysis because, W3 on people's life histories (SHARELIFE) collected considerably different information in terms of structure and content than the usual Waves. Additionally, the analysis of NHI across the waves for each country will be based on EasySHARE Data as well to compare the two datasets. The GG in the categories, mentioned above for each country will be analysed over a period of approximately 16 years and then will be compared with the rest European countries if

[1] Total income received by other household members

[2] An extensive Analysis of data sets and variables included can be found in chapter 2.

[3] The W7 questionnaire includes a SHARELIFE module for respondents who have previously participated in a SHARELIFE Interview.

the data are available on the same Waves. On this basis, we will be able to track the progress of the GG over time and compare and identify the nations with the most significant GG problems. It is well known that employing numerous methods will result in more accurate outcomes. This research will use various methods for calculating and collecting data depending on established research needs. Before we analyse the data, we must first explain the variables that this research included in each income category. The variables contributing to each Wave's overall income are displayed in the following tables based on different Waves (Table 3.3,3.4 & 3.5).In W1, net income metrics are derived from reported gross revenues, and most income variables were collected prior to taxes and social contributions; however, in subsequent Waves (W2 - W7), most income variables were collected after taxes and social contributions to capture the concept of take-home pay. The module gv_grossnet includes net income measurements (NHI & NII) to make the various income measures comparable between waves and to simplify longitudinal analysis. For this reason, for us to be able to compare the NHI and NII across the Waves, descriptive statistics for W1 were generated using gv_grossnet model and based on NHI (hhytotn) and NII [(ytotn), (Table 3.2)] and the thinc variable of gv_imputations for subsequent waves. In addition, the NPI and NIIW for W1 have not been calculated since these variables are a composite of numerous variables (aggregate value) and as the components of NHI (hhytotn) and NII (ytotn)[4] are not considered distinct variables when analysing the

[4] According to the gv_grossnet model, the NHI describes the sum of respondents' labor income, pension and replacement income, capital income and private transfers, NET of taxes and social contributions, plus NET income of NRPs and other household members, and household level benefits (SHARE, release 7-1-0). And NII includes labor income, pension and replacement income, capital income and private transfers (at the individual level), NET of taxes and social insurance contributions (SHARE, release 7-1-0). Still, the values of each contributor to NHI and NHI are unknown in both instances.

gv_grossnet model, NPI and NIIW cannot be calculated, therefore, the comparison for NPI & NIIWP with rest of the Waves will start from W2.

Table 3. 2: The variables that contribute to each different Income category_W1.

NPI	NHI	NII	NIIWP	Variables Description
ℓℓℓ	*hhytotn*		ℓℓℓ	Net THI
		ytotn		Net Total Individual Income

Source: Author's own research findings. Release guide (7-1-0)[5] which contains general information on the SHARE database. **Note:** This table's variables are classified based on W1 data (2004/2005). NPI & NIIWP cannot be calculated for W1 as the gv_grossnet model does not include the Income for Individuals as distinct variables; but has an aggregate value of NHI & NII. The comparison for NPI & NIIWP with rest of the Waves will start from W2.NHI for W1 will be based on Variable hhytotn & NII on variable ytotn respectively.

For the rest of the Waves the contributors to each of income categories are clearer as shown in the tables below (Table 3.3 & 3.4), where is briefly shown the NPI, a variable that describes each individual's total pension and is being consisted of 3 types of pensions the Annual Old Age, Early Retirement Pension, Survivor, War Pension (ypen1), Private and occupational pensions (ypen2), and Disability Pensions & Benefits (ypen36) for Waves 2,4 and 6 and the same variables for Waves 6 & 7 with the only difference that variable of Disability Pensions & Benefits has been renamed from ypen36 to ypen3.

The NHI describes the individual's income from work and pensions, the individual income from benefits and social assistance but also considers the income from the other household income. Here is essential to note that the income from rent and the total income by interest/dividend from financial assets is split among the household

[5] SHARE datasets have been registered with a Digital Object Identifier (DOI) since 2013, so they can be permanently identified and cited.

members, so we cannot clearly understand an individual's income from rents or interest/dividends at a household level. The NHI describes the individual's income from labor and pensions, the TII from benefits and social assistance, and considers the income from other household sources. It is important to note that the income from rent and the total income by interest/dividend from financial assets is split among the household members, so we cannot clearly understand an individual's income from rents or interest/dividends at a household level nor the individual payment from work (past & present). As a result, the variable NIIW has been calculated to consider only the individual's income from work (past & present) to obtain accurate results. Finally, the variable of NII describes the NHI without including the income from other household members but still including the variables of income from rents and dividends (NII= NHI – Yaohm).

Table 3. 3 Variables that contribute to each different Income Category from W2,4 & 5.

NPI	NHI[6]	NII	NIIWP	Variables Description
Ypen1	**Ypen1**	**Ypen1**	**Ypen1**	Annual Old Age, Early Retirement Pension, Survivor, War Pension
Ypen2	**Ypen2**	**Ypen2**	**Ypen2**	Private and occupational pensions
Ypen36	**Ypen36**	**Ypen36**	**Ypen36**	Disability Pensions & Benefits
	Ypen4	**Ypen4**		Unemployment benefits and insurances
	Ypen5	**Ypen5**		Social Assistance
	Ydip	**Ydip**	**Ydip**	Earnings from employment
	Yind	**Yind**	**Yind**	Earnings from self- employment
	Yreg2	**Yreg2**		Private transfers
	Yrent	**Yrent**		Income from rent
	Yaohm			Total income received by other household members
	Ybabsmf			Interest/dividend from financial asset

Source: Author's own research findings. Release guide (7-1-0), which contains general information on the SHARE database. **Note:** This table's variables are classified based on W2 (2006/07), W4 (2011)

[6] The variable of the NHI (thinc/Version A) remains constant between Waves. Since the NII is based on the NHI and is derived as the difference between the NHI and the variable of Yaohm, it will also remain constant across Waves.

and W5 (2013) data. For Waves 2, 4 & 5, the Disability Pensions & Benefits component is called Ypen36, while for Waves 6 & 7, the same variable in the dataset is called ypen3.

Table 3. 4: Variables that contribute to each different Income category from W6 & 7.

NPI	NHI	NII	NIIWP	Variables Description
Ypen1	**Ypen1**	**Ypen1**	**Ypen1**	Annual Old Age, Early Retirement Pension, Survivor, War Pension
Ypen2	**Ypen2**	**Ypen2**	**Ypen2**	Private and occupational pensions
Ypen3	**Ypen3**	**Ypen3**	**Ypen3**	Disability Pensions & Benefits
	Ypen4	**Ypen4**		Unemployment benefits and insurances
	Ypen5	**Ypen5**		Social Assistance
	Ypen6	**Ypen6**		Sickness benefits and pensions
	Ydip	**Ydip**	**Ydip**	Earnings from employment
	Yind	**Yind**	**Yind**	Earnings from self- employment
	Yreg2	**Yreg2**		Private transfers
	Yrent	**Yrent**		Income from rent
	Yaohm			Total income received by other household members
	Ybabsmf			Interest/dividend from financial asset

Source: Author's own research findings. Release guide (7-1-0) which contains general information on the SHARE database. **Note:** This table's variables are classified based on W6 (2015) & W7(2017). For Waves 2, 4 & 5, the Disability Pensions & Benefits component is called Ypen36, while for Waves 6 & 7, the same variable in the dataset is called ypen3.

GG in Total Pension Income NPI, NII, and NIIW will be calculated using respectively the formula below:

$$GG\ in\ NPI\backslash NII\backslash NIIW(\%) = \left(100\% - \frac{Women's\ Average\ Income}{Men's\ Average\ Income}\right) \qquad (1)$$

$$GG\ in\ NHI\ (\%) = Average\ \left(100\% - \frac{Woman's\ Income}{Man's\ Income}\right) \qquad (2)$$

The overall number of participants participating in the survey across all Waves is provided in the table below (Table 3.5). For GG in NPI, NHI, NII and NIIW, the number of participants increases annually from W1 to W6; however, the number of participants has considerably declined in W7. Irrespectively the dependent variable with the highest number of participants was W6. In any case, the number of participants is sufficient for us to obtain accurate results (Appendix 2.3,2.4,2.5).

Table 3. 5: Total Frequencies across the Waves for GG in NPI/NHI/NII/NIIW (Individuals:65+, Income>0).

Total Frequencies across the Waves, GG in NPI%											
W1		W2		W4		W5		W6		W7	
F[7]	M	F	M	F	M	F	M	F	M	F	M
		36206	39347	59061	69865	73709	83781	80693	91521	23009	26288
Total Frequencies across the Waves, GG in NHI & NII %											
W1		W2		W4		W5		W6		W7	
F	M	F	M	F	M	F	M	F	M	F	M
5214	6101	35351	31240	57593	61027	71114	72420	77779	78706	22936	23232
Total Frequencies across the Waves, GG in NIIW%											
W1		W2		W4		W5		W6		W7	
F	M	F	M	F	M	F	M	F	M	F	M
		36683	39560	52851	59478	74785	84372	79477	89837	23412	26446

Source: Author's own research findings from SHARE of Frequencies, [W1(2004/05), W2 (2006/07), W4 (2011) and W5 (2013), W6 (2015),W7(2017), (Main Release 7.1.0). **Note:** NPI & NIIW for W1 cannot be calculated (as explained above) that's why there are no frequencies.

3.7 Analysis of SHARELIFE Data (W7)

SHARELIFE data was collected during Waves 3 and 7, focusing on capturing respondents' life histories. While regular SHARE waves primarily cover current circumstances, SHARELIFE gathers detailed information on family dynamics, housing, employment history, and health, providing a cross-national, interdisciplinary database for research in sociology, economics, gerontology, and demography. This dataset complements SHARE panel data by enhancing understanding of how early-life experiences and events throughout life shape older adults' circumstances.

To address challenges with respondents', recall accuracy, SHARELIFE employs the Life History Calendar (LHC) approach. This technique helps respondents link life events (e.g., "I moved after my first child was born") to improve the precision of

[7] F: Female & M:Male

retrospective information. During Wave 3, all respondents completed the SHARELIFE questionnaire. In Wave 7, the SHARELIFE modules were administered to respondents who missed Wave 3 (82%), while standard panel modules were given to those who participated in Wave 3 (18%). It is important to note that the questionnaire's complex routing structure may result in missing data for some variables.

3.8 Conceptual framework of the research

The conceptual framework (Figure 1.1 & Appendix 1.1) outlines the key components and relationships that underpin the GPG and its contributing factors. It serves as a visual guide for understanding how labor market inequalities, systemic discrimination, and secondary income sources interact to influence pension outcomes for men and women across Europe. By illustrating these complex dynamics, the framework establishes a foundation for the analysis of gender disparities in pension systems, guiding the investigation of the study's research questions and hypotheses.

At the core of the framework are three primary contributory factors that drive gender inequalities during working life:

- Gender Inequalities in the Workforce: Women often encounter barriers to accessing higher-paying roles, promotions, and professional advancement opportunities. These limitations significantly impact their earning capacity and, subsequently, their pension contributions.

- Occupational Segregation: Women are disproportionately concentrated in lower-paying industries and professions, including roles requiring caregiving and social skills. These industries frequently offer limited pension benefits, exacerbating long-term financial disparities.

- Gender Differences in Care Responsibilities: Caregiving responsibilities, whether for children or elderly family members, fall disproportionately on women. These responsibilities often result in career interruptions, reduced working hours, and part-time employment, all of which directly limit women's ability to accumulate pension entitlements.

In addition to these structural inequalities, the framework identifies two potential amplifying factors:

- Systemic Discrimination: Beyond labor market barriers, pension systems themselves are not neutral. They often favor uninterrupted and consistent employment histories, which disadvantages women with irregular career trajectories. This systemic discrimination translates into lower pension outcomes for women, reflecting gender-based biases embedded in pension calculation formulas and eligibility rules.
- Secondary Income Sources: The framework examines the role of secondary income sources, such as property rentals, financial returns, and long-term savings, in influencing pension outcomes. While rental income demonstrates the potential to narrow pension disparities, its effectiveness remains highly dependent on national pension policies and individual financial circumstances. Financial returns and long-term savings, in contrast, have shown inconsistent impacts due to market volatility and gendered differences in financial planning behaviors.

Beyond these structural and labor-market-related inequalities, the framework reflects systemic discrimination as a reinforcing factor. Pension systems are often structured in ways that inadvertently favor consistent, uninterrupted employment contributions, disproportionately disadvantaging women whose careers are more likely to be non-linear. This systemic bias compounds the wage disparities experienced during working life and contributes significantly to the observed pension gap.

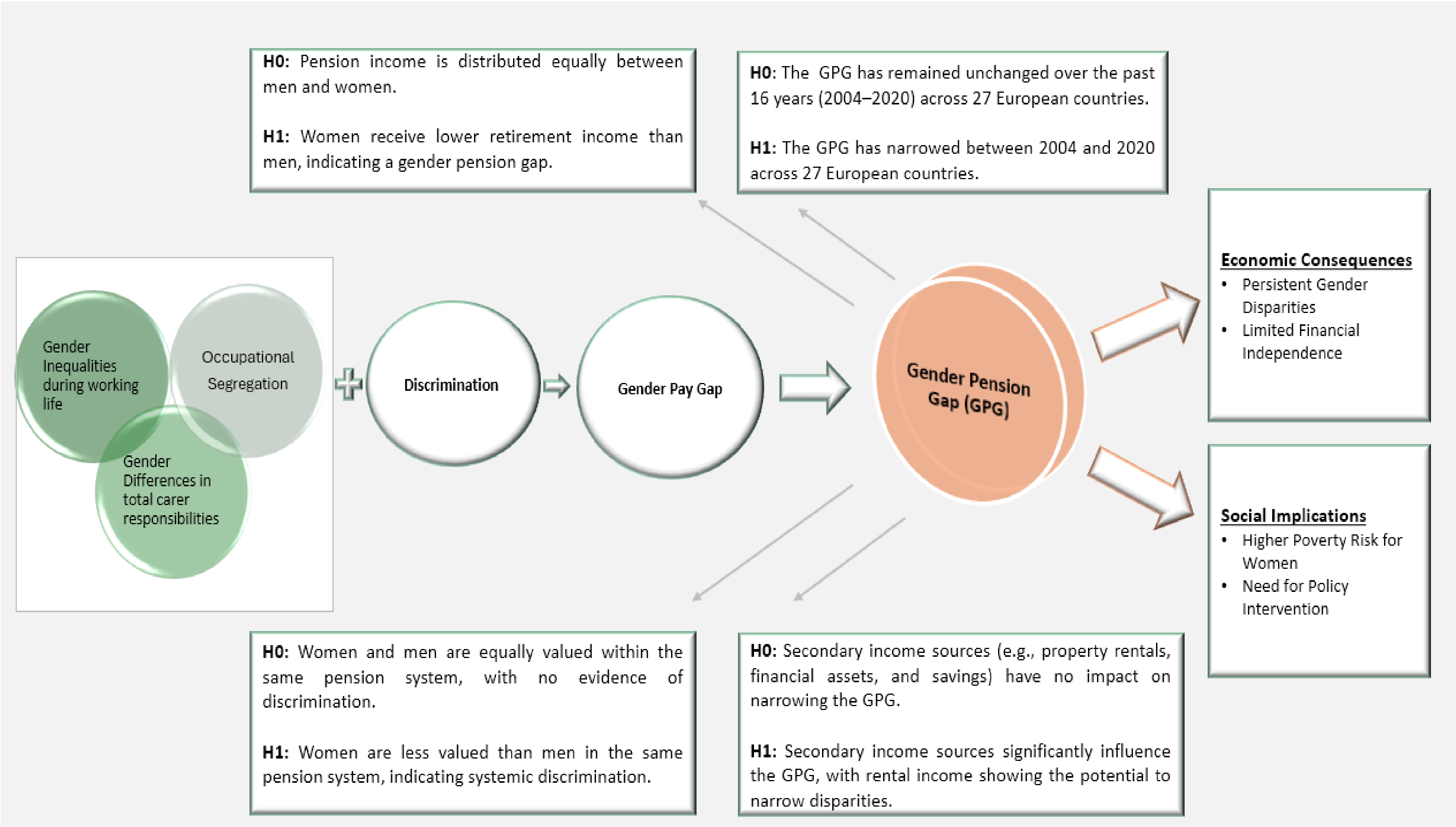
Additionally, secondary income sources—such as property rentals, financial returns, and long-term savings—are presented as influential factors within the framework. At the centre of the framework lies the GPG —a result of the cumulative interaction of these contributory factors. While systemic discrimination and labor market inequalities play dominant roles, the extent to which secondary income sources mitigate or exacerbate the GPG remains context dependent.

The framework also emphasizes the broader consequences of the GPG, which manifest across economic and social dimensions:

- Economic Consequences: Persistent gender disparities in pension income result in limited financial independence for women in retirement, restricting their ability to maintain financial security without external support.
- Social Implications: From a social perspective, the GPG heightens poverty risks among older women. Women who are financially dependent on limited pension incomes may face reduced quality of life, increased reliance on social welfare systems, or even social isolation. These vulnerabilities underscore the need for targeted policy interventions that address the systemic roots of pension disparities.

By mapping out these relationships, the conceptual framework underscores the interconnected nature of structural inequalities, systemic discrimination, and secondary income sources in perpetuating the GPG. It highlights the importance of examining these factors not in isolation but as part of a broader system of economic and social forces that shape pension outcomes.

Figure 1. 1. A conceptual framework of the research.



Source: Author's own chart. **Note:** The framework is organized based on research hypotheses

3.9 Summary of the Chapter

Chapter 3 outlines the methodology and data collection strategies used to analyse the GPG across European countries. It introduces the research framework, justifies the use of quantitative methods, describes the data preparation process, and provides insights into the dataset's attributes. The chapter also establishes the theoretical and methodological foundations necessary for analysing pension disparities through robust and multidimensional approaches.

The chapter begins by emphasizing the importance of a quantitative research approach, which is chosen for its capacity to collect and analyse numerical data at scale. Quantitative methods provide statistical precision and generalizability, making them ideal for addressing research questions related to systemic inequalities like the GPG. Alternative qualitative methods, while valuable for exploring individual experiences, were deemed less suitable for the large-scale cross-country comparisons required for this research.

The dataset used for this study is derived from the Survey of Health, Ageing, and Retirement in Europe (SHARE), one of the most comprehensive longitudinal panel studies globally. SHARE offers harmonized microdata on public health, socio-economic conditions, and living situations of individuals aged 50 and older. Spanning from 2004 to 2017, it includes nearly 530,000 interviews across 28 European countries and Israel. The chapter highlights SHARE’s alignment with other major studies, such as the U.S. Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA), enhancing its relevance for comparative analyses.

This research focuses on data from Waves 1 to 7 of SHARE, spanning from 2004 to 2017. The exclusion of later waves, such as Waves 8 and 9, is a deliberate methodological choice to avoid biases introduced by retrospective data collection or pandemic-specific disruptions. Waves 1 to 7 provide a robust and uninterrupted foundation for analysing systemic trends in pension disparities under normal socio-economic conditions.

The data preparation process involved rigorous cleaning to ensure relevance and accuracy. The sample was refined to focus on individuals aged 65 and older, representing retirees with measurable pension income. Respondents without pension income or incomplete demographic data were excluded to ensure that the findings accurately capture income-related disparities. Additionally, this chapter describes the use of SHARELIFE modules to enhance the understanding of how early-life experiences shape later-life outcomes; while addressing challenges such as recall accuracy through the Life History Calendar approach.

A key component of the methodology is the Blinder-Oaxaca decomposition, performed using the Oaxaca package in R, which separates pension disparities into explained and unexplained components. This technique distinguishes between differences due to observable characteristics, such as age and education, and unobservable factors like systemic discrimination. The chapter also highlights the integration of SPSS for data preparation and R for advanced analysis, ensuring methodological rigor.

The chapter further explains the conceptual framework of the research, which identifies the primary factors driving gender inequalities in pension systems. These include labor market inequalities, occupational segregation, caregiving responsibilities, and systemic discrimination. Secondary income sources, such as rental income and financial returns, are also considered for their role in mitigating or exacerbating the GPG. The framework emphasizes the interconnectedness of these factors and their broader economic and social consequences, such as increased poverty risks among older women and greater reliance on social welfare systems.

The chapter concludes by defining key variables used in the analysis, including Net Pension Income (NPI), Net Household Income (NHI), Net Individual Income (NII), and Net Individual Income from Work (NIIW). It provides a detailed breakdown of how these variables are calculated across different waves and discusses their relevance for understanding gender-based disparities. The robustness of the dataset and the methodological approach ensures that the study contributes meaningful and actionable insights into the systemic drivers of pension disparities.

In summary, Chapter 3 establishes the research’s methodological foundation by integrating a quantitative approach with a robust dataset, advanced analytical tools, and a multidimensional framework. These elements enable a comprehensive analysis of the GPG, providing evidence-based recommendations for policymakers to design equitable and sustainable pension systems across Europe.

Chapter 4: Analysis and Findings

4.1 Introduction

This chapter presents a comprehensive analysis of the GPG across European countries and Israel, using data from multiple SHARE survey waves (W1–W7) and supplementary EasySHARE datasets. Through descriptive statistical measures such as mean, median, and skewness, the chapter evaluates disparities in pension income (NPI), net household income (NHI), net individual income (NII), and income derived exclusively from work (NIIW).

The findings reveal persistent gender inequalities in pension outcomes, with Luxembourg, Germany, and the Netherlands showing the highest GPGs in pension income, while Denmark and Estonia exhibit the lowest disparities. The analysis highlights the role of supplementary household income sources in moderating pension gaps, showing consistently lower GPGs in NHI compared to NPI. Income derived exclusively from employment (NIIW) reveals the widest disparities, emphasizing the cumulative impact of career breaks, caregiving responsibilities, and wage inequality on women's pensions. The chapter also examines the coverage gap across the three pension pillars (public, occupational, and individual savings). Public pensions (Pillar 1) remain the primary source of income, yet significant gender coverage gaps persist in countries like Luxembourg and Greece. Occupational pensions (Pillar 2) exhibit pronounced disparities, while individual savings schemes (Pillar 3) remain underutilized, with Austria and Germany showing the highest participation rates.

Trends over time indicate a general decline in the GPG across most European countries, though exceptions exist, notably in Luxembourg, Belgium, and Slovenia, where disparities have increased. The analysis also underscores the importance of survivor pensions in reducing the GPG and reveals that disparities are highest among younger retirees (50–64 years old) and tend to decrease with age. This chapter emphasizes that addressing the GPG requires comprehensive, structural reforms targeting pension system design, gender-sensitive policies, and better integration of caregiving credits and flexible work arrangements. The findings provide a foundation for policymakers to develop equitable retirement systems that ensure financial security for women across Europe.

4.2 The GG in NPI across European Countries

Descriptive statistics play a vital role in quantitative research, as they offer a more meaningful and comprehensible way to summarise and interpret raw data (Ezzy, 2013). In this study, descriptive statistics are employed to present information gathered from nearly all European countries, ensuring that otherwise complex datasets become understandable and visually interpretable. This approach is particularly indispensable given the breadth of data analysed—spanning multiple European nations and covering a considerable time frame. Specifically, descriptive statistical measures such as skewness (capturing the degree of distribution of a variable around its mean), central tendency (mean and median), and spread (range, standard deviation, and quartiles) are used to provide initial yet crucial insights into the research questions.

The Gender Pension Gap (GPG) here is calculated using NPI, which comprises the accumulated annual amount of:

- **Public pensions (Pillar 1)** – Old age, early retirement, survivor and war pensions.
- **Occupational pensions (Pillar 2)**;
- **Private and individual savings schemes (Pillar 3)** – including contractual savings and life insurance.
- **Disability pensions and benefits**.

By applying descriptive statistics, the study condenses large volumes of data and yields preliminary findings—notably for Hypotheses 1 and 2—regarding the calculation of the GPG across European countries for the period 2004–2018 (with 2020 data to be incorporated once publicly available). Initial results indicate that, overall, the GPG has shown a downward trend over the years, although disparities remain significant in certain countries.

This section specifically analyses the GPG in NPI across European countries by focusing on the most recent SHARE wave available for each country. The key findings are presented in Table 4.1 and Figure 4.1. Consistent with existing literature, women receive lower pensions than men in all EU member states; however, the magnitude of this gap varies considerably:

- **Luxembourg (W6)** records the largest gap, with women aged 65+ receiving on average 47.9% less pension income than men (mean-based) and 52.1% less by the median-based measure. Luxembourg’s pension system is dominated by Pillar 1 public pensions, which provide broad coverage but are closely tied to contribution histories. Women’s shorter contribution periods and lower lifetime earnings significantly widen the gap, even in a country where the overall risk of poverty in retirement is relatively low (Eurostat, 2018).

- **Germany (W7)** also shows a substantial gap, with women receiving 35.0% less pension income than men (mean-based) and 36.7% less by the median. Germany's system combines a strong Pillar 1 with a sizeable Pillar 2 occupational pension sector, but the latter exhibits pronounced gender coverage gaps (see Section 4.10), reflecting women's lower participation in sectors with generous occupational schemes and more frequent career interruptions.
- **Denmark (W7)** features one of the smallest gaps (3.9% mean; 0% median). This outcome is closely linked to its near-universal Pillar 1 public pension provision, which ensures a strong income floor for all retirees and significantly limits gender disparities. Occupational pensions (Pillar 2) are also widespread but operate as supplements, making the public pillar the key equalising factor.
- **Estonia (W6)** also reports a low GPG (2% mean; 2.2% median). Here, modest Pillar 1 benefits are often supplemented by continued labour market participation among older women, driven by both necessity and tax incentives. This reduces dependency on pension income alone and narrows the gap.

On average, combining Waves 6 and 7 data, women in Europe receive 24.5% less pension income than men based on the mean, and 24.4% less based on the median. Although Luxembourg exhibits the highest GPG in NPI, Eurostat (2018) notes that retirees there face a relatively low risk of poverty compared to other EU member states—9.6% overall, with a disproportionate share affecting women (12.8%) relative to men (7.6%). In Germany, the second-highest GPG warrants further investigation into the pension outcomes of divorced and widowed women compared to married women; notably, German law mandates pension sharing upon divorce, which narrows the gap for these groups (mean 9.95%; median 16.67% – see Appendix 2.6).

By contrast, Denmark and Estonia illustrate how a dominant and inclusive Pillar 1 system (Denmark) or sustained labour market attachment among older women (Estonia) can minimise disparities. These differences underscore the role of pension pillar composition in shaping gendered outcomes—a theme examined in detail in Section 4.10.

Overall, the findings reveal a heterogeneous landscape across European nations: while some countries demonstrate notable progress in reducing the GPG, others still exhibit marked disparities, highlighting the complexity of ensuring equitable pension outcomes. The observed variation offers valuable opportunities for policymakers to examine effective structures—such as Denmark's universal public provision or Estonia's employment incentives—and consider how these might be adapted to reduce the financial vulnerability of older women.

4.2.1 GG Trends Overtime

Table 4.2 illustrates the trends in the Gender Gap (GG) in Net Pension Income (NPI) across multiple waves of the SHARE dataset. From 2006/07 (Wave 2) to 2017 (Wave 7), a general decline in GG in pensions is observed across many European countries. This trend highlights gradual improvements in gender equity in pension systems over time, reflecting the potential impact of policy reforms, changing labor market dynamics, and societal shifts in gender roles. However, exceptions to this trend underline the persistent structural challenges in certain countries.

Belgium represents one of the outliers, where the GG slightly increased over time, rising from 28.6% in Wave 2 to 28.7% in Wave 7 based on the mean. Although this change is minimal, it signifies stagnation in bridging gender disparities in pensions despite broader European trends of improvement. This stagnation could indicate enduring systemic inequalities in labor market participation, pension contributions, or policy frameworks within Belgium that disproportionately affect women.

Similarly, the **Czech Republic** experienced an increase in GG over the observed period. The mean GG in pensions rose significantly from 7% in Wave 2 to 11% in Wave 7. This notable rise suggests growing inequalities in pension outcomes, which could be attributed to changes in labor market dynamics or shifts in pension policies that failed to adequately address gender-based disparities. Such an increase also signals the need for targeted interventions to mitigate these trends.

In **Luxembourg**, a striking increase in GG is evident. From Wave 5 (34.8%) to Wave 6 (47.9%), GG in pensions surged significantly, reflecting one of the sharpest rises among the analysed countries. This substantial increase raises critical questions about the underlying causes, such as policy changes, labor market shifts, or demographic factors. Further investigation is warranted to understand whether the rise stems from disparities in pension system design, employment histories, or other socio-economic influences.

Greece presents a mixed picture. While the mean GG in pensions showed a slight decrease, the median GG increased over time. This duality suggests that while some improvements were made for certain groups within the population, deeper disparities persist for others. This divergence between mean and median values may reflect greater disparities among the highest and lowest income earners, indicating a complex interplay of systemic factors that continue to disadvantage women.

The **Netherlands** is another noteworthy case, as its most recent available data (Wave 5) reveals a relatively high GG in pensions. The mean GG stood at 36.3%, while the median GG was 38.4%, ranking the Netherlands third among European countries in terms of pension gender disparities for Wave 5. This high GG highlights persistent challenges within the Dutch pension system, potentially linked to occupational segregation, part-time employment patterns, or insufficient compensatory mechanisms for career breaks among women. Due to data limitations, updates for the Netherlands in Waves 6 and 7 were not available, leaving a gap in understanding how these disparities evolved in recent years.

On a broader level, the declining GG trends observed in most other European countries reflect positive strides toward gender parity in pension systems. These improvements may be attributed to various factors, including pension reforms aimed at increasing equity, enhanced labor force participation among women, and the introduction of policies that address caregiving responsibilities. However, the exceptions noted in Belgium, the Czech Republic, Luxembourg, and Greece underscore the uneven progress across countries. These cases highlight the need for continued efforts to ensure that pension systems adequately account for gendered disparities in employment and caregiving, which have long-term implications for retirement income.

The disparities in GG trends across countries also underscore the importance of cross-national comparisons in understanding how different policy frameworks and socio-economic conditions influence pension outcomes. Countries with increasing GG trends, such as Luxembourg and the Czech Republic, provide valuable lessons on potential pitfalls in pension design, while those with declining trends offer insights into effective strategies for reducing gender inequalities. This analysis emphasizes the need for tailored policy interventions that account for national contexts while addressing structural factors contributing to the GPG.

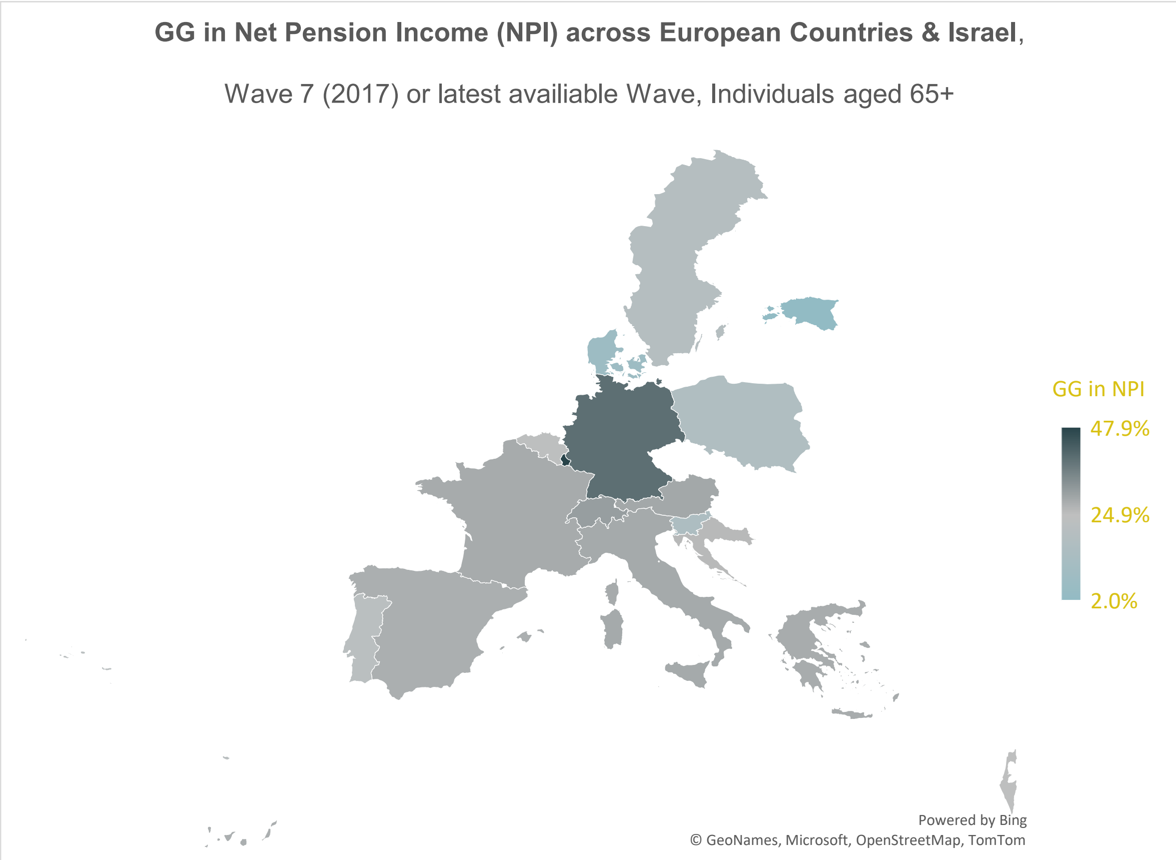
In conclusion, while the overall trends point toward declining GG in pensions across Europe, the exceptions highlight persistent challenges and the critical importance of sustained policy focus. These findings provide a foundation for further research into the underlying causes of these trends and the development of targeted solutions to promote gender equity in retirement outcomes.

Table 4. 1: GG in NPI (%) across European Countries (Most Recent Wave/each country).

	Mean			Median			
	Average NPI(NPI)			Average NPI(NPI)			
Country	**M**	**F**	**GG in NPI (%)**	**M**	**F**	**GG in NPI (%)**	**Wave**
Austria	19333.0	13455.2	**30.4**	19200.0	12492.0	**34.9**	7
Germany	18272.7	11873.8	**35.0**	16880.0	10680.0	**36.7**	7
Sweden	18506.9	14701.6	**20.6**	17228.0	14115.0	**18.1**	7
Spain	10935.4	7901.1	**27.7**	9600.0	7560.0	**21.3**	7
Italy	13516.6	9998.0	**26.0**	13200.0	9000.0	**31.8**	7
France	24436.2	16755.4	**31.4**	21648.0	14400.0	**33.5**	7
Denmark	14737.9	14161.1	**3.9**	13322.3	13323.7	**0.0**	7
Greece	8677.4	6296.1	**27.4**	8640.5	6000.0	**30.6**	7
Switzerland	41009.8	28517.4	**30.5**	30760.0	23171.7	**24.7**	7
Belgium	27353.9	19516.5	**28.7**	18960.0	15600.0	**17.7**	7
Cz. Republic	5285.0	4705.0	**11.0**	5469.8	4831.7	**11.7**	7
Ireland	20779.8	14428.2	**30.6**	11568	10556	**8.7**	2
Poland	4433.5	3429.1	**22.7**	4473.0	3241.7	**27.5**	7
Luxemburg	52863.8	27550.3	**47.9**	42000.0	20136.0	**52.1**	6
Portugal	7611.3	5917.7	**22.3**	6600.0	4200.0	**36.4**	6
Slovenia	9080.7	7641.4	**15.9**	7800.0	6000.0	**23.1**	6
Estonia	4149.3	4067.7	**2.0**	4296.0	4200.0	**2.2**	6
Hungary	4580.9	3389.3	**26.0**	4255.3	3152.0	**25.9**	6
Netherlands	19997.2	12729.6	**36.3**	17492.5	10775.1	**38.4**	5
Israel	13849.1	10454.6	**24.5**	8853.4	7892.8	**10.8**	6
Croatia	4580.9	3389.3	**26.0**	4255.3	3152.0	**25.9**	6

Source: Author's own research findings from SHARE [W5 (2013), W6 (2015), W7(2017) - Main Release 7.1.0]. **Note:** The estimation is based on W6 & W7, except for the Netherlands. For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment. Ireland is the only country with data for W2, but the data available only for 2006/07 will not be compared with GG for the rest of the Waves.

Figure 4.1: GG in NPI(NPI), based on mean, across European Countries and Israel, W7(2017) or latest available Wave, Individuals aged 65+.



Source: Author's own findings from SHARE [W5 (2013), W6 (2015), W7(2017) - Main Release 7.1.0]. **Note:** The estimation is based on W6 & W7 (the most recent Wave for each country), except for the Netherlands. For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment.

Dispersion Measures

Dispersion measures for NPI across Waves are summarized below (Table 4.2). The standard deviation, and range show variation in NPI, while skewness and kurtosis indicate distribution characteristics. These measures provide insight into the extent and variability of GG across countries and Waves.

Table 4. 2: GG in NPI (%) across European Countries by Wave – Individuals aged 65+.

	GG in NPI (%) _Based on Mean across the Waves					GG in NPI (%) _Based on Median across the Waves				
Country	**W2**	**W4**	**W5**	**W6**	**W7**	**W2**	**W4**	**W5**	**W6**	**W7**
Austria	32.4	31.2	32.2	29.2	30.4	36.5	33.7	33.3	33.3	34.9
Germany	45.4	47.6	41.5	39.9	35.0	44.7	48.5	46.4	40.2	36.7
Sweden	25.5	24.7	21.5	19.9	20.6	24.2	23.5	22.7	19.8	18.1
Spain	32.2	29.0	25.9	27.9	27.7	24.1	23.6	28.0	24.8	21.3
Italy	32.9	31.1	4.6	28.9	26.0	40.9	33.7	14.0	33.6	31.8
France	39.7	27.5	28.3	28.6	31.4	33.9	31.1	30.5	29.5	33.5
Denmark	11.4	5.5	8	7.7	3.9	1.6	0.0	3.6	3.6	0.0
Greece	27.5			28.5	27.4	28.6			26.9	30.6
Switzerland	32.7	38.0	39.3	31.0	30.5	34.2	45.6	44.2	25.5	24.7
Belgium	28.6	27.2	16.8	23.9	28.7	18.7	20.0	14.7	16.6	17.7
Israel	28.6		14.9	24.5		28.6		22.9	10.8	
Czech Republic	7	9.0	8.3	9.9	11.0	7.9	10.4	13.0	14.2	11.7
Poland	24.0	24.7		17.4	22.7	22.2	26.2		26.7	27.5
Luxembourg			34.8	47.9				46.9	52.1	
Ireland	30.6					8.7				
Portugal		27.6		22.3			33.3		36.4	
Slovenia		11.6	19.1	15.9			30.6	18.3	23.1	
Estonia		1.6	1.4	2.0			1.2	0.9	2.2	
Netherlands	34.6	31.1	36.3			38.7	37.2	38.4		
Hungary		12.4					13.0			
Croatia				26.0					25.9	

Dispersion Measures_NPI

	Std.Dev.	Range	Skewness	Percentiles (25)	Percentiles (75)	Kurtosis
W2	17093.0	1200990.0	26.1	5317.9	14760.0	1584.5
W4	21689.8	536396.8	6.9	4201.4	16116.0	71.3
W5	18701.9	878637.9	10.4	5604.0	18000	244.6
W6	18902.2	1613267.9	10.9	4838.8	16212.0	386.9
W7	15420.9	226850.0	6.4	6120.0	18000.0	66.8

Source: Author's own research findings from SHARE, [W1(2004/05), W2 (2006/07), W4 (2011) and W5 (2013),W6 (2015),W7(2017, (Main Release 7.1.0)]. **Note:** For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment. Figures reflect repeated cross-sections of individuals aged 65+, which means sample composition changes between waves due to entry of new retirees and exit of older participants. Observed fluctuations may therefore reflect both cohort effects and demographic turnover, particularly in countries with smaller samples.

4.3 The GG in NHI across European Countries

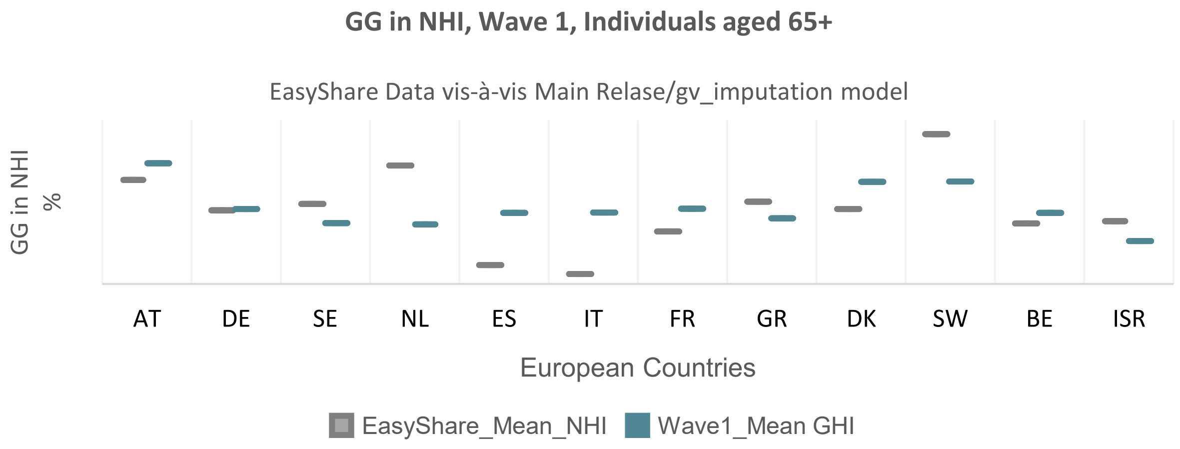
This section investigates the GG in NHI. For Wave 1, the GG in NHI was calculated using the gv_grossnet model (Table 3.2), as the original Wave 1 data in the main SHARE release records income before taxes and social contributions (gross). The gv_grossnet model applies the EUROMOD tax-benefit microsimulation to derive net income values. For the subsequent waves, the GG in NHI was calculated using the gv_imputations model (Tables 3.3 & 3.4), which provides harmonised net household income estimates (*thinc*) across all countries and waves.

To ensure accuracy and comparability, Figure 4.2 compares the mean GG in NHI percentages from Wave 1 (main release, calculated using gv_grossnet or gv_imputations) with those from Wave 1 EasySHARE data (*thinc_m*).

In EasySHARE, *thinc_m* for Wave 1 is derived directly from gv_grossnet, while later waves use gv_imputations. This means both datasets are on a net basis for Wave 1, but minor level differences may occur due to EasySHARE's harmonisation and coding adjustments (e.g., standardised missing values).

Both datasets confirm that the Netherlands, Switzerland, and Austria exhibit the highest GG in NHI, demonstrating consistency across all three sources (gv_grossnet, gv_imputations, and EasySHARE) (Table 4.3, Appendix 3.1). This consistency strengthens confidence in the robustness of the results despite differences in dataset construction.

Figure 4.2 Percentage GG in NHI, Wave 1: comparison of Easy SHARE vs. main SHARE release. Individuals aged 65+.



Source: Author's calculations from SHARE main release W1 (2004/05) Release 7.1.0 and EasySHARE W1 (2004/05) Release 8.0.0/9.0.0. **Notes**: Wave-1 gross incomes in the main release are converted to net via gv_grossnet (EUROMOD). EasySHARE's thinc_m uses gv_grossnet for W1 and gv_imputations (thinc) for later waves. Patterns are consistent across datasets.

This section provides a detailed analysis of the Gender Gap (GG) in National Household Income (NHI), which has been calculated across various Waves of the data. Table 4.3 and Figure 4.3 present a comprehensive overview of the disparities between male and female household incomes, revealing notable patterns and trends. Specifically, Switzerland emerges as the country with the highest GG in NHI based on mean values, at 30.1%, followed by Austria at 24.6%. These findings highlight consistent inequalities in household income distribution, even in countries with generally high average income levels.

Interestingly, these results show a divergence from those countries that exhibit the largest GG in National Pension Income (NPI). For instance, the Netherlands, which records one of the highest GGs in NPI, has a comparatively low GG in NHI—only

10.6% when using the mean and 17.0% when using the median. This suggests that NHI, which includes not only pension income but also various other sources of household income, presents a different landscape of gender inequality. Such a contrast underlines the importance of examining multiple measures of economic disparity to fully understand the complexities of income inequality across genders.

When examining median-based results, the rankings shift. Estonia shows the highest GG in NHI at 42%, followed by Switzerland at 37% and the Czech Republic at 28.4%. These median figures suggest that, in certain countries, the central point of household income distribution (as measured by the median) reveals even greater disparities than the mean does. This could reflect underlying income structures where a larger proportion of women are concentrated in the lower income brackets, thereby increasing the median gap.

The lower GGs in NHI compared to NPI across many countries can be explained by the additional sources of income that make up NHI. Unlike NPI, which is largely derived from individual pension entitlements, NHI captures a broader array of household-level financial inflows. These include contributions from other household members who may earn incomes, rental income from owned properties, and returns on financial investments. These additional income streams can help offset disparities that are more pronounced in individual-level pension incomes. For example, in households where multiple members contribute to the overall income, a male member’s higher pension might be balanced by a female member’s non-pension income sources, thereby narrowing the overall household income gap. Similarly, rental income and financial returns—while not evenly distributed across genders—may still reduce the net disparity in NHI as compared to NPI.

This nuanced interplay of income sources underscores why the GG in NHI often appears lower than in NPI. By including non-pension financial contributions, NHI provides a more holistic view of household economic well-being, revealing that secondary income streams have a mitigating effect on overall gender disparities. However, it also highlights that these mitigating effects are unevenly distributed across countries and income measures. While some countries benefit significantly from additional household income components in reducing the GG, others see more modest impacts.

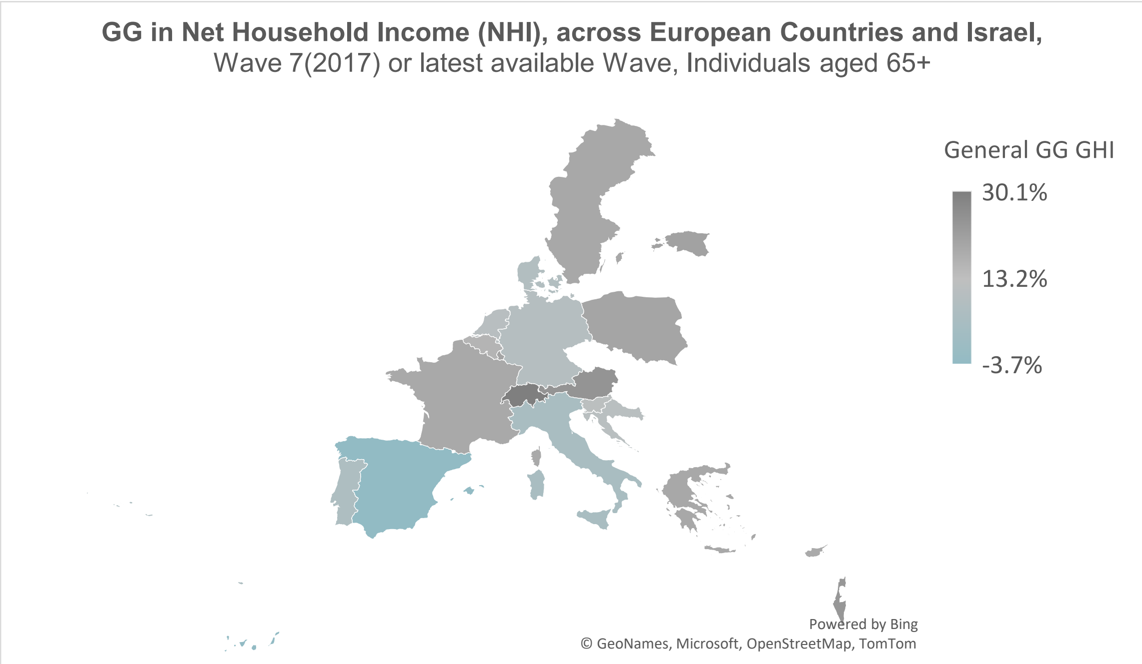
Overall, the analysis of Table 4.3 and Figure 4.3 offers a deeper understanding of the gender income gap's variability. By considering both mean and median values, as well as the broader components of NHI, we can appreciate the complex dynamics that shape economic inequalities. These findings not only shed light on the relative positions of different countries but also lay the groundwork for further exploration of how various income sources contribute to or reduce gender disparities. The subsequent sections will delve into these factors in greater detail, examining how secondary income sources and broader household-level financial arrangements influence the observed patterns and trends.

Table 4. 3 GG in NHI (%) across European Countries (Most Recent Wave/each country).

Mean				Median			
	Average NHI			Average NHI			
Country	M	F	GG in NHI (%)	M	F	GG in NHI (%)	Wave
Austria	35881.8	27055.2	**24.6**	31212.0	23374.5	**25.1**	7
Germany	32412.6	29323.9	**9.5**	28854.8	25235.3	**12.5**	7
Sweden	38947.2	31481.5	**19.2**	34094.9	27071.3	**20.6**	7
Spain	17941.8	18604.2	**-3.7**	15400.0	15700.0	**-1.9**	7
Italy	22813.0	21703.6	**4.9**	19310.0	19040.0	**1.4**	7
France	41029.2	33207.7	**19.1**	35200.0	27784.7	**21.1**	7
Denmark	33192.5	30403.4	**8.4**	29844.3	26055.9	**12.7**	7
Greece	12958.9	10460.7	**19.3**	10800.0	8400.0	**22.2**	7
Switzerland	85994.3	60093.0	**30.1**	68251.5	43013.2	**37.0**	7
Belgium	60826.4	51021.3	**16.1**	31936.9	25086.5	**21.4**	7
Israel	32844.0	25068.9	**23.7**	24798.0	19349.9	**22.0**	6
Czech Republic	9987.4	8125.2	**18.6**	9950.6	7124.1	**28.4**	7
Poland	7628.7	6099.3	**20.0**	7331.5	5271.3	**28.1**	7
Luxembourg	91168.0	72684.7	**20.3**	62634.2	51047.0	**18.5**	6
Ireland	53543.1	41282.4	**22.9**	27775.6	20176.0	**27.4**	2
Portugal	12516.7	11642.2	**7.0**	10336.6	9000.0	**12.9**	6
Slovenia	16727.6	14772.1	**11.7**	13798.0	11000.0	**20.3**	6
Estonia	8094.3	6413.3	**20.8**	8310.0	4812.0	**42.1**	6
Croatia	8534.0	7584.0	**11.1**	6619.3	5358.5	**19.0**	6
Netherlands	38203.4	34140.1	**10.6**	32120.0	26650.0	**17.0**	5
Hungary	8964.6	7076.4	**21.1**	7547.2	5841.5	**22.6**	4

Source: Author's own research findings from SHARE, [W1(2004/05), W2 (2006/07), W4 (2011) and W5 (2013), W6 (2015), W7(2017, (Main Release 7.1.0)]. **Note:** For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment. Ireland is the only country with data for W2, but the data available only for 2006/07 will not be compared with GG for the rest of the Waves.

Figure 4.3: GG in NHI, based on mean, across European Countries and Israel, W7(2017) or latest available Wave, Individuals aged 65+



Source: Author's own findings from SHARE [W5 (2013), W6 (2015), W7(2017) - Main Release 7.1.0]. **Note:** The estimation is based on W6 & W7 (the most recent Wave for each country), except for the Netherlands. For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment.

GG Trends Across Waves

Table 4.4 presents a comprehensive examination of the Gender Gap (GG) in National Household Income (NHI) across a series of Waves, offering valuable insights into long-term trends and variations among different countries. This detailed analysis reveals not only which countries exhibit consistently high or low GG levels, but also how these levels have shifted over time and how different calculation methods—mean versus median—affect the observed disparities.

Overview of General Trends:

In most countries, GG in NHI tends to show a gradual decline over time, with later Waves generally displaying smaller disparities than earlier ones. This pattern suggests a slow but steady convergence of male and female household incomes in many contexts. However, exceptions to this trend exist, underscoring the complexity of gender income dynamics. For example, France and Israel stand out as countries where GG in NHI increased modestly over the observed period, contrasting with the broader trend of narrowing gaps. These findings highlight the importance of examining country-specific factors, such as changes in employment policies, social welfare programs, and cultural norms, which may influence the direction and pace of gender income convergence.

Notable High GG Countries:

Switzerland emerges as a particularly striking example, consistently showing the highest GG across all Waves. The mean GG peaked at 30.1% in W7, while the median-based GG reached 37%—the highest of any country in the dataset. This persistent disparity underscores Switzerland’s unique economic and social landscape. Despite the country’s high overall income levels and relatively stable economy, structural factors such as occupational segregation, differences in labor market participation rates, and disparities in access to higher-paying roles may contribute to the pronounced GG. Similarly, Austria and Belgium maintain consistently high GG levels throughout the Waves. These countries share some structural similarities, including long-standing wage gaps, gendered patterns of part-time employment, and differences in pension contributions, all of which can contribute to sustained disparities in household income.

Countries with Low GG Levels:

In contrast, Spain and Italy exhibit some of the lowest GG levels in NHI. In certain Waves, these countries' GG percentages approach zero, suggesting near parity in household income between genders. While this might initially appear positive, it warrants a deeper investigation into the underlying factors. In some cases, low GG percentages might not indicate true equality but rather reflect a lower overall income level or widespread financial insecurity that affects both genders similarly. Additionally, countries with low GG levels may still have significant gender disparities in other economic areas, such as labor market participation rates or pension benefits, which are not fully captured by NHI alone.

Mean versus Median Disparities:

The choice of calculation method—mean versus median—provides further nuance to the analysis. While mean values offer a broad average that accounts for the entire income distribution, median values focus on the midpoint, potentially highlighting disparities among the majority of the population. In countries like the Czech Republic and Poland, the difference between these two approaches is particularly pronounced. For example, the median-based GG in these countries is considerably higher than the mean-based GG, suggesting that a larger proportion of women may be concentrated in lower income brackets, thereby increasing the median gap. This finding illustrates the importance of using multiple measures to capture the full extent of income inequality.

Implications and Next Steps:

The patterns observed in Table 4.4 emphasize the need for a multi-faceted approach to understanding and addressing gender disparities in household income. While some countries have made progress in reducing GG over time, others continue to struggle with persistent gaps. The differences between mean and median calculations also highlight the importance of examining the full income distribution, rather than relying solely on average values. Moving forward, future sections will delve deeper into the underlying causes of these trends, exploring the role of secondary income sources, policy interventions, and structural factors that shape the gender income landscape. By providing a more comprehensive understanding of these dynamics, this analysis contributes to ongoing efforts to achieve greater gender equity in household income.

Table 4. 4 GG in NHI (%) across European Countries by Wave – Individuals aged 65+.

	GG in NHI (%) _Based on Mean across the Waves						GG in NHI (%) _Based on Median across the Waves					
Country	**W1**	**W2**	**W4**	**W5**	**W6**	**W7**	**W1**	**W2**	**W4**	**W5**	**W6**	**W7**
Austria	30.8	29.2	23.1	22.5	17.1	24.6	7.1	30.1	23.1	24.9	19.5	25.1
Germany	18.0	28.6	24.1	17.5	19.7	9.5	5.6	19.1	14.2	16.2	10.9	12.5
Sweden	20.1	17.1	16.6	12.7	14.2	19.2	22.1	14.5	29.3	17.5	15.8	20.6
Spain	18.4	3.5	-0.3	2.9	7.4	-3.7	16.2	24.0	-1.7	-1.6	3.2	-1.9
Italy	28.0	6.6	-2.7	10.3	1.5	4.9	14.8	5.7	2.2	3.2	4.0	1.4
France	10.9	22.1	17.1	33.5	17.2	19.1	19.6	22.3	20.5	18.2	20.6	21.1
Denmark	16.1	18.6	12.3	12.0	15.1	8.4	18.7	21.3	18.6	12.6	17.2	12.7
Greece	24.2	24.5			20.5	19.3	24.8	32.4			20.0	22.2
Switzerland	33.0	31.3		26.9	23.1	30.1	34.0	33.8	24.3	28.3	27.7	37.0
Belgium	28.5	21.1	19.2	8.7	19.1	16.1	28.6	13.3	16.9	10.5	17.9	21.4
Israel	19.1	14.2	18.0	9.8	23.7		19.9	19.5		22.0	27.4	
Czech				21.8						28.8		
Republic		22.0	23.2		21.9	18.6		31.4	33.7		33.4	28.4
Poland		21.3	23.2		18.3	20.0		23.9	22.8		26.0	28.1
Luxembourg			18.2	1.1	20.3					12.2		
Ireland		22.9						27.4			18.5	
Portugal					7						12.9	
Slovenia			18.1	10.5	11.7				31.8	20.6	20.3	
Croatia					11.1						19.0	
Estonia			18.0	1.5	20.8				29.7	31.1	42.1	
Netherlands	40.1	5.9	13.4	10.6			24.7	37.2	17.3	17.0		
Hungary			21.1						22.6			

Dispersion Measures_NHI						
	Std.Dev.	Range	Skewness	Percentiles (25)	Percentiles (75)	Kurtosis
W1[8]	48517.4	2766657	13.8	11697.1	36051.0	469.3
W2	42674.1	1985161.0	14.7	9700.0	29185.2	379.6
W4	56579.8	5806944.0	31.4	8120.0	31663.8	2397.5
W5	77875.2	10047885	95.0	11400.0	37160.0	12022.3
W6	39936.6	2528626.0	13.8	8834.6	30898.8	557.0
W7	110034.8	7398809.0	61.1	10288.9	33757.9	4080.8

Source: Author's own research findings from SHARE, [W1(2004/05), W2 (2006/07), W4 (2011) and W5 (2013), W6 (2015), W7(2017, (Main Release 7.1.0)]. **Note:** For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment. Ireland is the only country with data for W2, but the data available only for 2006/07 will not be compared with GG for the rest of the Waves. Figures reflect repeated cross-sections of individuals aged 65+, which means sample composition changes between waves due to the entry of new retirees and exit of older participants. Observed fluctuations may therefore reflect both cohort effects and demographic turnover, particularly in countries with smaller samples.

4.4 The GG in NII across European Countries

This section provides a comprehensive analysis of the Gender Gap (GG) in National Individual Income (NII) among individuals aged 65 and older, focusing exclusively on personal income sources and excluding contributions from other household members (Yaohm). The purpose of isolating NII is to better understand how income generated solely by individuals reflects gender disparities and to evaluate the effectiveness of various social, economic, and retirement policies in reducing these gaps. Table 4.5 highlights that Greece exhibits the highest GG in NII for Wave 7 based on mean calculations, with a substantial disparity of 30.7%. This finding suggests significant structural inequalities in personal income sources between men and women in Greece, likely reflecting broader economic and labor market dynamics. Switzerland follows closely, recording a mean GG of 26.0%, which underscores the persistent challenges even in high-income countries known for their robust financial systems.

[8] The dispersion measures are based on dependent variable of thinc for W1

These high GGs in countries like Greece and Switzerland indicate that, despite differing economic contexts, gender-based income inequalities remain entrenched.

When shifting the focus to median calculations, Switzerland takes the lead, with a median GG of 30.5%, slightly exceeding Greece's 26.1%. The higher median GG in Switzerland implies that the income disparities are not limited to a few extreme cases but rather affect a broader segment of the population. This consistency between mean and median measurements further highlights Switzerland's pronounced gender disparities in NII, despite its overall wealth and high standard of living. The results for Wave 6 reveal notable differences in GG rankings depending on the calculation method. Using the mean, Israel displays the highest GG at 28.3%, followed closely by Luxembourg at 26.8%. However, when the median is considered, the Czech Republic emerges at the top with a GG of 35.0%, followed by Israel at 32.8%. These differences between mean and median results suggest that in certain countries, the bulk of the female population experiences lower individual incomes relative to their male counterparts, rather than the gap being driven solely by a few outliers with very high or very low earnings. Luxembourg's relatively high mean and median GGs highlight the persistence of gender-based income disparities in a country known for its affluent population and generous social welfare programs. Israel's position at or near the top in both mean and median GGs underscores the unique challenges faced by women in that country's income distribution structure. The Czech Republic's leading position in median GG (35.0%) reflects that, while the mean may be slightly lower, the typical (median) income experience for women is significantly less favorable than for men, indicating that income disparities are widespread and not confined to the extremes.

On the other end of the spectrum, Portugal consistently shows the lowest GG in NII across both mean and median calculations, at 11.9% and 15.8%, respectively. These figures suggest that gender income disparities in Portugal are relatively small compared to other countries, which may be due to a more even distribution of pensions, benefits, or income streams among retired individuals. Portugal's smaller GG could also reflect certain policy measures, labor market conditions, or social norms that mitigate gender differences in individual income. Sweden also ranks among the countries with lower GGs, showing a mean GG of 17.0%. Sweden's progressive social policies, strong labor market participation of women, and comprehensive pension system likely contribute to this more equitable outcome. Germany's median GG of 13.5% similarly places it among the countries with the lowest gender disparities in NII. The relatively small GG in Germany might indicate that, while income inequalities persist, there are effective mechanisms—such as well-regulated pension schemes or social transfers—that help limit the extent of these disparities.

The findings in Table 4.5 provide valuable insights into the patterns of gender disparities in individual income, particularly at older ages. The observed variations between mean and median GGs demonstrate the importance of considering multiple measures of central tendency when evaluating gender income gaps. Countries like Switzerland and Greece, with high GGs, point to systemic challenges that require targeted interventions, such as increased pension credits for caregivers, stronger anti-discrimination policies in the labor market, and initiatives to support higher female workforce participation throughout the life course. In contrast, the lower GGs in Portugal, Sweden, and Germany suggest that certain policy frameworks and cultural factors can effectively reduce income inequalities. These cases highlight the potential benefits of universal or near-universal pension schemes, gender-neutral retirement policies, and active labor market programs that promote equal opportunities.

Overall, this analysis underscores the need for a nuanced understanding of gender income disparities at older ages. By excluding household-level contributions and focusing solely on NII, it reveals the true extent of individual-level gender gaps and provides a clearer picture of where targeted policy interventions are most urgently needed. The next steps in this research will involve examining how these gender gaps have evolved over time, the role of various policy interventions in mitigating disparities, and the long-term impacts of narrowing the GG in NII on overall economic well-being and social equity.

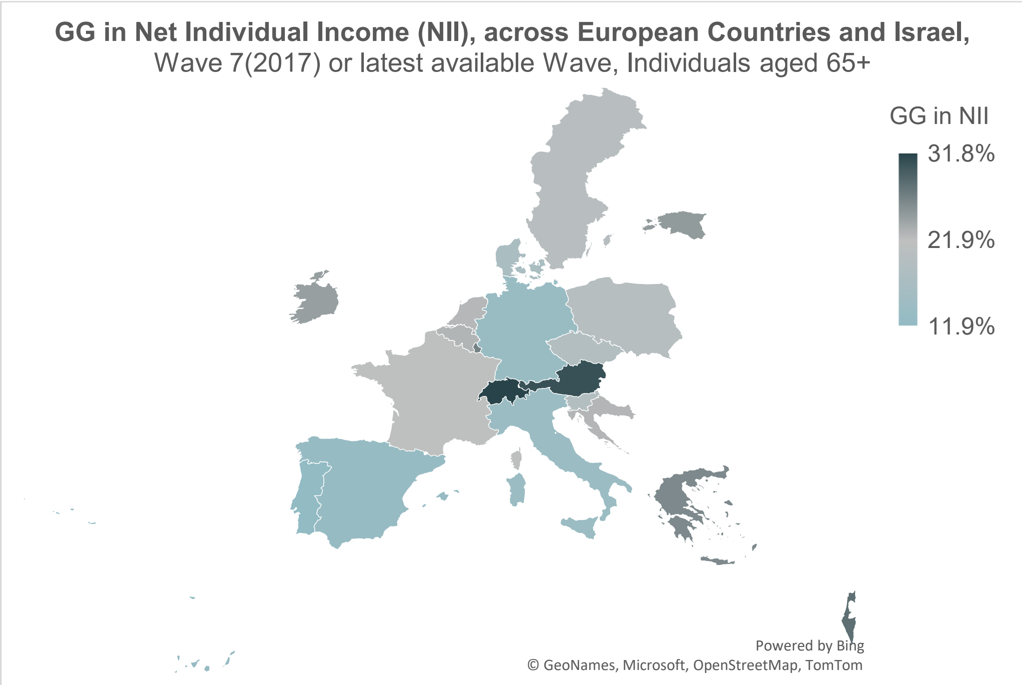
A degree of fluctuation in the GG values reported in Tables 4.2 and 4.4 can be explained by both cohort effects and the dynamic nature of the SHARE panel design. Each wave represents a repeated cross-section of individuals aged 65 and above, which means that the sample changes over time through the 'entry' of newly eligible retirees and the 'exit' of participants who pass away or drop out of the survey. In countries with smaller sample sizes or more heterogeneous pension structures, such as Luxembourg and the Netherlands, these demographic shifts can have a proportionally larger effect on the observed GG. Pension income levels are also shaped by cohort-specific characteristics, including variations in lifetime earnings trajectories, employment histories, and the timing of pension reforms. Newly retired cohorts may benefit from different accrual rules, replacement rates, or indexation formulas compared to older cohorts, thereby influencing the aggregate GG at each wave. This combination of entry–exit dynamics and policy-driven cohort differences is an important factor when interpreting year-to-year changes, particularly where pronounced fluctuations are observed.

Table 4. 5: GG in NII (%) across European Countries (Most Recent Wave/each country).

	Average NII			Average NII			
	Mean			Median			
Country	**M**	**F**	**GG in NII (%)**	**M**	**F**	**GG in NII (%)**	**Wave**
Austria	32444.3	25588.3	21.1	29544.0	22560.0	23.6	7
Germany	33718.4	26391.6	21.7	26540.0	22952.0	13.5	7
Sweden	40202.2	33369.9	17.0	35007.3	29207.3	16.6	7
Spain	17232.1	13984.7	18.8	14560.9	11867.6	18.5	7
Italy	23206.6	19025.1	18.0	19321.9	15600.0	19.3	7
France	32479.6	26187.0	19.4	28758.7	22232.5	22.7	7
Denmark	36406.2	28985.4	20.4	30727.9	24354.4	20.7	7
Greece	16512.5	11445.0	30.7	12017.0	8880.0	26.1	7
Switzerland	92591.6	67791.1	26.8	70692.8	49157.3	30.5	7
Belgium	57045.5	43623.6	23.5	31549.0	23838.5	24.4	7
Israel	33994.8	24370.2	28.3	24430.3	16429.1	32.8	6
Czech Republic	9275.7	7163.4	22.8	9237.8	6001.0	35.0	7
Poland	8467.0	6871.8	18.8	7199.4	5162.5	28.3	7
Luxembourg	90125.6	65937.9	26.8	61632.4	46364.4	24.8	6
Ireland	50634.4	38238.6	24.5	24000.0	18735.7	21.9	2
Portugal	12800.7	11275.3	11.9	10356.8	8724.0	15.8	6
Slovenia	16553.7	13387.5	19.1	13703.0	9600.0	29.9	6
Estonia	8906.1	6696.4	24.8	8418.4	4902.5	41.8	6
Croatia	8357.1	6463.0	22.7	6461.7	4268.4	33.9	6
Netherlands	35047.0	29935.9	21.1	29974.9	24288.15	19.0	5
Hungary	**7759.5**	**6120.1**	**21.1**	**6843.2**	**5232.9**	**23.5**	**4**

Source: Author's own research findings from SHARE, [W1(2004/05), W2 (2006/07), W4 (2011) and W5 (2013), W6 (2015), W7 (2017, (Main Release 7.1.0)]. **Note:** For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave

Figure 4.4 GG in NII, based on mean, across European Countries and Israel, W7(2017) or latest available Wave, Individuals aged 65+



Source: Author's own findings from SHARE [W5 (2013), W6 (2015), W7 (2017) - Main Release 7.1.0]
Note: The estimation is based on W6 & W7 (the most recent Wave for each country), except for the Netherlands. For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment. Ireland is the only country with data for W2, but the data available only for 2006/07 will not be compared with GG for the rest of the Waves.

Whether we include the income of other Household members in the calculation of the GG or not, the GG in W2 is significantly greater than in W6 or W7; this indicates that the GG is decreasing over time, as previously confirmed in the computation of the GG in NHI (Table 4.5) and now from the table below (Table 4.6) where again being conservative and even if the W1 has been calculated we will start the analysis from W2 where all the models utilize the same data. Switzerland and Sweden are the only nations where the GG increases marginally from W2 to W7. Luxembourg is one of the countries with a notable GG in NII and a notable increase from W4 to W5 from 15.4% to 26.8%.

Table 4. 6 GG in NII (%) across European Countries from W1 to W7

	GG in NII_Mean						GG in NII_Median					
Country	**W1**	**W2**	**W4**	**W5**	**W6**	**W 7**	**W1**	**W2**	**W4**	**W5**	**W6**	**W7**
Austria	16.9	32.2	26.7	25.3	21.1	30.8	29.4	35	28.2	15.9	23.6	30.2
Germany	44.0	31.3	24.9	21.1	21.7	13.5	46.4	20.8	14.6	17.9	13.5	14.7
Sweden	29.0	19.7	18.7	13.2	17.0	20.3	28.8	16.8	18	15.8	16.6	20.3
Spain	34.5	22.5	21.4	18.6	18.8	12.9	39.4	24.1	22.1	17.5	18.5	23.8
Italy	57.2	22.6	15.9	17.8	18.8	13.9	31.1	19.1	14.9	14.9	19.3	12.2
France	35.1	24.5	21.6	36.5	18.0	21.6	35.1	25.2	24.1	20.4	22.7	24.0
Denmark	32.6	21.9	15.5	19.2	20.4	17.1	29.1	24.1	21.7	17.8	20.7	17.6
Greece	24.5	29.7			30.7	26.2	13.6	30.4			26.1	23.9
Switzerland	37.4	31.5	23.1	28.1	26.8	31.8	32.9	28.5	24.4	30	30.5	40.3
Belgium	34.8	29.7	18.8	13.2	23.5	22.7	41.2	16.8	20.9	17.2	24.4	23.6
Israel	35.1	20.2		20.8	28.3		27.2	24.3		28.5	32.8	
Czech Republic		22.0	25.4	22.2	22.8	19.2		35.4	37.6	33.2	35.0	29.7
Poland		24.2	19.4		18.8	20.1		26.7	23.5		28.3	28.8
Luxembourg				15.4	26.8					16.7	24.8	
Ireland		24.5						21.9				
Portugal			37.3		11.9				21.8		15.8	
Slovenia			23.6	20.5	19.1				35.7	31.9	29.9	
Croatia					22.7						33.9	
Estonia			23.1	4.7	24.8					25.3	41.8	
Netherlands			15.9	14.6				13.8	18.2	19.0		
Hungary			21.1						23.5			

Dispersion Measures_NII

	Std.Deviation	**Range**	**Skewness**	**Percentiles (25)**	**Percentiles (75)**	**Kurtosis**
W1	47266.5	2766658.7	14.8	10847.7	33280.0	522.0
W2	41789.6	1985161.3	15.3	9000.0	27520.0	406.7
W4	55450.6	5806944.4	33.3	7574.0	30040.0	2600.7
W5	76976.2	10047962.8	98.3	10619.7	35280.0	12603.7
W6	39925.8	2528625.6	13.8	8803.2	30790.0	557.7
W7	110036.6	7398809.1	61.1	10256.0	33637.7	4080.7

Source: Author's own research findings from SHARE, [W1(2004/05), W2 (2006/07), W4 (2011) and W5 (2013), W6 (2015), W7 (2017, (Main Release 7.1.0)]. **Note:** For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment. Ireland is the only country with data for W2, but the data available only for 2006/07 will not be compared with GG for the rest of the Waves.

4.5 Comparison of NHI & NII across the Waves

The analysis presented in Figure 4.5 offers a comparative view of the Gender Gap (GG) in National Household Income (NHI) and National Individual Income (NII) for Wave 1, providing valuable insights into the role of household-level contributions in mitigating gender income disparities. Across all countries and Waves, the GG in NII is consistently higher than in NHI, reflecting the importance of additional household income sources—such as spousal income, shared assets, and other contributions—in reducing gender disparities at the household level.

The Netherlands stands out as a notable exception in Wave 1, where the GG in NHI exceeds the GG in NII. This unique pattern can be attributed to structural characteristics of the Dutch pension system. The Netherlands operates a hybrid pension system that combines a pay-as-you-go model for state pensions with an individual investment system. In this system, both groups and individuals invest in assets with varying levels of risk to supplement state pension benefits. Consequently, the distribution of household income in the Netherlands may reflect greater variability in how income is pooled and shared among household members, potentially amplifying disparities at the household level relative to individual income.

The disparity between GG in NII and NHI is particularly pronounced in countries such as Greece and Switzerland, where the GG in NII is significantly higher. This suggests that household income pooling plays a substantial role in mitigating income inequalities for women in these countries. For example, in Greece, cultural norms often emphasize extended family support, which could contribute to reducing household-level disparities. In Switzerland, despite having one of the highest GGs in NII, the household-level contributions appear to narrow the gap slightly, though the overall disparities remain significant.

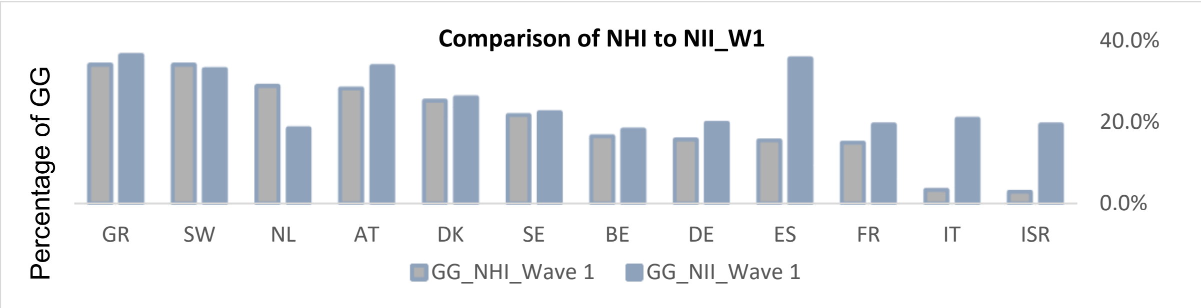
In countries like Denmark and Sweden, the differences between GG in NHI and NII are relatively smaller, indicating that individual income disparities are less severe, and the impact of household-level income pooling is less pronounced. This finding aligns with the strong social safety nets and progressive family policies in these Nordic countries, which likely contribute to reducing both individual and household-level gender income gaps.

Another key observation is the relatively smaller GG in NHI compared to NII across countries with comprehensive pension and welfare systems, such as Germany, Belgium, and France. These systems often include mechanisms like spousal pension benefits, tax incentives for joint income filing, and social transfers that disproportionately benefit lower-earning or non-earning spouses, thereby reducing the household-level GG.

The analysis of Figure 4.5 underscores the importance of distinguishing between individual and household-level income measures when examining gender disparities. While individual income measures like NII highlight the direct economic inequalities between men and women, household-level measures like NHI reveal the mitigating effects of income pooling and shared financial resources. However, the data also highlights that these mitigating effects vary widely across countries, shaped by differences in pension systems, social policies, cultural norms, and economic structures.

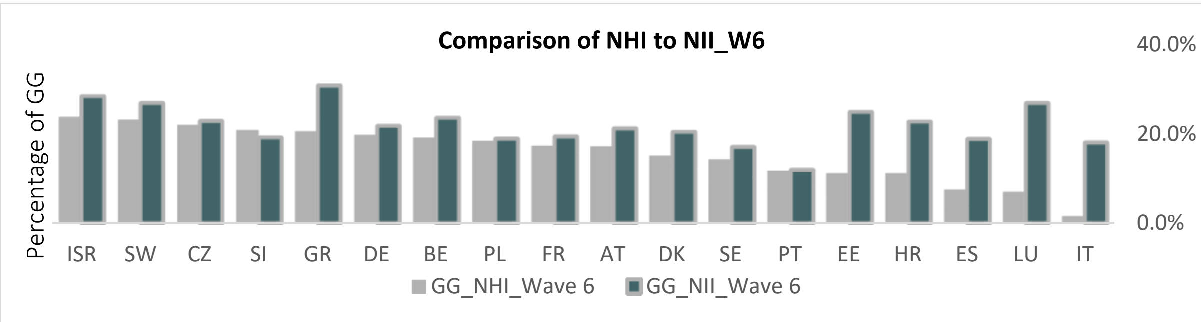
In conclusion, the consistently higher GG in NII compared to NHI demonstrates the critical role of household income pooling in reducing gender disparities at the household level. However, the exception of the Netherlands in Wave 1 highlights how unique pension systems can alter these dynamics. Future sections will explore how these patterns evolve over time across Waves and assess the long-term impacts of pension system designs, welfare policies, and household structures on reducing gender income disparities.

Figure 4.5 Comparison of NHI to NII_W1.



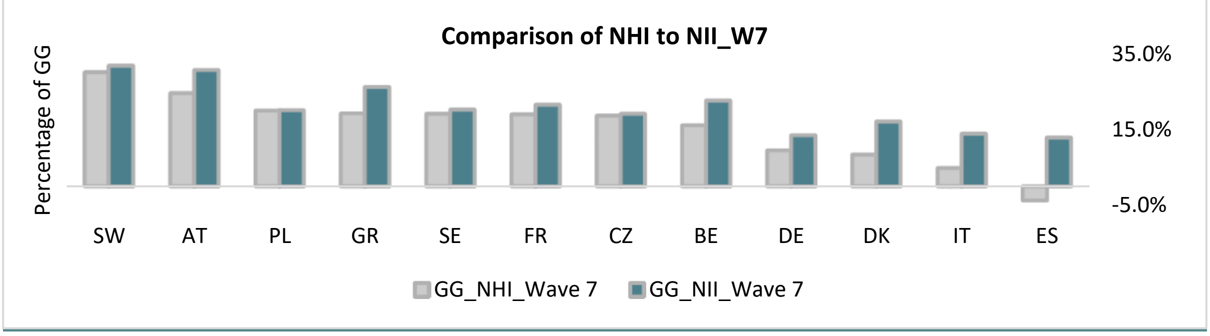
Source: Author's own findings from SHARE (W1 - W7). **Note:** Estimates are based on data 2004 /2005 – 2017- All GG percentages have been sorted from largest to smallest value based on NHI.

Figure 4.6 Comparison of NHI to NII_W6.



Source: Author's own findings from SHARE (W1 - W7). **Note:** Estimates are based on data 2004 /2005 – 2017- All GG percentages have been sorted from largest to smallest value based on NHI.

Figure 4.7 Comparison of NHI to NII_W7



Source: Author's own findings from SHARE (W1 - W7). **Note:** Estimates are based on data 2004 /2005 – 2017- All GG percentages have been sorted from largest to smallest value based on NHI.

Figure 4.6 compares the Gender Gap (GG) in National Household Income (NHI) and National Individual Income (NII) for Wave 6. The data reveal a consistent pattern across countries: GG in NII remains higher than GG in NHI, further reinforcing the observation that income pooling within households mitigates gender disparities. However, the degree of this reduction varies significantly by country, highlighting the interplay between individual income inequalities and the mitigating effects of shared household income.

Israel, Sweden, and the Czech Republic exhibit some of the largest GGs in both NII and NHI for Wave 6. Israel records one of the highest GGs in NII, with a stark disparity between men's and women's individual incomes. Despite this, the household-level GG in Israel is somewhat lower, reflecting the impact of income contributions from other household members. Similarly, in Sweden and the Czech Republic, while GGs in NII are substantial, NHI narrows the gap, albeit insufficiently to bring about significant equity.

Greece emerges as another country with a notable disparity. The high GG in NII underscores systemic inequalities in individual income, likely tied to labor market conditions, pension disparities, and cultural norms. However, the household-level GG in NHI narrows considerably, suggesting that family or household income contributions play a significant role in reducing disparities.

Conversely, Portugal and Italy exhibit the lowest GGs in both NII and NHI. This suggests a relatively equitable income distribution at both the individual and household levels, potentially reflecting more inclusive labor market policies, pension schemes, or cultural practices that support gender equity. However, the smaller GGs in these countries could also result from generally lower income levels, which may obscure deeper structural inequalities.

Analysis of GG in NHI and NII for Wave 7:

Figure 4.7 extends the analysis to Wave 7, revealing interesting shifts in GG patterns compared to earlier waves. Switzerland and Austria record the highest GGs in both NII and NHI, with Switzerland maintaining its position as a leader in income disparities. The persistent high GG in Switzerland’s NII indicates structural issues such as gendered labor market participation, unequal pension contributions, and societal norms that perpetuate income inequalities. While NHI in Switzerland narrows the GG slightly, the disparity remains substantial.

Poland and Greece also show elevated GGs in Wave 7, with Poland displaying a particularly high GG in NII. This finding underscore significant challenges in achieving income equity at the individual level, although household income contributions in NHI slightly reduce the disparity.

Spain is a notable outlier in Wave 7, where GG in NHI is negative, meaning women's household income exceeds that of men on average. This unusual pattern may reflect specific social or economic policies that disproportionately benefit women or the impact of pooling income from female-dominated sectors within households. Similarly, Italy exhibits one of the lowest GGs, consistent with its results in Wave 6, suggesting that gender disparities in individual and household income are less pronounced.

Countries such as France, Belgium, and Germany show moderate GGs in both NII and NHI, indicating consistent but less extreme disparities. The reductions in GG from NII to NHI suggest that household-level income contributions have a significant role in mitigating disparities in these countries.

Comparison Across Waves (W1, W6, W7):

When comparing Waves 1, 6, and 7, several key patterns emerge. First, across all three waves, GG in NII is consistently higher than GG in NHI, underscoring the mitigating role of household-level income pooling. This pattern holds true across nearly all countries, with the notable exception of the Netherlands in Wave 1, where GG in NHI exceeded that of NII.

Second, the magnitude of GG varies significantly by country and wave. Switzerland and Greece consistently rank among the countries with the highest GGs in both NII and NHI, indicating persistent structural issues driving gender disparities. In contrast, countries like Portugal and Italy consistently exhibit some of the lowest GGs across all waves, suggesting a more equitable income distribution.

Third, changes over time reveal both progress and stagnation. While some countries, such as Portugal and Italy, maintain low GGs across all waves, others like Israel, Poland, and Switzerland show little improvement in reducing disparities, particularly at the individual level. Notably, Spain emerges as a unique case in Wave 7, with a negative GG in NHI, representing a significant deviation from earlier waves.

Finally, the differences between mean and median calculations of GG within and across waves suggest varying income distribution patterns. Countries with higher median GGs, such as the Czech Republic, Poland, and Israel, indicate that disparities are not confined to the extremes but are more widespread across the income distribution.

The analysis of Figures 4.5, 4.6, and 4.7 demonstrates that while household income pooling (NHI) consistently reduces gender disparities relative to individual income (NII), the extent of this reduction varies widely by country and over time. Persistent high GGs in countries like Switzerland and Greece highlight structural challenges that require targeted policy interventions, while the lower GGs in Portugal and Italy suggest the potential for more equitable income systems. The trends observed across the three waves underscore the importance of continued efforts to address the root causes of gender disparities in income, both at the individual and household levels. Future sections will explore the underlying factors contributing to these patterns, including labor market dynamics, pension systems, and social policies, and their implications for achieving gender equity in income.

4.6 The GG in NIIW across European Countries

The variable NIIW (National Individual Income from Work) isolates total income derived solely from employment, excluding contributions from household members, rental income, and dividends. By focusing solely on income from employment, NIIW provides a more direct measure of the disparities in earned income between men and women, free from the mitigating effects of pooled household income or secondary income sources. Table 4.7 reveals that the Gender Gap (GG) in NIIW is higher than in previous income categories, reaffirming that the exclusion of additional income sources, which often help reduce disparities, leads to significantly higher GG percentages. This highlights the persistence of structural inequalities in the labor market, where women tend to earn significantly less than men on average.

Germany emerges as the country with the highest GG in NIIW, with disparities of 40.4% based on the mean and 39.9% based on the median. These figures underscore the entrenched gender inequalities in Germany’s labor market, characterized by substantial wage gaps, occupational segregation, and lower participation rates for women in full-time employment. These structural issues are compounded by cultural norms and policies that may not fully support gender equality in the workplace. Similarly, Switzerland and Austria follow closely behind, with GGs in NIIW of 37.1% and 34.7% (mean), respectively. The consistently high GGs in these high-income countries highlight that economic prosperity alone does not translate into gender parity. Factors such as differences in access to high-paying jobs, gendered career paths, and unequal caregiving responsibilities likely play significant roles in perpetuating these disparities.

In stark contrast, the Czech Republic exhibits the lowest GG in NIIW, with 13.7% based on the mean and 13.6% based on the median. These relatively low figures suggest that gender wage disparities in the Czech Republic's labor market are narrower compared to other countries in the dataset. However, it is essential to consider that these lower GGs may also reflect overall lower income levels or a compressed wage structure, which can reduce apparent disparities but not necessarily indicate true gender equity. Hungary also reports a relatively low GG in NIIW, with mean and median values of 13.4% and 16.5%, respectively, indicating a similar trend of narrower disparities compared to other countries.

Other countries such as Denmark, Estonia, and Slovenia show moderate GGs in NIIW, with percentages ranging from 7.5% to 24.0% (mean). Denmark, for instance, exhibits a GG of 18.9% based on the mean, which is among the lowest in Western Europe. This finding aligns with Denmark's reputation for progressive labor market policies and high female labor force participation. However, even in countries with strong gender equality frameworks, wage gaps persist, suggesting that systemic barriers to equal pay remain unresolved. Estonia shows the smallest GG in NIIW among the countries examined, with a mean GG of 7.5% and a remarkably low median GG of 2.5%. This suggests that Estonia's wage distribution between men and women is more equitable than in most other countries, although it is important to consider the broader context of overall lower income levels in Estonia.

At the opposite end of the spectrum, Luxembourg and the Netherlands demonstrate some of the highest GGs in NIIW. Luxembourg reports a mean GG of 48.4% and a median GG of 51.9%, reflecting a stark disparity in earned income between men and women. The Netherlands, similarly, records a mean GG of 40.1% and a median GG of 41.7%. These high disparities indicate significant structural issues in labor markets, including unequal access to full-time employment, gendered wage policies, and persistent barriers to women's participation in higher-paying sectors. Such disparities may also be linked to cultural and institutional factors, such as the prevalence of part-time work among women in these countries, which can exacerbate income inequality.

Portugal and Italy, while not reaching the extremes of countries like Luxembourg, also report substantial GGs in NIIW. Portugal shows a mean GG of 27.5% and a median GG of 41.7%, highlighting significant disparities despite the country's relatively low overall income levels. Italy reports a mean GG of 27.8% and a median GG of 31.8%, reflecting persistent challenges in achieving gender equity in the workforce.

France, Spain, and Belgium report moderate to high GGs in NIIW. France's mean and median GGs of 31.5% and 34.3% suggest significant disparities, likely linked to persistent wage gaps and occupational segregation. Spain and Belgium, while slightly lower, still show GGs in the range of 27–29%, highlighting ongoing challenges in reducing workplace inequalities.

Ireland stands out with a significant divergence between mean and median GGs in NIIW. The mean GG is 37.1%, while the median is considerably lower at 15.5%. This suggests a skewed income distribution where extreme values or higher wages among a smaller subset of men drive up the mean, while the majority of workers experience smaller disparities. This pattern highlights the importance of examining both mean and median GGs to gain a nuanced understanding of income inequality.

In summary, the analysis of NIIW highlights that gender disparities in earned income are more pronounced when secondary income sources and household-level contributions are excluded. Countries such as Germany, Switzerland, and Luxembourg exhibit the highest GGs, reflecting deeply rooted structural inequalities in their labor markets. By contrast, the Czech Republic, Hungary, and Estonia show the narrowest disparities, suggesting either more equitable labor market conditions or structural factors that compress wage gaps. These findings emphasize the critical need for targeted policies to address wage gaps, promote equal opportunities in the workforce, and reduce systemic barriers to gender equity in labor markets. Future sections will further explore the underlying drivers of these disparities and assess the effectiveness of existing policy interventions in narrowing the gender income gap.

Table 4. 7 GG in NIIW (%) across European Countries (Most Recent Wave/each country).

Average Individual Income from Work				Average Individual Income from Work			
Mean				Median			
Country	**M**	**F**	**GG in NIIW (%)**	**M**	**F**	**GG in NIIW (%)**	**Wave**
Austria	20854.3	13617.4	**34.7**	19200.0	12492.0	**34.9**	7
Germany	20881.4	12452.1	**40.4**	18000.0	10824.0	**39.9**	7
Sweden	21954.0	16676.6	**24.0**	18681.6	14841.5	**20.6**	7
Spain	11529.3	8337.5	**27.7**	10000.0	7560.0	**24.4**	7
Italy	14137.7	10207.3	**27.8**	13200.0	9000.0	**31.8**	7
France	24755.3	16956.1	**31.5**	22200.0	14580.0	**34.3**	7
Denmark	19356.1	15700.9	**18.9**	15157.4	14065.5	**7.2**	7
Greece	8843.8	6407.6	**27.5**	8880.0	6240.0	**29.7**	7
Switzerland	47448.4	29823.9	**37.1**	36700.5	23976.7	**34.7**	7
Belgium	27968.4	19755.6	**29.4**	19200.0	15600.0	**18.8**	7
Czech Republic	5751.4	4964.3	**13.7**	5697.7	4922.8	**13.6**	7
Poland	4661.0	3498.3	**24.9**	4510.2	3241.7	**28.1**	7
Luxembourg	53696.0	27691.3	**48.4**	42000.0	20192.8	**51.9**	6
Portugal	8586.5	6225.7	**27.5**	7200.0	4200.0	**41.7**	6
Slovenia	9428.7	7751.6	**17.8**	8132.8	6000.0	**26.2**	6
Estonia	4908.3	4541.0	**7.5**	4356.0	4248.0	**2.5**	6
Croatia	5099.2	3663.3	**28.2**	4452.6	3152.0	**29.2**	6
Israel	17388.1	11863.0	**31.8**	11839.3	8174.7	**31.0**	6
Hungary	4629.5	4007.9	**13.4**	4201.4	3508.4	**16.5**	4
Netherlands	22168.9	13274.7	**40.1**	19061.1	11120.5	**41.7**	5
Ireland	23351.7	14691.0	**37.1**	12680.0	10712.0	**15.5**	2

Source: Author's own research findings from SHARE, [W1(2004/05), W2 (2006/07), W4 (2011) and W5 (2013), W6 (2015),W7(2017, (Main Release 7.1.0)].**Note:** For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment. Ireland is the only country with data for W2, but the data available only for 2006/07 will not be compared with GG for the rest of the Waves.

Table 4.8 provides a comprehensive overview of the Gender Gap (GG) in National Individual Income from Work (NIIW) across multiple Waves, offering insights into how disparities in earned income between men and women evolve over time. The data indicate that, in most countries, GG in NIIW exhibits a general declining trend over the years, mirroring patterns observed in other income categories, such as National Pension Income (NPI), National Household Income (NHI), and National Individual Income (NII). However, the rate of decline in GG in NIIW is slower, reflecting the persistence of structural and systemic labor market inequalities that disproportionately affect women’s earnings. Additionally, notable exceptions to the general downward trend highlight the influence of specific economic, cultural, and policy contexts.

General Decline in GG in NIIW Across Countries: The data reveal a general decline in GG in NIIW across most countries over the Waves. For instance, Germany, which consistently records some of the highest GGs, shows a steady decline from 46.5% (mean) in Wave 2 to 40.4% in Wave 7. Similarly, Austria’s GG increases slightly in earlier waves but decreases from 33.4% (mean) in Wave 5 to 30.3% in Wave 6, before rising again slightly to 34.7% in Wave 7. These patterns indicate that, while progress has been made in reducing gender disparities in earned income, significant gaps remain, particularly in countries with historically entrenched gender inequalities in the labor market.

Sweden and Denmark also demonstrate a steady reduction in GG in NIIW over time. In Sweden, the GG declines from 28.0% (mean) in Wave 2 to 24.0% in Wave 7, with an even sharper decline in the median GG, from 26.3% to 20.6%. Denmark’s GG similarly shows a downward trend, with mean values dropping from 19.6% in Wave 2 to 18.9% in Wave 7. These trends are indicative of the progressive labor market policies and gender equality initiatives in Nordic countries, which aim to address wage disparities and increase female labor market participation.

Stagnation or Marginal Changes in Certain Countries: In some countries, GG in NIIW remains largely unchanged across Waves, indicating persistent structural challenges. Switzerland, for example, consistently exhibits high GGs across Waves, with mean values ranging from 37.3% in Wave 2 to 37.1% in Wave 7. While there is some fluctuation, the overall trend remains stagnant, suggesting that systemic factors such as occupational segregation, unequal access to high-paying jobs, and gendered career interruptions continue to drive disparities. Similarly, Belgium’s GG remains relatively stable, with mean values fluctuating slightly but remaining in the range of 26.1% to 29.4% across Waves. This indicates that, despite ongoing policy efforts, progress in reducing gender disparities in earned income has been slow. France also exhibits a mixed pattern, with some waves showing reductions in GG and others showing slight increases. For example, the mean GG declines from 40.0% in Wave 2 to 28.7% in Wave 6, before increasing slightly to 31.5% in Wave 7. This volatility highlights the complex dynamics of gender income disparities, which may be influenced by shifts in labor market conditions, changes in social policies, or broader economic trends.

Notable Increases in GG in Specific Countries: While most countries demonstrate a declining or stagnant trend in GG in NIIW, a few countries stand out for their notable increases over time. Luxembourg, for instance, exhibits a significant increase in GG, with the mean rising from 36.7% in Wave 5 to 48.4% in Wave 6. Similarly, the median GG rises from 44.4% to 51.9% over the same period. These sharp increases may reflect structural changes in the labor market, such as growing wage disparities in high-income jobs or the underrepresentation of women in sectors experiencing rapid wage growth.

Slovenia also shows an upward trend, with mean GG increasing from 11.4% in Wave 4 to 17.8% in Wave 6, and median GG rising from 19.4% to 26.2% over the same period. This suggests a widening of gender disparities in earned income, potentially driven by economic shifts or changes in the composition of the workforce. The upward trend in these countries underscores the need for targeted interventions to address the root causes of growing disparities.

Outliers and Unique Trends: Certain countries exhibit unique patterns that warrant further analysis. For instance, Greece shows a relatively high GG in NIIW in Wave 2 (30.9%), which remains stable at 30.2% in Wave 6 before declining slightly to 27.5% in Wave 7. This stability suggests persistent challenges in reducing gender wage disparities, despite broader efforts to address labor market inequalities.

Portugal presents a different trend, with GG declining from 31.6% (mean) in Wave 4 to 27.5% in Wave 6, while the median GG rises sharply from 40.0% to 41.7% over the same period. This divergence between mean and median values suggests that disparities are becoming more pronounced in the lower and middle segments of the income distribution, even as the overall average gap narrows.

Estonia consistently exhibits some of the lowest GGs in NIIW across all waves, with mean values declining from 8.0% in Wave 4 to 7.5% in Wave 6. Median values are even lower, dropping from 2.8% to 2.5% over the same period. These figures highlight Estonia's relatively equitable income distribution, though it is important to consider the broader context of overall lower income levels.

Conclusion and Comparative Analysis Across Waves: Overall, the trends observed in Table 4.8 indicate that GG in NIIW has generally declined over time in most countries, albeit at a slower rate than other income categories such as NPI or NHI. This slower progress reflects the persistent structural barriers in labor markets, such as occupational segregation, wage gaps, and unequal access to high-paying jobs, which disproportionately affect women. While countries such as Sweden, Denmark, and the Czech Republic demonstrate consistent progress in reducing GG, others, such as Switzerland and Belgium, show little change, and a few, like Luxembourg and Slovenia, exhibit notable increases.

The comparison across Waves underscores the complexity of gender disparities in earned income and highlights the need for targeted policy interventions to address persistent inequalities. Countries with high and stagnant GGs, such as Germany and Switzerland, require comprehensive reforms to tackle structural issues, while those with rising GGs, such as Luxembourg and Slovenia, need to identify and address the underlying causes of these trends. Future research should explore the role of specific labor market policies, cultural norms, and economic conditions in shaping these disparities and assess the effectiveness of interventions aimed at achieving greater gender equity in earned income.

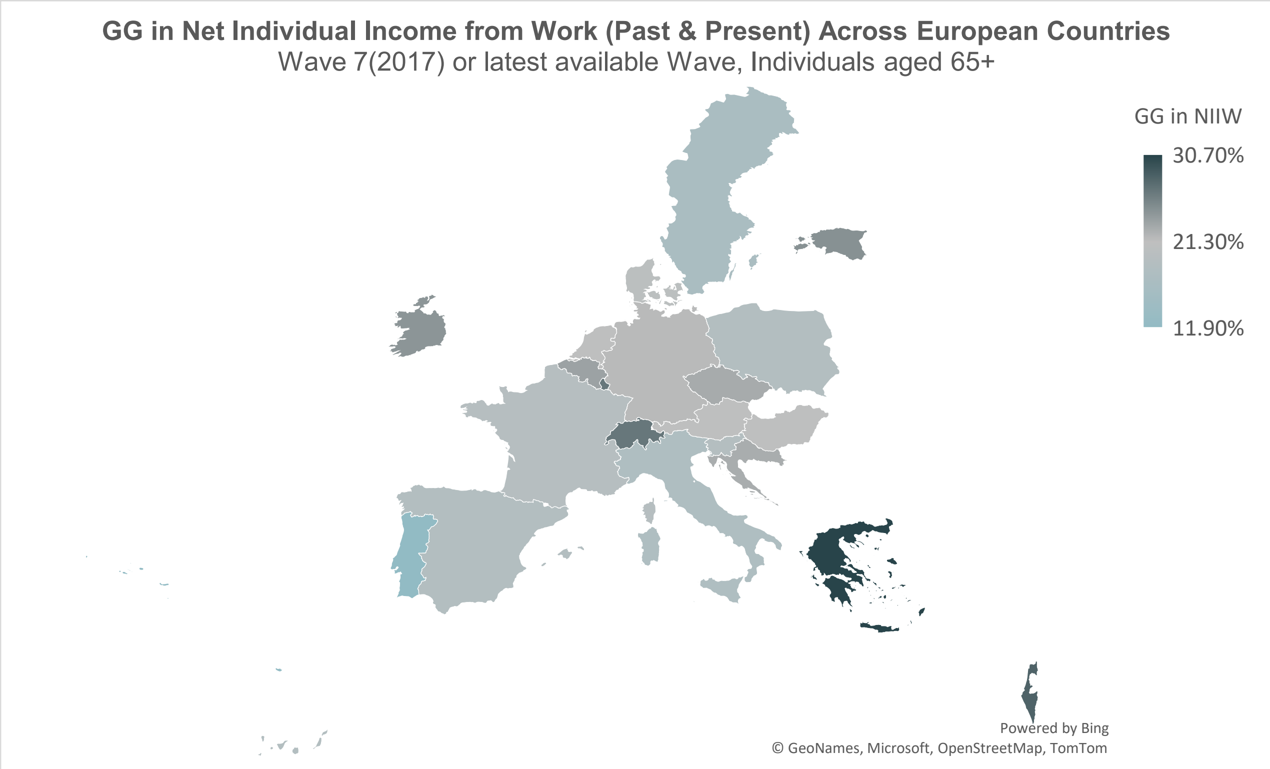
Table 4. 8 GG in NIIW (%) across European Countries from W2 to W7

	GG in NIIW (%) _Based on Mean across the Waves					GG in NIIW (%) _Based on Median across the Waves				
Country	**W2**	**W4**	**W5**	**W6**	**W7**	**W2**	**W4**	**W5**	**W6**	**W7**
Austria	33.0	32.3	33.4	30.3	34.7	36.2	34.1	33.8	33.3	34.9
Germany	46.5	48.8	44.0	41.7	40.4	44.7	48.7	46.9	41.4	39.9
Sweden	28.0	26.9	24.7	24.3	24.0	26.3	27.0	23.7	22.3	20.6
Spain	31.8	32.3	27.9	28.9	27.7	27.5	27.0	30.6	26.5	24.4
Italy	37.4	36	30.9	31	27.8	44.9	36.8	36.4	36.5	31.8
France	40.0	28.6	28.9	28.7	31.5	33.2	32.8	30.4	30.0	34.3
Denmark	19.6	10.8	20.2	21.5	18.9	5.6	4.2	10.4	10.1	7.2
Greece	30.9	-	-	30.2	27.5	28.6	-	-	28.1	29.7
Switzerland	37.3	41.9	44.0	39.3	37.1	40.6	49.9	49.2	35.2	34.7
Belgium	28.7	27.8	18.1	26.1	29.4	19.7	18.7	14.3	18.8	18.8
Israel	36.3	-	28.4	31.8	-	35.0	-	31.5	31.0	-
Czech Republic	10.4	13.6	11	15	13.7	9.1	13.2	14.5	12.8	13.6
Poland	25.3	26.3	-	20.3	24.9	23.8	25.6	-	28.6	28.1
Luxembourg	-	-	36.7	48.4	-	-	-	44.4	51.9	-
Ireland	37.1	-	-	-	-	15.5	-	-	-	-
Portugal	-	31.6	-	27.5	-	-	40.0	-	41.7	-
Slovenia	-	11.4	20.4	17.8	-	-	32	19.4	26.2	-
Estonia	-	8.0	8.5	7.5	-	-	2.8	2.7	2.5	-
Netherlands	35.6	33.6	40.1	-	-	38.4	39.5	41.7	-	-
Hungary	-	13.4	-	-	-	-	16.5	-	-	-
Croatia	-	-	-	28.2	-	-	-	-	29.2	-

Dispersion Measures_NIIW						
	Std.Dev.	**Range**	**Skewness**	**Percentiles (25)**	**Percentiles (75)**	**Kurtosis**
W2	17661.1	1210590.0	24.4	5520.0	15452.7	1432.9
W4	22716.6	536390.9	6.4	4418.0	16800.0	61.3
W5	20430.3	934616.8	9.7	6000.0	19188.0	222.8
W6	20263.2	1613239.7	9.6	5058.8	16920.0	298.3
W7	16775.6	255351.5	5.7	6381.5	18720.0	52.1

Source: Author's own research findings from SHARE, [W2 (2006/07), W4(2011) and W5 (2013), W6 (2015), W7(2017, (Main Release 7.1.0)]. **Note:** For the Netherlands, W5 was used because it met the criteria established for the analysis - In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment. Ireland is the only country with data for W2, but the data available only for 2006/07 will not be compared with GG for the rest of the Waves.

Figure 4.8 GG in NIIW(Past & Present), based on mean, across European Countries and Israel, W7(2017) or latest available Wave, Individuals aged 65+.

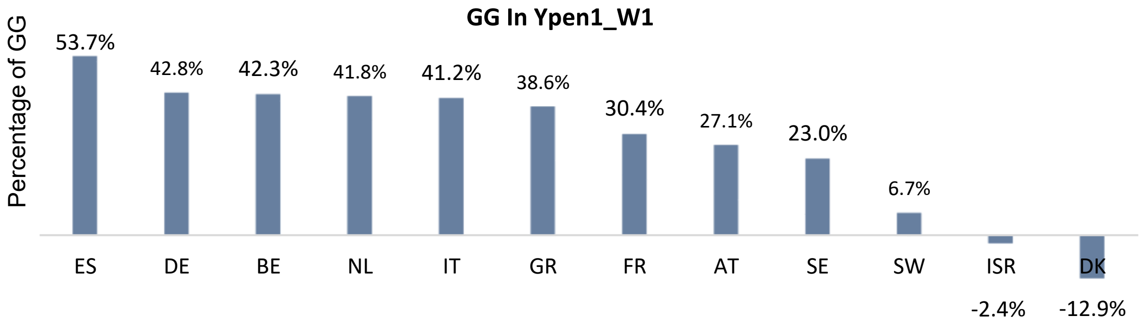


Source: Author's own findings from SHARE [W5 (2013), W6 (2015), W7(2017) - Main Release 7.1.0].
Note: The estimation is based on W6 & W7 (the most recent Wave for each country), except for the Netherlands, where W5 was used because it met the criteria established for the analysis.

4.7 GG in different categories of pension across European Countries

The Total Pension GG was calculated using different variables for W1 compared to Waves 2, 6, and 7 (Tables 2.3, 2.4, & 2.5). These variables, previously analysed as part of NPI, are examined separately in this chapter. Based on Figure 4.9 and W1 descriptive statistics, the GG is higher when calculated solely on annual old age, early retirement, and Survivor War pensions rather than total pension income. Spain shows the highest gender disparity (53.7%), while Denmark stands out with a higher average pension income for women than men, resulting in a disparity of -12.9%.

Figure 4.9 GG in Ypen1 (Annual Old Age, Early Retirement Pension, Survivor, War Pension) based on Mean, (all population).



Source: Author's own findings from SHARE (W1, Release 7.1.0).**Note:** Estimates are based on data 2004 -2005 for eleven European Countries & Israel (W1). All the population, Variable Ypen1_ based on Mean.

To analyse retirees in greater detail, they are divided into three age groups: pre-retirement (50–64), active retirees (65–80), and older retirees (80+). As shown in Table 4.9, the GPG is typically highest among younger retirees (50–64) and decreases with age. The Netherlands shows the highest GPG for ages 50–64, Spain for ages 65–80, and Belgium for ages 80+. In the second part of the analysis, widowed and divorced individuals were excluded to focus on own-work pensions and remove the impact of survivor benefits. This adjustment reveals that, except in Denmark and Switzerland, GPG increases when excluding survivor benefits, confirming that these benefits tend to reduce GPG. Further analysis evaluates whether the GPG in Annual Old Age, Early Retirement, and Survivor War pensions (excluding widowed and divorced individuals) decreases more from W1 to W6 compared to the total population. This analysis was conducted only for W1 nations, excluding the Netherlands.

Table 4. 9 GG in Ypen1, Annual Old Age, Early Retirement Pension, Survivor, War Pension, all population & Excluded Widowed & Divorced Individuals.

	All population			Excluding Widowed & Divorced Individuals		
Country	**Age:50-64**	**Age: 65-80**	**Age: 80+**	**Age: 50-64**	**Age 65-80**	**Age 80+**
Austria	8.7	28.9	18.3	14.5	32.6	20.4
Germany	44.3	44.8	41.8	62.1	57.8	65.7
Sweden	-25.2	23.7	21.9	1.7	29.8	38.7
Netherlands	78.9	45.8	15.0	89.2	52.6	24.3
Spain	71.8	58.60	39.7	91.1	71.6	54.4
Italy	54.2	44.63	11.0	60.1	53.2	31.7
France	26.2	30.74	31.8	49.3	48.8	50.9
Denmark	-9.7	-10.74	-12.0	-12.3	0.8	-0.3
Greece	24.7	42.13	18.8	50.4	64.0	33.5
Belgium	47.4	41.52	45.6	61.4	57.9	70.1
Israel	-9.5	2.1	-22.9	11.4	11.5	-25.9
Switzerland[9]	-482.6	26.50	12.6	-158.0	0.7	39.7

Source: Author's own research findings from SHARE (W1 - Release 7.1.0). **Note:** Estimates are based on data 2004 -2005 for eleven European Countries & Israel (W1). Right of the table: All the population - Variable Ypen1_ Mean. Left of the table: From the analysis have been excluded Widowed & Divorced Individuals - Variable Ypen1_Mean.

According to the preceding table (Table 4.9), the GG on Annual Old Age, Early Retirement, Survivor, and War Pension is decreasing for all age groups in most nations. The GG has decreased across all age groups from W1 to W6 in Germany, France, and Belgium. As shown in the table below (Table 4.10), the GG has decreased in all countries except Sweden, Denmark, and Greece for those aged 50 to 64. The most significant increase can be observed in Sweden, where the GG has increased by more than 1000%, but this will be considered an outlier[10], so we will conclude that Denmark is the only country with the most significant increase in GG Ypen1 (Appendix

[9] Switzerland is a country that requires additional analysis since the GG in the 50–64-year-old population is enormous, and the pension income for women in this age group is significantly higher than for males. While for the other two groups, there is an increase in male possessions. Thus, the percentage of the pension gap is 26.5% between the ages of 65 and 80, while it is 12.6% for the population older than 80.

[10] The Average Pension Income for Sweden was 673.59 for men and 542.5 for women in W1 (GG:1.7%) while in W2 was 11611.56 and 9372.58 respectively (GG:19.5%).

3.2). In contrast, Switzerland is the country where the GG is increasing significantly (313%), followed by Austria with 52.8%. In the age group of 80+, the GG is not moving in the same direction for most countries, as the GG is increasing for half of them and decreasing for the other half. The measurement of only one income category cannot be accurate for the total Income. Still, the purpose of this analysis is to demonstrate that the different group age (dummy variable) of the participants is a significant variable that we anticipate will affect the Dependent Variables[11] differently (To be analysed further below).

Table 4. 10 Change in the Percentage of Pension Gap from W1 to W6 (Ypen1-Excluding Widowed & Divorced).

Change in Pension Gap from W1 to W6			
	Age:50-64	**Age:65-80**	**Age:80+**
Austria	-6.2	52.8	116.4
Germany	-31.2	-15.1	-11.3
Sweden	ℓℓℓ	-35.2	-23.0
Spain	-19.2	-10.0	8.1
Italy	-1.7	-7.5	36.5
France	-20.3	-16.6	-27.5
Denmark	266.1	-566.7	49.0
Greece	6.9	-4.7	69.7
Switzerland	-110.3	313.1	-80.8
Belgium	-33.5	-26.5	-5.4
Israel	-75.1	26.0	-138.9

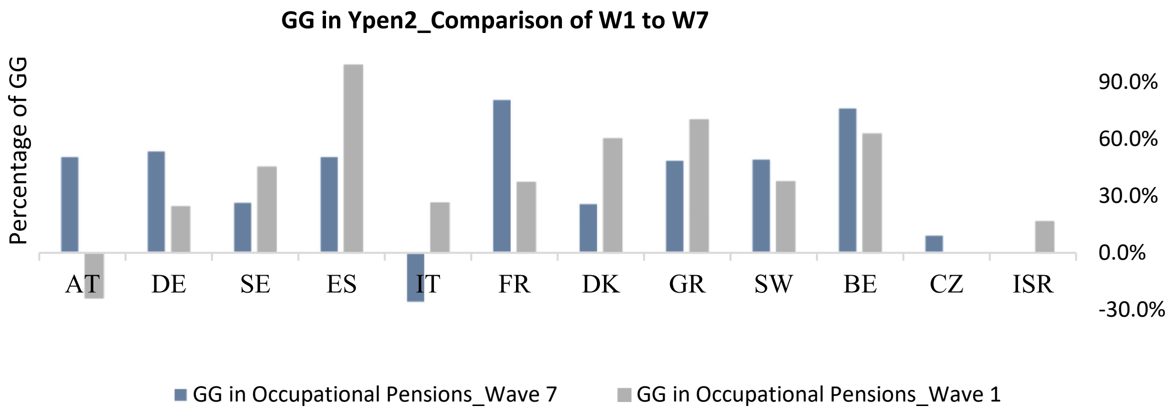
Source: Author's own research findings from SHARE (Release 7.1.0). **Note:** Estimates are based on data 2004 -2005 (W1) & 2015 (W6) for eleven European Countries & Israel – which participated in the W1. The sign indicates whether the change in the difference from W1 to W6 is positive or negative, regardless of whether the percentage of women or men is higher.

Except for the Annual Old Age, Early Retirement Pension, Survivor, a big percentage of pensioners' income has the occupational pension, for which, according to the figure below (Figure 4.10), we can conclude that for W1 (2004/2005) Spain has the highest level of GG in Occupational Pensions with a percentage of 98.7%, followed by Belgium

[11] NHI, NPI & NII as explained above in table 4.1.

with a percentage of 62.8%. While in the Netherlands, we see that women invest significantly more in occupational pensions on average than males, which is why the Netherlands is not included in the chart[12]. Comparing to W1 for occupational pensions reveals that the percentage of GG is increasing rather than falling in the most of nations, with the exceptions of Sweden, Spain, Italy, Denmark, and Greece. In W7, France had the highest percentage of GG in Private and Occupational Pensions, with 80.8%, followed by Belgium, with 76.4%.

Figure 4.10 GG innYpen2, Private and Occupational Pensions, Individuals Aged 65+.



Source: Author's own findings from SHARE W1 (Release 7.1.0). **Note:** Estimates are based on data 2004 -2005 (W1) for eleven European Countries & Israel & on data 2017(W7). Poland has not been included in the chart as there are no male individuals meeting the criteria of the analysis (yPen2>0 & Age>65).

Moving forward, the percentage of GG of each income component contributes to total pension income will be analysed independently of the combination of variables to total pension income, as well as the frequencies, as it is crucial to determine the accuracy

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[12] Men's average Private and Occupational Pension Income in the Netherlands is 2,977.11, whereas women's average Private and Occupational Pension Income is 7,762.52, resulting in a Pension Gap of more than (160%), which is crucial to note. The sample consisted of 1149 individuals, including 757 males and 392 females.

of the results given that there is a significant difference between the pension categories and the number of the participants in each country. Based on the table below (Table 4.11), we conclude that, for W1, Germany has the most significant GPG in old age, early retirement, and survivor benefits, at 39.51%. In comparison, in Denmark, women earn 10.75% more than men from old age, early retirement, and survivor pensions, which has a modest percentage. The sample size for each country is sufficiently large, averaging 2,245 males and 2,430 women. Therefore, these results are pretty accurate. Table 4.5 below shows the frequencies of participants as well participating in each country. We can see that most participants receive Old Age, Early Retirement, and Survivor pensions, whereas the frequencies for the remaining pension categories are reduced significantly. Spain has the highest Occupational Pensions GG, with a percentage of 98.7%, while the Netherlands is the first country, we've seen with a GG of -160.74% (we need to consider here the fact that in the survey have only responded 36 males and 30 females), a fact that eliminates the accuracy of the result. In total, we can see here that Netherlands, is a country where women's income from private and occupational pensions and other private pensions exceeds men's by more than 150% but again the frequencies of the participants are too low.

Furthermore, it is worth noting that we can also see exceeding pension income from Sickness benefits and pensions for women in Austria, Germany, Italy, Switzerland, Belgium, and Israel. The GPG could not be calculated for unemployment benefits and social assistance due to 0 frequencies; nonetheless, the calculation has been completed where possible, and the only country that could be calculated is again the Netherlands, for which GG is 58.45%.

Table 4. 11 GG in Pensions & Frequencies of Individuals based on Mean - W1.

Percentage of Pension Gap in different categories[13] of Pension income & Frequencies of Individuals.					
Country	*Ypen1*	*Ypen2*	*Ypen3*	*Ypen4*	*Yreg1*
Austria	**12.0** (M:1230, F:1740)	**-23.9** (M:85, F:150)	**-41.4** (M:35, F:35)		**-123.9** (M:65, F:40)
Germany	**39.5** (M:2679, F:2922)	**24.8** (M:757, F:392)	**34.1** (M:15, F:5)	**100.0***[14] (M:2, F:0)	**-218.6** (M:205, F:102)
Sweden	**23.6** (M:3102, F:3222)	**45.4** (M:2261, F:1990)	**-62.5** (M:105, F:65)	**-23.0** (M:16, F:10)	**39.0** (M:710, F:637)
Netherlands	**30.9** (M:2530, F:2753)	**-160.7** (M:36, F:30)	**-381.8** (M:20, F:12)	**100.0*** (M:15, F:0)	**51.0** (M:255, F:99)
Spain	**24.6** (M:2326, F:1879)	**98.7** (M:170, F:100)	**61.3** (M:55, F:50)		**43.4** (M:40, F:30)
Italy	**35.0** (M:2120, F:2160)	**26.6** (M:1759, F:1921)	**30.5** (M:15, F:80)		**-332.0** (M:5, F:5)
France	**22.5** (M:2722, F:3456)	**37.3** (M:593, F:518)	**-100.5** (M:98, F:65)	**100.0*** (M:6, F:0)	**56.5** (M:91, F:51)
Denmark	**-10.7** (M:1315, F:1779)	**60.2** (M:20, F:25)	**-20.7** (M:30, F:60)	**100.0*** (M:5, F:0)	**35.8** (M:214, F:182)
Greece	**30.5** (M:2300, F:2643)	**70.1** (M:476, F:273)	**27.0** (M:140, F:106)		**78.3** (M:10, F:15)
Switzerland	**9.3** (M:941, F:1093)	**37.6** (M:145, F:111)	**48.9** (M:21, F:25)	**100.0*** (M:5, F:0)	**-104.2** (M:92, F:40)
Belgium	**22.3** (M:3615, F:3218)	**62.8** (M:1042, F:899)	**-75.8** (M:125, F:35)	**-30.2** (M:30, F:6)	**-65.6** (M:105, F:35)
Israel	**5.9** (M:2047, F:2263)	**16.8** (M:16, F:248)	**33.1** (M:154, F:103)		**-89.3** (M:107, F:52)

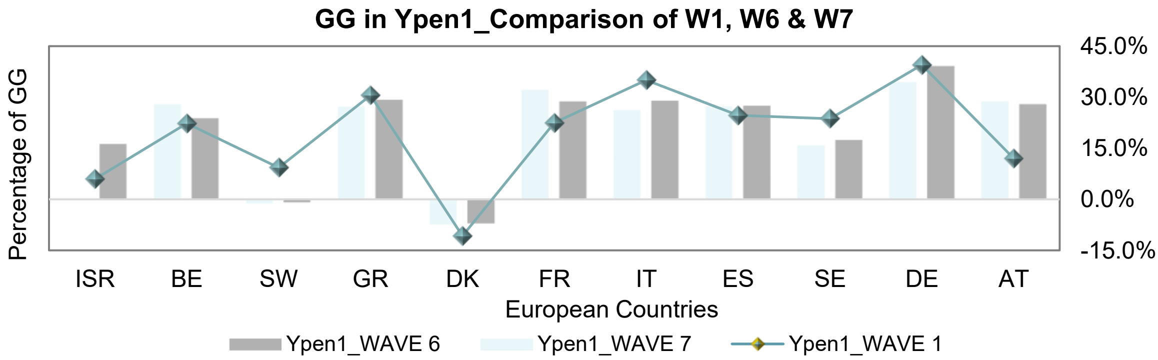
Source: Author's own research findings from SHARE W1 – (Release 7.1.0). **Note:** Estimates are based on data 2004 -2005 (W1) for eleven European Countries & Israel For the ypen5 there is a record only for Netherlands (-58.45, M:20,22, F:6) and for ypen6 there are only for records for Sweden (-158.5,M:11, F:11),Spain (32.4 M:31, F:162), Italy (7.9,M:181, F:198) and Greece (19.0,M:65, F:321).

[13] As mentioned above (Table 4.1)

[14] All countries marked with a (*) have a 100 percent GG since there are no frequencies in one of the gender categories; therefore, these countries will not be commented on further.

To assess changes in the Pension Gap from W1 to W6, the GG in W6 was analysed for 18 countries, with a clear comparison available only for those that participated in W1. As shown in Appendix 3.7, the GG for Annual Old Age, Early Retirement, Survivor, and War Pensions increased between 2004/2005 (W1) and 2017 (W6) in Austria, Spain, France, Belgium (slightly), and Israel. Given that old age, early retirement, and survivor pensions are the most common pension categories, a comparison of GG across W1, W2, and W7 (Figure 4.11) confirms the trend that GG has generally decreased over the years for this category. This analysis, limited to W1 countries (excluding the Netherlands), ensures consistent and accurate data for the same time. The results reveal that in all countries except Austria, Spain, France, Belgium, and Israel, the GG has declined substantially. This trend aligns with findings for total pension income, where GG also failed to decrease for these specific countries. The overall reduction in GG across the years is a promising development toward narrowing the pension gap between men and women in Europe, particularly given the challenges posed by the 2007–2008 economic crisis.

Figure 4.111 GG in Ypen1 (Old age, early retirement, and survivor pensions, Wave1 – Wave7, Individuals aged 65+.



Source: Author's own findings from SHARE (W1 & W7). **Note:** Estimates are based on data 2004 /2005 - 2017 for eleven European Countries & Israel. In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment. Pension Gap for Israel (W7) could not be analysed due to missing values.

In W6, participation rates are higher across all nations that participated in W1, leading to more robust results. Regarding private and occupational pensions, Slovenia and Italy exhibit the highest levels of GG in W6, with women receiving significantly higher income in this category. Private and occupational pensions have undergone notable changes between W1 (2004–2005) and W6 (2017), with the GG decreasing only in Greece and Denmark. For disability pensions and benefits, the GG has declined in most countries, except for Denmark, Switzerland, and Belgium, where it has increased, with women earning significantly more than men. Comparisons for pensions derived from unemployment benefits, other private pensions, and sickness benefits are not possible for W1, as these variables were excluded from total pension income calculations in that Wave, rendering comparisons invalid. Additionally, caution is required when interpreting W6 results due to relatively low participant frequency for certain variables.

Overall, the analysis of GG in pensions demonstrates that measuring GG is complex and cannot be confined to a single variable. Differences in variables across Waves and inconsistencies in the composition of total pension income complicate comparisons. The percentage of GG varies by country and depends on the specific focus of the analysis, such as age group, marital status, or pension category.

4.8 The GG in NHI across European Countries based on EasySHARE dataset

The NHI variable provides essential insights into the financial dynamics of households, encompassing income from all household members, as noted in the EasyShare database. For the purposes of this analysis, NHI serves as a critical indicator for exploring the GG in financial outcomes across European countries. Data from EasyShare facilitated the examination of trends and disparities in NHI between 2004 and 2020 (Waves 1 to 8). To ensure consistency and accuracy, the analysis utilized data from the major releases rather than supplementary datasets, and the specific dataset used for each analysis was noted explicitly.

Following the United Nations geoscheme (Appendix 3.3), European countries were categorized into four regions—Eastern, Western, Northern, and Southern Europe. This regional grouping allows for systematic comparisons of GG trends over time and highlights the interplay of cultural, economic, and policy factors influencing gender-based disparities. The dataset comprised a total population of 211,956 individuals (102,933 men and 109,023 women), as outlined in Appendix 3.4.

Western Europe: Persistent Gaps Despite Declines

Among Western European nations, Switzerland exhibited the highest GG in NHI, with a striking 36.1% in Wave 1 (W1), which reduced to 26.2% in Wave 8 (W8). This decline, while notable, remains insufficient to close the gender disparity fully, underscoring the entrenched structural factors contributing to income inequality in one of Europe’s wealthiest nations. Similarly, Germany, another prominent Western country, presented a fluctuating trend: the GG increased during Waves 2 and 4 but showed a steady decline from Wave 5 onward, reflecting the gradual impact of reforms aimed at gender equality in the labor market and pension systems.

France, in contrast, displayed a unique trajectory. The GG in NHI began at a relatively low level but increased consistently over the years, stabilizing over the past 16 years. This trend suggests the persistence of gendered income disparities in a nation with extensive welfare provisions. Belgium also presented a counterintuitive pattern, where participants in W1 reported a smaller NHI gap than those in W8, highlighting the challenges in achieving sustained progress.

The Netherlands showed one of the most significant initial improvements, with a dramatic 69% reduction in GG from W1 to W2, followed by a period of relative stability. Notably, the distribution of GG in the Netherlands remained symmetrical, as evidenced by the consistency in results regardless of whether mean or median values were used (Appendix 3.5). Overall, Western Europe showed the highest GG percentages across all regions, indicating that even in economically advanced nations, systemic inequalities remain pervasive.

Eastern Europe: Growing Gaps and Limited Progress

Eastern Europe presented a more diverse picture, with Latvia and Lithuania leading in GG percentages for W8 at 27.1% and 25.5%, respectively. However, as these countries participated only in W8, longitudinal comparisons were not possible. Estonia followed closely with a GG of 23.2%, while Romania and the Czech Republic reported 20.6% each. The Czech Republic exhibited a striking 57% increase in GG from W1 to W8, a trend that underscores the challenges Eastern European countries face in addressing gender disparities amid economic transitions and labor market shifts.

Interestingly, no Eastern European country reported a year-over-year decrease in GG, signaling systemic issues that require targeted policy interventions. The persistence and, in some cases, widening of GG in Eastern Europe reflect the interplay of limited institutional support for work-life balance, traditional gender norms, and the legacy of transitional economies that have yet to fully integrate gender equity in their labor and social policies.

Southern Europe: Mixed Outcomes and Unique Patterns

Southern Europe displayed a range of GG trends, with Cyprus and Greece showing the highest disparities. In Greece, the GG approached 20% in W1 and W2 but decreased significantly in subsequent Waves, reflecting potential impacts of economic crises and policy adjustments aimed at social equity. In contrast, Spain consistently reported a GG below 5%, and in Italy, women often earned higher NHI than men, suggesting unique labor market dynamics that favor gender equity in specific income groups. However, these trends should be contextualized within broader labor market participation rates, as lower female labor force participation in some Southern European countries may skew these results.

Portugal, which participated in W4 and W6, reported a low but increasing GG during these Waves, reflecting a divergence from trends observed in Spain and Italy. Southern Europe's mixed outcomes highlight the varying effectiveness of gender equality measures and the complex interplay of cultural and economic factors influencing income dynamics.

Northern Europe: Stability Amid Persistent Gaps

Northern Europe demonstrated relatively low and stable GGs in NHI, with Denmark maintaining a consistent GG below 20% across all Waves from 2004 to 2020. Sweden's GG fluctuated slightly but remained stable overall, irrespective of the calculation method, reflecting a robust welfare state that promotes gender equity in labor and income. Finland, which participated only in W8, reported a GG of 17.0%, aligning with trends observed in Sweden. These findings reinforce the notion that Northern Europe's comprehensive welfare systems and progressive labor policies contribute to lower GGs. However, the stability in disparities also underscores that even advanced social policies have limitations in fully eradicating gender-based income gaps.

Non-European Context: Insights from Israel

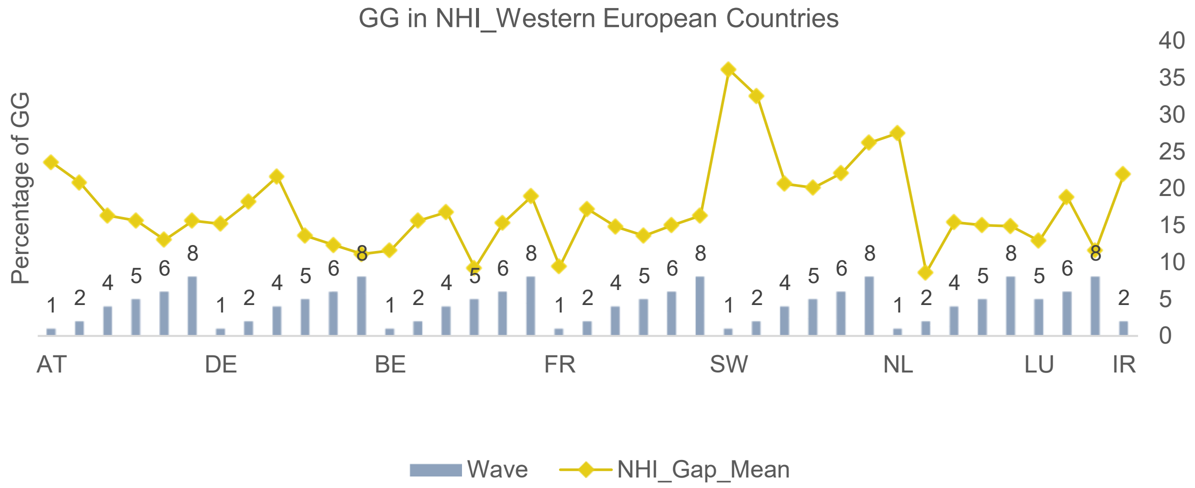
Israel, the only non-European country included in the analysis, reported some of the lowest GGs in NHI. However, the GG in Israel fluctuated significantly across Waves, indicating variability in gender-based income dynamics over time. These fluctuations may reflect the influence of cultural, economic, and policy-specific factors unique to Israel's socio-economic context.

General Observations and Insights

In general, Western Europe reported the highest GG percentages, while Northern Europe showed relatively low and stable gaps, reflecting the influence of social policies and labor market structures. Southern Europe exhibited mixed outcomes, with notable reductions in GG for Greece but increasing disparities in Portugal. Eastern Europe demonstrated persistent or growing GGs, with some countries like the Czech Republic experiencing substantial increases over time.

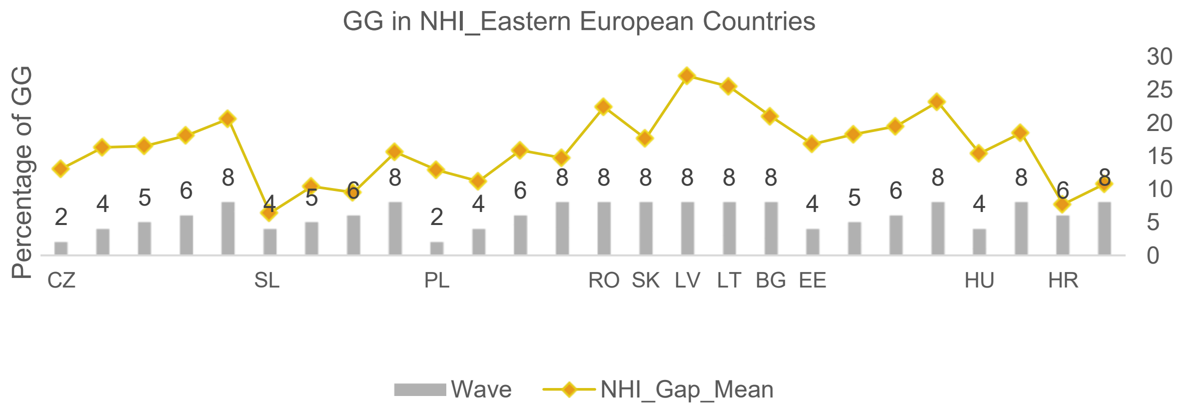
Importantly, the analysis revealed that GG in NHI does not differ significantly when calculated using mean or median values, suggesting a symmetrical distribution of income disparities (Appendix 3.5). This methodological insight adds robustness to the findings, indicating that the observed trends are not artifacts of statistical methods but reflect genuine patterns in the data.

Figure 4.12 GG in Net Income across Western European Countries (W1 - W8, for Retired Population over 65 years old).



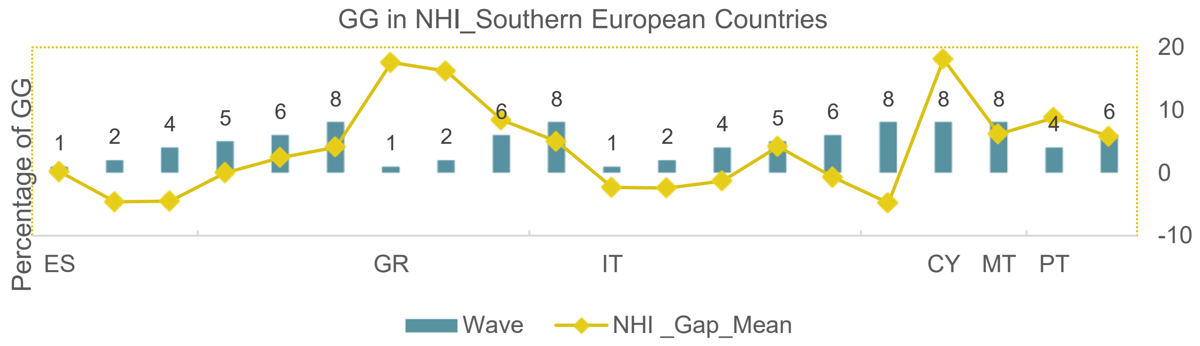
Source: Author's own findings from SHARE (easySHARE-Release 8.0.0) **Note:** All GG percentages have been sorted from largest to smallest value based on NHI. The graphs above describe all the Waves that could be analysed for each country (Columns)and the Percentage of GG in each Wave (Line). The country is being mentioned under the First Wave we had the data for the analysis (Axis-European Countries).

Figure 4.13 GG in Net Income across Eastern European Countries (W1 - W8, for Retired Population over 65 years old).



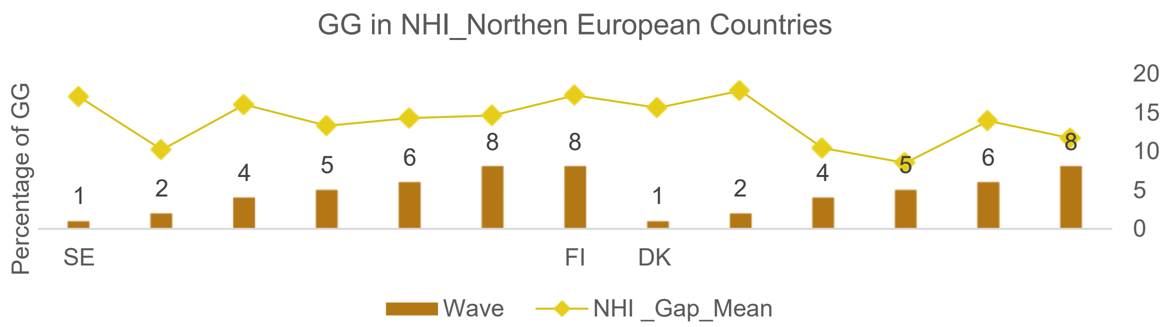
Source: Author's own findings from SHARE (easySHARE-Release 8.0.0) **Note:** All GG percentages have been sorted from largest to smallest value based on NHI. The graphs above describe all the Waves that could be analysed for each country (Columns)and the Percentage of GG in each Wave (Line). The country is being mentioned under the First Wave we had the data for the analysis (Axis-European Countries).

Figure 4.14 GG in Net Income across Southern European Countries (W1 - W8, for Retired Population over 65 years old).



Source: Author's own findings from SHARE (easySHARE-Release 8.0.0) **Note:** All GG percentages have been sorted from largest to smallest value based on NHI. The graphs above describe all the Waves that could be analysed for each country (Columns)and the Percentage of GG in each Wave (Line). The country is being mentioned under the First Wave we had the data for the analysis (Axis-European Countries).

Figure 4.15 GG in Net Income across Northern European Countries (W1 - W8, for Retired Population over 65 years old).



Source: Author's own findings from SHARE (easySHARE-Release 8.0.0) **Note:** All GG percentages have been sorted from largest to smallest value based on NHI. The graphs above describe all the Waves that could be analysed for each country (Columns)and the Percentage of GG in each Wave (Line). The country is being mentioned under the First Wave we had the data for the analysis (Axis-European Countries).

Table 4. 12 GG in Net Income in Israel (W1 - W8, for Retired Population over 65 years old).

Country	Wave	GG in NHI
IS [15]	2	12.2%
	5	1.1%
	6	17.5%
	8	3.1%

Source: Author's own research findings from SHARE (easySHARE-Release 8.0.0). **Note:** Israel is not a European Country, which is why the data are being demonstrated separately.

Given that previous research suggests that the GG should decrease over time (Kellstedt et al., 2010), this is not what we expected to see. Furthermore, based on one of the most recent research projects on the gender wage gap and the fact that both the explained and unexplained parts of the gender wage gap have decreased significantly over the last ten years (Böheim et al., 2021)[16], we would have expected to see potential results in the NHI. This is also confirmed when the NHI is calculated using the Median (Appendix 3.5)

Comparing the above countries to the present, it is evident that the increase and decrease in GG are more likely attributable to national political and economic conditions than to the general economic or political conditions that have impacted European countries. We reached this conclusion as there are no Waves in which the percentage of the GG has increased or decreased for all countries. The preceding data analysis suggests a reasonable degree of optimism that the GG in NHI is

[15] Although Israel is not geographically located in Europe, it is a member in many European transnational federations and frameworks.

[16] Using data from the Austrian EU-SILC, this research evaluated the development of the gender wage gap in Austria from 2005 to 2017.

decreasing annually. However, doubt remains, particularly in light of the unprecedented times of Covid – 19 for which the findings will not be revealed soon.

4.9 Coverage Pension Gap across European Countries & Israel

The limited reach of many European pension systems in covering substantial segments of the population—particularly in *economically emerging* or *transitioning* countries—represents a significant structural weakness. As highlighted by Gill et al., (2004), Holzmann (2005), and Forteza et al., (2009), quantifying what is referred to as the Coverage Gap constitutes the essential first step in addressing this challenge. In this context, the Coverage Gap denotes the proportion of individuals who lack access to formal pension benefits or adequate income support in old age. This chapter therefore focuses on the Percentage of Coverage Gap for Elderly Individuals within various European nations, establishing a foundation for understanding the extent of pension shortfalls across diverse socioeconomic settings.

Calculating the Coverage Gap for Elderly Populations

The process of measuring the Coverage Gap for older populations is relatively straightforward compared to active labor force coverage. It involves assessing the proportion of individuals at or above retirement age who receive pensions or comparable income support (Holzmann et al., 2009). However, as Forteza et al. (2009) highlight, certain factors complicate these calculations and require careful consideration to ensure accurate interpretations.

Key Factors Influencing Pension Coverage Rates

1. **Post-Retirement Employment**: A significant portion of retirees chooses to remain in the workforce beyond the legal retirement age. These individuals often delay claiming pension benefits, either to maximize their eventual payouts or because they do not yet require income supplementation. As a result, coverage rates may appear artificially low when this group is excluded from pension recipient statistics. For example, in countries like Sweden and Denmark, where flexible retirement policies are prevalent, post-retirement employment is more common, leading to nuanced coverage dynamics.
2. **Alternative Income Sources**: Elderly individuals who rely on private savings, investments, or family support structures may delay or forgo pension applications altogether. While this reduces immediate pressure on public pension systems, it complicates the interpretation of coverage statistics, as these individuals may not be reflected in pension recipient data. Research by Holzmann et al. (2009) notes that such patterns are particularly evident in higher-income countries, where alternative income streams are more accessible.
3. **Multiplicity of Pension Systems**: European countries exhibit significant diversity in their pension arrangements, ranging from single-tier public systems to complex multi-pillar structures involving public, occupational, and private schemes. In countries like Germany and the Netherlands, retirees may draw income from multiple sources, including public pensions and employer-sponsored plans. This multiplicity makes it challenging to establish a unified metric for coverage, as individuals receiving partial benefits from one scheme may still lack full financial security.

4. **Universal Pension Models**: Certain nations, such as Norway and the Netherlands, have adopted universal or means-tested pension systems that provide at least a baseline level of income support to all elderly individuals, regardless of prior contributions. While these systems reduce the absolute Coverage Gap, they also highlight disparities in benefit adequacy, as baseline pensions may not be sufficient to meet living costs in high-income countries. For instance, Holzmann (2005) underscores that universal systems in Nordic countries achieve high coverage rates but often require complementary measures to address adequacy concerns.
5. **Defined-Benefit Schemes with Lump-Sum Payouts**: In some pension systems, retirees have the option to receive their benefits as lump-sum payouts rather than periodic income. While this provides flexibility, it complicates annual coverage statistics by distorting the flow of income over time. Studies from countries like Austria and Portugal indicate that lump-sum payouts are more common among higher-income retirees, further skewing coverage interpretations (Forteza et al., 2009).
6. **Early Retirement Options**: Early retirement provisions, while beneficial for certain populations, introduce complexities in pension coverage statistics. By allowing individuals to claim benefits before reaching the standard retirement age, these provisions inflate the number of beneficiaries in the system. However, they also blur the line between labor force exit and full retirement, particularly in countries like Italy and France, where early retirement remains a common practice.

Regional and Cross-National Comparisons

The Coverage Gap varies significantly across European countries, reflecting disparities in economic development, labor market structures, and pension system designs. For instance:

- Western Europe: Countries like Germany and the Netherlands achieve high pension coverage due to well-established multi-pillar systems. However, coverage gaps persist among marginalized groups, such as women with interrupted work histories and low-income earners.
- Eastern Europe: Transitioning economies in this region, including Romania and Bulgaria, face substantial coverage gaps due to the incomplete integration of informal workers into formal pension systems. Studies by Gill et al. (2004) emphasize that economic restructuring has disproportionately affected pension inclusivity in these nations.
- Southern Europe: Countries like Italy and Spain have high nominal coverage rates but face challenges related to benefit adequacy. Early retirement options and family support structures play a significant role in mitigating perceived gaps, as noted by Forteza et al. (2009).
- Northern Europe: Universal pension systems in countries like Norway and Sweden ensure high coverage levels but still face adequacy challenges, particularly for individuals reliant solely on baseline benefits.
- Israel: Israel, the only non-European country in this analysis, demonstrates unique patterns in pension coverage. While coverage rates are relatively high due to mandatory pension contributions, disparities persist among specific demographic groups, such as immigrants and women in part-time employment.

Demographic Shifts and Their Impact

In 2020, more than 20.6% of the EU population was aged 65 years or older, and Eurostat (2021) projects that this proportion will rise sharply in the coming decades. Such a demographic transition carries far-reaching implications: with fewer workers supporting a growing cohort of retirees, government budgets experience heightened strain on social expenditures, including pensions (Eurostat, 2020). As the ratio of retirees to active workers increases, states may confront fiscal challenges, prompting reforms in contribution rates, retirement ages, and benefit formulas—each with the potential to reshape the Coverage Gap.

Variations and Determinants of the Coverage Gap

The Coverage Gap exhibits significant variability across European countries, stemming from differences in economic development, labor market structures, social policies, and cultural norms (Holzmann et al., 2009). While research indicates a positive correlation between elderly social security coverage and economic growth (often measured in terms of per capita income), it is evident that political decisions—including benefit eligibility, financing mechanisms, and pension governance—can be just as influential as economic factors in determining coverage outcomes. In other words, a higher level of economic prosperity does not automatically translate into comprehensive pension coverage. Instead, the policy choices made by governments—such as expanding the scope of universal pensions, incentivizing private retirement savings, or raising minimum benefit levels—can either bridge or widen the Coverage Gap.

Looking Forward

Given these demographic and policy-related pressures, an increase in the percentage of pension beneficiaries across Europe is anticipated. This shift may partially alleviate coverage shortfalls if pension reforms succeed in targeting vulnerable groups—especially those with intermittent labor market participation or those in atypical employment. However, it also heralds further complexities, as policymakers strive to balance the fiscal sustainability of pension schemes with the urgency of protecting older adults from poverty and economic insecurity.

By examining the Percentage of Coverage Gap among elderly populations in a comparative European context, this research shines a light on the magnitude of existing vulnerabilities and the policy levers that could effectively narrow the shortfalls. Ultimately, understanding how coverage disparities arise—and how they are influenced by demographic changes, labor market structures, and political choices—remains crucial for devising equitable and durable solutions within Europe's evolving pension landscape.

4.10 The Influence of Pension pillars for pensioners

Pension systems in European countries have undergone significant reforms over the past few decades, driven by global pressures, aging populations, and the financial challenges posed by economic crises (Holzmann et al., 2013). Multi-pillar pension systems, which are structured around three main pillars—public, occupational, and individual savings—are often considered more resilient in providing adequate pension benefits. However, the effectiveness of these systems varies significantly across countries and is heavily influenced by their design, financial stability, and the socio-political context in which they operate. Financial crises, in particular, have exposed vulnerabilities in all three pillars, with varying impacts on pension wealth, adequacy, and coverage.

Countries with a strong second pillar, consisting of funded occupational pensions, experienced substantial losses during stock market downturns, as seen during the 2008 global financial crisis (Holzmann et al., 2009; Holzmann et al., 2013). At the same time, pay-as-you-go (PAYG) systems, which rely on intergenerational funding through current contributions, face sustainability challenges due to demographic shifts, including declining birth rates and increasing life expectancy. This chapter examines the influence of each pillar on the Coverage Pension Gap (CPG), using data from the Survey of Health, Ageing and Retirement in Europe (SHARE) to provide a detailed analysis of the disparities in pension coverage across these pillars.

Structure of Pension Systems and Gender Coverage Gaps

The SHARE dataset enables an assessment of pension coverage gaps by categorizing pensions into three pillars:

1. **Pillar 1**: Public pensions, including old-age, early retirement, and survivor pensions.
2. **Pillar 2**: Occupational pensions provided through employment.
3. **Pillar 3**: Individual retirement savings, contractual savings, and life insurance policies.

Table 4.14 illustrates the coverage rates by gender for each pillar, highlighting significant disparities in pension access and adequacy across European countries.

The Gender Coverage Gap (GG) represents the percentage difference in pension coverage between men and women, providing insights into the extent of gender-based inequalities within each system.

Public Pensions (Pillar 1): Broad Coverage but Persistent Gaps

Pillar 1, the foundation of most European pension systems, offers the highest overall coverage rates but exhibits considerable variation in gender disparities across countries. Luxembourg stands out with the highest Gender Coverage Gap at 36.32%, followed by Greece (33.59%) and Spain (32.27%). In contrast, some countries, such as Sweden, Denmark, and Estonia, show negative or negligible GGs, suggesting relatively equitable access to public pensions.

Despite high nominal coverage rates, Pillar 1 systems often fail to provide adequate benefits to women due to their lower lifetime earnings, shorter contribution periods, and higher prevalence in part-time employment. Countries with universal or near-universal public pension systems, such as Denmark and Sweden, demonstrate lower gender disparities, indicating the positive impact of policies aimed at equalizing access and benefits. However, even in these countries, women’s pensions are often smaller than men’s due to systemic factors such as the gender pay gap and career interruptions for caregiving responsibilities.

Occupational Pensions (Pillar 2): Limited Coverage and Significant Gaps

Occupational pensions, which constitute the second pillar, are characterized by significant disparities in both coverage and gender gaps. As shown in Table 4.14, only five out of eighteen countries have coverage rates exceeding 30% for the total population, highlighting the limited reach of these schemes. Countries such as Austria, Germany, and Switzerland exhibit some of the highest Gender Coverage Gaps in this pillar, with Switzerland showing a striking 28.89% gap, followed by Germany at 12.91%.

Sweden stands out as an exception, with a low Gender Coverage Gap of 2.82% in Pillar 2, reflecting its strong occupational pension system and policies that promote gender equality. However, in most other countries, the limited coverage of occupational pensions exacerbates inequalities, as women are less likely to participate in formal employment sectors where these benefits are offered. Additionally, occupational pensions often require substantial contributions, which may be unaffordable for lower-income workers, further excluding women from these schemes.

Individual Savings (Pillar 3): High Participation but Persistent Inequalities

The third pillar, based on individual retirement accounts, contractual savings, and life insurance, shows high participation rates in countries like Austria, Germany, Sweden, France, Denmark, and the Czech Republic. Austria leads in Pillar 3 participation, with significant Gender Coverage Gaps, including 11.68% for Austria and 8.22% for the Czech Republic.

Conversely, countries such as Estonia, Italy, and Greece report negligible participation in this pillar, reflecting limited access to individual savings options or a cultural reliance on public pensions and family support. While individual savings schemes offer flexibility and additional retirement security, they also mirror existing inequalities in wealth and financial literacy. Women, who generally have lower disposable incomes and less access to financial education, are disproportionately disadvantaged in their ability to participate in these schemes.

Comparative Insights and Policy Implications

Using the Gender Coverage Gap (GG) as an indicator and comparing it with the GPG from Chapter 4, we observe consistent patterns of inequality. Spain and Greece emerge as countries with the highest combined GPG and CPG in Pillar 1, underscoring systemic shortcomings in public pension provisions. This alignment between different indicators reinforces the need for targeted policy interventions to address gender disparities in pension systems.

For the second pillar, the data reveals a stark divide between countries with well-established occupational pensions and those where coverage is negligible. The significant Gender Coverage Gaps in countries like Switzerland and Germany highlight the urgent need to expand access to these schemes and address barriers to women's participation in formal employment sectors.

In the third pillar, the disparities in participation and gender gaps underscore the importance of promoting financial literacy and incentivizing savings among underrepresented groups. Policies such as matching contributions, tax incentives, and employer-sponsored savings plans can help reduce inequalities and enhance retirement security for women.

Broader Context: The Role of Economic and Political Factors

Economic and political conditions play a critical role in shaping the development and effectiveness of pension systems. Countries with stable economies and strong social welfare traditions, such as Sweden and Denmark, demonstrate lower coverage gaps and greater resilience to financial crises. In contrast, countries with less developed systems or those undergoing economic transitions, such as Greece and Portugal, face significant challenges in ensuring equitable pension coverage.

The impact of financial crises on pension wealth, particularly in the second pillar, highlights the need for robust regulatory frameworks and diversified investment strategies to safeguard retirement savings. Similarly, demographic trends, such as aging populations and declining birth rates, necessitate reforms to ensure the long-term sustainability of pay-as-you-go systems.

Table 4. 13 Coverage GG – W6 (Retired, aged over 65, Excluded Retired with 0 Income).

	Pillar 1			Pillar 2			Pillar 3		
	Men (%)	Women	GG(%)	Men (%)	Women (%)	GG(%)	Men (%)	Women (%)	GG (%)
AT	98.25	87.84	**10.41**	8.71	3.84	**4.87**	58.49	46.81	**11.68**
DE	96.92	91.73	**5.19**	31.99	19.08	**12.91**	34.17	28.65	**5.52**
SE	93.78	95.04	**-1.26**	88.24	85.42	**2.82**	54.32	51.18	**3.15**
IS	97.90	65.62	**32.27**	1.15	0.40	**0.74**	6.20	4.21	**1.99**
IT	96.24	74.85	**21.38**	1.39	0.09	**1.30**	3.83	2.35	**1.47**
FR	98.39	91.09	**7.30**	1.29	0.92	**0.37**	64.00	56.64	**7.36**
DK	90.21	94.05	**-3.84**	43.39	36.65	**6.74**	35.36	28.89	**6.48**
GR	97.96	64.37	**33.59**	0.72	0.94	**-0.22**	3.95	2.11	**1.84**
SW	89.04	80.28	**8.75**	59.19	30.31	**28.89**	18.28	10.66	**7.62**
BE	95.89	82.09	**13.80**	2.71	1.46	**1.25**	18.96	14.17	**4.78**
ISR	82.51	63.59	**18.92**	31.61	22.60	**9.01**	15.93	10.37	**5.56**
CZ	96.76	96.93	**-0.16**	0.25	0.29	**-0.04**	52.68	44.46	**8.22**
PL	99.68	92.88	**6.80**	§	§	**§**	23.11	18.39	**4.72**
LU	96.98	60.66	**36.32**	8.46	0.98	**7.48**	22.72	13.25	**9.47**
PT	96.12	88.91	**7.21**	§	§	**§**	19.76	17.50	**2.26**
SL	99.32	89.80	**9.52**	1.13	0.83	**0.31**	12.40	11.85	**0.55**
EE	89.51	91.31	**-1.80**	0.60	0.25	**0.35**	2.24	0.80	**1.44**
HR	99.70	79.38	**20.32**	1.00	1.33	**-0.33**	9.17	5.59	**3.59**

Source: Author's own research findings from SHARE (W6 – Release 7-1-0). **Note:** 1) In SHARE W6, the Netherlands did not participate in the regular SHARE wave but conducted a mixed mode experiment 2) Portugal is an outlier, due to misclassification (a coding error which characterized state pensions as occupational pensions.

4.11 Understanding Cohen's Effect Size in the Context of the Gender Pension Gap.

To complement the analysis of the GPG based on mean differences, this section introduces Cohen's d—a standardized effect size measure used to assess the practical importance of differences between two group means. While GPG percentages provide a policy-relevant and intuitive measure of proportional disparity in pension income, they do not capture the degree of variability within income distributions, which is essential to understanding whether these gaps are substantial in real-world terms. Cohen's *d* quantifies the difference between two group means (in this case, men's and women's average pension incomes) in terms of standard deviation units, offering a dimensionless and comparable metric of effect size. The measure is particularly useful for assessing whether a difference is not only statistically significant but also economically or socially meaningful.

<u>Formula for Cohen's *d*:</u>

- Cohen's d[17] = $(\bar{X}\_men - \bar{X}\_women) / sp$
- Sp[18] = $\sqrt{[((n\_men - 1)\, s^2\_men + (n\_women - 1)\, s^2\_women) / (n\_men + n\_women - 2)]}$.

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17 $\bar{X}_{men}$: is the average pension income of men

$\bar{X}_{women}$: is the average pension income of women

Sp: is the pooled standard deviation

18 s^2_{men} is the variance of male pension income

s^2_{women} is the variance of female pension income

n_{men} and n_{women} are the sample sizes for men and women

The formula assumes normal distribution and homogeneity of variances assumptions that were confirmed through diagnostics presented in Chapter 5.

Table 4. 15 GPG in mean and median, W6.

	MEAN			MEDIAN		
COUNTRY	**MEN**	**WOMEN**	**GPG (%)**	**MEN**	**WOMEN**	**GPG (%)**
Austria	19298.1	15903.7	17.6	16800	14400	14.3
Germany	16590.4	13826.7	16.7	15600	12600	19.2
Sweden	17375.3	15574.3	10.4	16037.6	14754.6	8.0
Spain	9990.8	9174.4	8.2	9600	8400	12.5
Italy	12661.9	12105.9	4.4	12600	12000	4.8
France	19943.5	17659.2	11.5	17400	15840	9.0
Denmark	14631.6	14431.7	1.4	14497.1	14488	0.1
Greece	9379.3	7656.2	18.4	8400	7080	15.7
Switzerland	37238.2	33331.4	10.5	29213.4	27693.5	5.2
Belgium	30823.7	27369	11.2	16800	15924	5.2
Israel	12717.4	12217.2	3.9	8456.6	8174.7	3.3
Czech Republic	5221.7	4713.2	9.7	5454.7	4883.3	10.5
Poland	4456.2	4067.4	8.7	4101.3	3154.8	23.1
Luxembourg	45620.9	33503.1	26.6	40000	31200	22.0
Portugal	6870.6	6989.3	-1.7	5489.4	4800	12.6
Slovenia	8184.9	7610.1	7.0	7000	6000	14.3
Estonia	4013.1	4064	-1.3	4236	4200	0.8
Croatia	4496.7	3286.6	26.9	4255.3	3152	25.9

Source: Own Estimation from SHARE W6 - Release 7.1.0). Note: Estimates are based on data for 2015 (W6). Selected Cases : cjs=1 &fin_resp = 1 & age >= 65 & Pensions >0,sample1=1.

The data in the table above are based on a final sample of 52,388 individuals, selected using a more restrictive set of criteria than those applied in earlier analyses based solely on NPI. The purpose of these stricter filters is to enhance data reliability and comparability. The criteria for inclusion were as per the appendix above (Appendix 3.7). The table above presents both mean and median pension incomes for men and women across various countries, alongside the resulting GPG expressed as a percentage.

Several key patterns emerge:

1. **Countries with High GPG (Consistently Across Mean and Median):**
    - **Croatia** and **Luxembourg** show the largest disparities, with mean GPGs of 26.9% and 26.6%, respectively. Median values also reflect significant gaps (25.9% and 22.0%), highlighting persistent inequality at both average and typical income levels.
    - **Greece** and **Germany** also display high median GPGs (15.7% and 19.2%), even though the mean gap in Germany is slightly lower (16.7%).
2. **Countries with Moderate GPG:**
    - **Austria**, **France**, **Sweden**, **Belgium**, and **Switzerland** show mean GPGs ranging from 10% to 17%. Their median GPGs are generally lower, suggesting that extreme values might be inflating mean differences, particularly in Switzerland.
3. **Countries with Low or Minimal GPG:**
    - **Denmark** stands out for its near parity, with a mean GPG of just 1.4% and a negligible median GPG of 0.1%.
    - **Italy** and **Israel** show low GPGs by both measures, with differences under 5%.
4. **Countries with Inconsistent or Anomalous GPGs:**
    - **Portugal** and **Estonia** present negative mean GPGs (-1.7% and -1.3%, respectively), suggesting that women in these countries, on average, receive slightly higher pensions than men. However, their median GPGs

are positive (12.6% and 0.8%), indicating that typical men still earn more than typical women, and the negative mean may result from a few high-income female pensioners skewing the average.

5. **Discrepancies Between Mean and Median GPG:**

   - Several countries (e.g., **Poland**, **Slovenia**, **Spain**) show substantially higher GPGs at the median than at the mean. This points to greater inequality within the lower to middle portions of the pension distribution, possibly reflecting historical labor market disparities or pension system regressivity.

Table 4.16: Analysis of Gender Pension Gap Using Cohen's d Effect Size

Country	Mean Difference	Sig. (2-tailed)	Statistically Significant?	Cohen's d
Austria	3394.4	0	**Yes**	**0.4**
Germany	2763.8	0	**Yes**	**0.4**
Sweden	1801.0	0	**Yes**	**0.3**
Spain	816.5	0	**Yes**	**0.2**
Italy	556.0	0.005	**Yes**	**0.1**
France	2284.2	0	**Yes**	**0.2**
Denmark	199.9	0.425	**No**	**0**
Greece	1814.1	0	**Yes**	**0.5**
Switzerland	3906.8	0	**Yes**	**0.2**
Belgium	3454.7	0.013	**Yes**	**0.1**
Israel	500.2	0.37	**No**	**0.1**
Czech Republic	508.5	0	**Yes**	**0.3**
Poland	8.7	0	**Yes**	**0.1**
Luxembourg	12117.8	0	**Yes**	**0.4**
Portugal	-118.7	0.799	**No**	**0**
Slovenia	574.7	0.101	**No**	**0.1**
Estonia	-51.6	0.155	**No**	**0**
Croatia	1210.1	0	**Yes**	**0.5**

Source: Own Estimation from SHARE W6 - Release 7.1.0). Note: Estimates are based on data for 2015 (W6).

The interpretation of Cohen's d typically follows these benchmarks:

- **0.2** – considered a **small effect size**, indicating that the difference between men's and women's pensions is noticeable but modest in practical terms.

- **0.5** – a **medium effect size**, suggesting that the income gap is both statistically and economically meaningful.
- **0.8** or higher – a **large effect size**, representing a substantial and impactful difference in pension income levels.

However, these thresholds are only guidelines. The practical importance of an effect size should also be interpreted in the context of the data, policy relevance, and the social or economic consequences of the observed differences. For example, even a small effect size might be important if it reflects persistent structural inequalities across a large population or vulnerable group. Conversely, a medium or large effect size may call for urgent policy attention if it reveals systematic disadvantages faced by women in retirement income security.

Key Findings:

1. **Moderate Effect Sizes (d ≈ 0.4–0.5):**

   Countries such as Austria (0.4), Germany (0.4), Luxembourg (0.4), Greece (0.5), and Croatia (0.5**)** demonstrate medium effect sizes, suggesting that the gender gap in pension income is not only statistically significant but also meaningfully large in economic terms. These are countries where the difference between male and female pensions is both sizable and consistent relative to income variation.

2. **Small Effect Sizes (d ≈ 0.1–0.3):**

   Countries like **Sweden (0.3)**, **France (0.2)**, **Spain (0.2)**, **Czech Republic (0.3)**, and **Belgium (0.1)** show statistically significant but small practical differences in pensions. While these gaps exist, their impact on typical living standards may be more limited.

3. **Negligible or No Effect (d = 0):**

   Countries such as **Denmark**, **Portugal**, and **Estonia** report **non-significant results** with effect sizes of zero. These findings suggest gender parity in pension income, at least in statistical and practical terms, highlighting strong policy outcomes or equal pension entitlements.

4. **Statistically Non-Significant, Yet Small Effect Sizes (d ≤ 0.1):** In countries like **Israel** and **Slovenia**, small effect sizes and p-values above 0.05 indicate that gender differences may exist but are too inconsistent or minor to be considered meaningful in this dataset.

Cohen's d is a parametric statistic that requires the use of means and standard deviations to calculate standardized effect sizes. Because it is built on assumptions about the normality of distributions and homogeneity of variances (proven in chapter 5), it cannot be directly computed using medians or interquartile ranges. Medians reflect the typical (central) value in skewed distributions but do not capture variance, which is essential for effect size estimation.

In contrast:

- **Means** incorporate all values in the distribution, allowing the calculation of pooled standard deviations.
- **Medians** do not reflect spread and are **non-parametric**, which makes them incompatible with the Cohen's d framework.

Therefore, the analysis of effect size using Cohen's d was deliberately based on mean pension incomes to ensure methodological validity. While median GPG values are useful for describing distributional shifts and identifying outliers or asymmetry, they are not suitable for effect size metrics that require standardized mean differences.

Interpreting Cohen's d Effect Size in Relation to the Gender Pension Gap

While the Gender GPG, calculated as a percentage difference in mean pension income between men and women, offers an intuitive and policy-relevant measure of inequality, it does not account for variability within income distributions. To complement this, Cohen's d effect size was employed to assess the magnitude of the mean difference in pension income relative to the pooled standard deviation across genders. This standardised metric provides a clearer sense of the practical significance of observed gaps.

Importantly, the results derived from Cohen's d do not always align with those suggested by the GPG percentage. For instance, countries such as Belgium and Switzerland report moderate GPGs of 11.2% and 10.5% respectively. However, their corresponding effect sizes are small (d = 0.1 and d = 0.2), indicating that—despite the proportional pension differences—the actual disparities are modest relative to the variability in pension incomes. In other words, the average difference between men's and women's pensions is small when compared to the spread of pensions within each gender group.

Conversely, Greece presents a GPG of 18.4% along with a medium effect size (d = 0.5), suggesting that the gap is not only statistically significant but also economically meaningful. This contrast highlights the added value of using Cohen's d: it captures the practical significance of gender disparities, offering insights that a simple percentage gap may overlook. Therefore, integrating effect size analysis provides a deeper understanding of the magnitude and relevance of gender pension inequalities across countries.

These differences highlight that while GPG percentages can indicate the extent of proportional inequality, Cohen's d helps contextualise whether such differences are substantial within the broader income distribution. Therefore, both measures serve complementary purposes: GPG is useful for comparing inequality across countries, while Cohen's d helps assess the practical importance of such inequality in economic terms. Cohen's d was calculated using mean values, as the method relies on both means and standard deviations. It is not applicable to medians, which lack information on variability and are suited to non-parametric comparisons. This justifies the exclusive use of mean-based GPG data for the effect size analysis.

4.12 Key Insights from Descriptive GPG Analysis

National Pension Income (NPI): Persistent Disparities: The analysis of NPI highlights significant variations in GPG across countries. Luxembourg, Germany, and the Netherlands consistently exhibit the highest GPG percentages in the most recent Wave, with disparities exceeding 30%. These findings reflect deeply embedded inequalities in pension systems that are linked to gendered differences in lifetime earnings, contributions, and occupational opportunities.

In contrast, Estonia and Denmark show the lowest GPG levels in NPI, with percentages consistently below 5%. This indicates more equitable pension systems, supported by policies that promote gender balance in labor markets and address disparities in earnings and contributions.

Trends over time reveal both progress and setbacks. In Germany, for example, the GPG in NPI has been gradually decreasing from Wave 2 to Wave 7, reflecting the impact of policy reforms aimed at reducing gender disparities. However, Luxembourg shows an increase in GPG between Waves 5 and 6, and the Netherlands demonstrates mixed trends, with mean calculations showing a slight increase in GPG from Wave 2 to Wave 5, while median calculations indicate a decrease between Waves 4 and 5. Estonia consistently maintains GPG levels below 3% throughout Waves 4 to 7, demonstrating the effectiveness of their redistributive policies.

National Individual Income (NII): Labor Market Inequities: The analysis of National Individual Income (NII) reveals that Greece has the highest GPG in the most recent Wave based on mean calculations, followed by Switzerland and Luxembourg. However, median calculations suggest that Estonia, Croatia, and the Czech Republic have the highest GPG levels, emphasizing the importance of examining multiple metrics to capture the full scope of disparities.

Portugal and Sweden consistently report the lowest GPG levels in NII, reflecting more equitable labor market conditions and effective policies aimed at reducing gender-based income disparities. These findings align with broader trends in countries with progressive labor market policies and higher levels of female workforce participation.

National Individual Income from Work (NIIW): The Wage Gap Challenge: National Individual Income from Work (NIIW), which isolates income derived solely from employment, demonstrates the highest GPG percentages among all income measures analysed. Luxembourg, Germany, and the Netherlands report the largest disparities based on mean calculations, reflecting entrenched wage gaps and systemic barriers to gender equity in labor markets. Median calculations similarly highlight Luxembourg, the Netherlands, and Portugal as having the highest GPG levels.

Conversely, countries like Estonia, the Czech Republic, and Denmark exhibit the lowest GPG levels in NIIW, suggesting narrower wage gaps and more equitable employment conditions. These results underline the importance of wage equality and labor market policies in addressing gender disparities in individual earnings.

Pension Categories: Trends and Implications: The analysis of specific pension categories reveals significant trends. Old-age pensions, early retirement pensions, and survivor pensions show a gradual decline in GPG from Wave 1 to Wave 7, reflecting policy reforms and changing societal norms. Survivor pensions play a particularly important role in reducing disparities, as they disproportionately benefit women, who are more likely to outlive their spouses.

However, pensions linked to individual contributions and work history exhibit higher GPGs, reflecting the compounded impact of gendered differences in lifetime earnings, access to high-paying jobs, and labor force participation. This underscores the need for targeted interventions to address systemic barriers that limit women’s ability to accumulate retirement wealth.

Age-Related Trends in Gender Gaps: An important age-related pattern emerges in the analysis: the GPG is highest among younger retirees (aged 50–64) and gradually decreases with age. This trend can be attributed to the cumulative effects of redistributive mechanisms, such as survivor benefits and minimum income guarantees, which help level income disparities among older retirees. Younger retirees, however, experience the full impact of labor market inequalities, resulting in higher initial disparities.

A key observation from this chapter is the distinction between countries with high GPGs in NHI versus NPI. This difference underscores the importance of supplementary income sources in reducing disparities at the household level, even when individual income inequalities persist. For example, Spain and Italy demonstrate low GPG levels in NHI due to the redistributive effects of household income pooling, while countries like Luxembourg and Switzerland continue to exhibit high disparities in NPI.

These findings also highlight regional variations in GPGs across Europe. Northern European countries, such as Denmark and Estonia, consistently show lower disparities, reflecting robust social welfare systems and gender-equal labor market policies. In contrast, countries in Western Europe, such as Luxembourg and Germany, exhibit higher GPG levels, emphasizing the need for further reforms to address systemic inequities.

4.13 Summary of the Chapter

This chapter provides a comprehensive analysis of the GPG across European countries and Israel using data from the SHARE survey (Waves 1–7) and supplementary EasySHARE datasets. Through descriptive statistical measures—

mean, median, and skewness—the chapter examines disparities in pension income (NPI), household income (NHI), individual income (NII), income derived exclusively from work (NIIW), and various pension categories, including old-age and survivor benefits.

Key Findings:

Persistent GPG:

- Luxembourg, Germany, and the Netherlands exhibit the highest GPG in Net Pension Income (NPI), with disparities exceeding 30%.
- Estonia and Denmark have the lowest GPG in NPI, with gaps under 5%, reflecting more equitable pension systems.

Income Components and Gender Gap:

- Gender disparities are more pronounced in Net Individual Income from Work (NIIW) compared to NPI and NHI, underlining the role of supplementary income in reducing income inequality.
- Greece, Switzerland, and Luxembourg show the highest GPG in NII, while Portugal and Sweden report the lowest.
- The inclusion of household income components in NHI calculations significantly reduces gender disparities, with countries like Spain and Italy exhibiting minimal GPG in NHI.

Trends Over Time:

- The GPG in pensions generally declined across most European countries between 2004 and 2017. However, exceptions include Luxembourg, Belgium, and Slovenia, where disparities have increased.

- The decline in GPG aligns with policy reforms, improved labor force participation among women, and evolving societal norms.

Influence of Age and Survivor Pensions:

- The GPG is highest among younger retirees (aged 50–64) and decreases with age, reflecting the cumulative impact of survivor benefits and supplemental income over time.
- Excluding survivor benefits increases the GPG, emphasizing their role in mitigating pension disparities.

Coverage and Multi-Pillar Pension Systems:

- Significant coverage gaps exist across the three pension pillars—public (Pillar 1), occupational (Pillar 2), and individual savings (Pillar 3).
- Luxembourg, Greece, and Spain exhibit the largest gender coverage gaps in public pensions, while countries like Denmark and Sweden report more balanced coverage.
- Participation in private and occupational pensions (Pillar 2) remains limited in most countries, with significant gender disparities in coverage.

Regional Disparities:

- Western European countries show higher GPG in pension income compared to Eastern, Northern, and Southern regions, reflecting differences in pension system designs and labor market dynamics.
- Switzerland consistently ranks highest in GPG across multiple income categories, highlighting structural inequalities in its pension system.

- The Czech Republic and Greece exhibit significant increases in GPG over time, while Spain and Italy show consistent reductions.

Impact of Financial Crises:

- The chapter underscores the vulnerability of pension systems to economic shocks, with countries relying on funded schemes (Pillar 2) experiencing substantial losses during financial crises.
- The role of public pensions (Pillar 1) as a stabilizing factor in mitigating gender disparities is evident, particularly in countries with robust universal schemes.

Key Insights and Implications:

- Structural Reforms: Addressing the GPG requires targeted reforms in pension system design, including improved integration of caregiving credits, flexible work arrangements, and gender-sensitive policies.
- Regional Collaboration: Cross-national comparisons provide valuable insights into effective strategies for reducing gender disparities, highlighting Denmark’s public pension model and Estonia’s policies promoting workforce participation among older women as potential benchmarks.
- Focus on Coverage: Closing gender coverage gaps is essential for equitable pension outcomes. Expanding access to Pillar 2 and Pillar 3 pensions, particularly in countries with low participation rates, is critical.
- Age-Specific Interventions: Policies should address the specific needs of younger retirees, where gender disparities are most pronounced, and promote financial security for women throughout retirement.

- Data-Driven Policy: The findings underscore the importance of robust data collection and analysis, including gender-specific metrics, to inform and evaluate policy interventions.

In conclusion, this chapter highlights the complexity and multifaceted nature of the GPG. While progress has been made in narrowing disparities, persistent inequalities underscore the need for comprehensive and context-specific policy measures. These findings serve as a foundation for developing equitable retirement systems that ensure financial security for women across Europe.

Chapter 5: Multivariate Regression Model

5.1 Introduction

This chapter employs a multivariate regression model to analyse the determinants of NPI across European countries, with a specific focus on how these determinants shape the GPG. The dependent variable in the analysis is individual pension income (NPI), rather than the pension gap itself. The GPG is therefore derived indirectly by comparing outcomes across genders, rather than being modelled as a stand-alone dependent variable. This approach ensures clarity in distinguishing between the investigation of pension income drivers and the interpretation of their gendered implications.

The unit of analysis is the individual retiree aged 65 and above, observed within repeated cross-sectional samples from the SHARE survey. While the panel dimension of the dataset provides a rich backdrop for understanding cohort dynamics, the regression analysis presented in this chapter is primarily cross-sectional in nature, designed to highlight structural and individual-level factors influencing pension income. A fuller discussion of the basic model specifications and justification of these choices is provided in Chapter 3, to ensure consistency between the research design and the empirical implementation.

This chapter explores three key hypotheses related to gender-based disparities in pension outcomes. The first hypothesis posits that significant differences exist in pension income between genders, shaped by employment patterns, career interruptions, and wage disparities throughout working life. This hypothesis builds on existing literature showing how women’s lower lifetime earnings and more frequent career breaks, often linked to caregiving responsibilities, translate into reduced pension entitlements.

The second hypothesis examines the role of systemic discrimination within pension systems that may perpetuate gender inequalities. This includes analysing how benefit calculation rules and eligibility criteria disproportionately disadvantage women. The regression framework allows for testing whether such structural disadvantages materially lower NPI for women relative to men.

The third hypothesis focuses on the potential mitigating effects of secondary income sources on the GPG. This involves testing whether additional income streams—such as rental income, investment returns, or savings—serve as buffers against pension inequality.

To test these hypotheses, the regression incorporates a broad set of socio-economic and demographic variables, including marital status, education, income sources, savings behaviour, age, and mobility limitations. By integrating these into the model, the chapter seeks to disentangle both systemic and individual-level dynamics that drive disparities in pension outcomes.

In summary, the analysis presented here provides a cross-sectional exploration of the determinants of pension income, with a gendered lens that highlights the sources of the GPG. Later chapters complement this with further analyses that trace changes across waves and explore dynamic effects over time. Together, these approaches provide a comprehensive understanding of how gender, socio-economic status, and pension system structures interact to shape retirement security across Europe.

Key Insights from the Regression Analysis:

1. Gender Disparities: Women consistently receive lower pension incomes than men, even after adjusting for socio-economic and demographic differences. The "gender" variable demonstrates statistically significant negative coefficients in most countries, revealing persistent systemic inequalities embedded within European pension systems.
2. Education: Contrary to expectations, higher education does not consistently translate into higher pension incomes for women. This finding points to structural biases in pension systems, where educational attainment alone does not offset cumulative disadvantages, such as career interruptions or part-time work.
3. Savings and Investments: Income from savings and long-term financial assets is positively associated with higher pension incomes. This emphasizes the critical role of financial planning and investment opportunities in enhancing retirement security, particularly for women.
4. Mobility Limitations: Physical limitations significantly reduce pension incomes, underscoring the compounded financial vulnerability faced by individuals with health challenges.
5. Country-Specific Variations: Gender disparities vary widely across European countries. Countries such as Germany and Luxembourg exhibit the largest negative gender coefficients, indicating deep-seated inequalities, while

countries like Spain and Italy show minor or even positive associations, reflecting localized socio-economic conditions and policy impacts.

Model Performance:

The regression model achieves an R-squared value of 0.294, which, while moderate, highlights the model's ability to capture a meaningful portion of the variance in pension incomes. This is noteworthy given the inherent complexities and multi-dimensional nature of socio-economic data. The analysis also recognizes limitations, such as potential omitted variable bias and data constraints, which may affect the explanatory power of the model.

Transition to Further Analysis:

The findings from this regression analysis serve as a foundation for deeper exploration in subsequent chapters. Specifically, the Oaxaca Decomposition Method introduced in Chapter 6 will dissect the GPG into explained components (observable differences in characteristics like education or employment) and unexplained components (likely reflective of discrimination or systemic biases). This dual approach offers a nuanced understanding of both visible and hidden factors perpetuating gender disparities in pension income.

5.2 Model Analysis: Employing Multivariate Regression for GPG Analysis.

To address the hypotheses surrounding the GPG and explore the socio-economic and demographic factors influencing NPI, this study employs a multivariate regression model. Regression analysis is a powerful statistical tool widely used in social sciences to examine relationships between variables, quantify their effects, and identify key drivers of disparities. By employing this method, we can control multiple factors simultaneously, isolating the impact of each independent variable on the dependent variable while accounting for confounding influences.

Regression analysis was chosen for this research due to its numerous advantages in understanding complex socio-economic phenomena such as the GPG:

1. **Capturing Multi-Dimensional Relationships**: Regression allows for the simultaneous analysis of multiple independent variables, offering insights into how various socio-economic and demographic factors interact and contribute to disparities in pension incomes. This is particularly valuable for analysing multifaceted issues like the GPG, where gender intersects with age, education, income sources, and mobility limitations.

2. **Isolating the Effect of Gender**: The ability to control for confounding variables—such as marital status, education, or savings—enables a precise assessment of the independent effect of gender on pension incomes. By controlling for these factors, the model ensures that observed disparities are not attributed to other underlying variables.

3. **Quantifying Impacts**: Regression coefficients provide a clear and interpretable measure of the strength and direction of relationships between variables, facilitating meaningful comparisons across countries and subgroups. For example, the gender coefficient reveals the percentage reduction in pension income associated with being female.

4. **Facilitates cross-national comparisons (cross-sectional, not panel).**

   Regression analysis supports systematic comparisons across European countries by including country dummies and interaction terms. This enables the evaluation of how systemic and policy differences shape pension outcomes for men and women. The analysis is based on repeated cross-sectional data rather than a longitudinal panel model, meaning the focus is on identifying structural and contextual differences between countries at given points in time, rather than following individuals across survey waves. This design avoids confusion about units of analysis and ensures clarity in interpreting the country-level effects on the GPG.

5. **Robustness and Statistical Testing**: Regression provides tools for assessing the statistical significance of variables, evaluating model fit (e.g., R-squared), and validating results through diagnostic tests. This ensures that the findings are both reliable and methodologically sound.

The GPG is a complex issue driven by multiple interrelated factors, including lifetime earnings, caregiving responsibilities, systemic biases, and structural differences in pension systems. A multivariate regression model is well-suited for this research because:

- It accounts for the heterogeneity of factors influencing pension outcomes, such as gender, age, education, and country-specific policies.
- It provides a framework for testing hypotheses about the differential impact of socio-economic variables on men and women.
- It captures cross-national variability, revealing how policy environments and socio-economic contexts shape disparities.
- It isolates the effect of gender on pension incomes, controlling for confounding variables like marital status, secondary income sources, and health limitations.

5.3 The Multivariate Regression Model: Variables and Specifications

This study employs a regression model where the dependent variable is the log-transformed Net Pension Income (Log_NPI). The logarithmic transformation helps normalize the distribution of pension incomes, which are often skewed due to outliers or extreme values. This also allows for percentage-based interpretation of the coefficients, enhancing the practical relevance of the results.

The model includes the following variables (see Table 5.1 for details):

Dependent Variable: **NPI**: The dependent variable in all regression models is NPI, measured at the retiree level. NPI is constructed by aggregating:

public pensions, including old-age, early retirement, and survivor pensions (*Ypen1*),

private and occupational pensions (*Ypen2*), and

disability pensions or benefits (*Ypen3*).

This choice ensures clarity: the analysis seeks to identify the determinants of pension income at the individual level, rather than modelling the pension gap as a dependent variable. The GPG is therefore evaluated indirectly by interpreting the coefficient on the gender variable (female vs. male) and its interactions with other socio-economic and demographic factors.

Independent Variables:

Socio-economic and demographic factors: Gender, age, marital status, education level (Dummy_ISCED), number of children, and mobility limitations.

Income sources: Rent/subletting (Ysrent), financial assets (Ybabsmf), and savings for long-term investments (Slti).

Country identifiers: Captures the unique policy, economic, and structural differences across countries.

Case Selection: To ensure robust and meaningful analysis, cases were filtered to include only:

Respondents aged 65 and above with pension incomes greater than zero.

Individuals who are retired and financially responsible for their household data reporting.

Participants from SHARE waves providing complete and comparable data.

Table 5.1: Multivariate Regression Model

Dependent Variable		
Variable's Name	**Description**	
ypen1	Old age, early retirement, and survivor pensions	
ypen2	Private and occupational pensions	
ypen3	Disability pensions/benefits	
Dependent Variable	**NPI (Net Pension Income) = Ypen1 + Ypen2+Ypen3**	
Independent Variables/All models the same		
Variable's Name	**Description**	
country	Country identifier - The Cases to be split by Country (Given the variables significance)	
ysrent	Income from rent/sublet	
yaohm	Income from other household members	
ybabsmf	Interest/dividend from bank account, bond, stock, and mutual funds	
slti	Savings for long-term investments	
gender	Gender	
age	Age	
isced[19]	ISCED 1997 Coding of education	• Dummy equals 1 if the respondent is highly educated (isced 3 – 6)[20] • Dummy equals 2 if the respondent has a mid to low educational level (All others).
mstat	Marital status	• Dummy Variable equals to 1 if the respondent is married (living or not with spouse) or registered partners. • 2 if he/she is widowed or divorced. • 3 if he/she is in any other marital status (never married etc.)

[19] The ISCED 1997 (International Standard Classification of Education) is a framework developed by UNESCO to classify and compare education programs and levels across countries. It organizes education into levels and fields to standardize reporting and analysis of educational attainment and outcomes globally.

[20] Certain internationally diverse variables, such as education (ISCED) or occupation (ISCO, NACE), necessitate country-specific measurements and ex-post harmonization. This is due to the inherent variations across countries in these domains, requiring careful consideration and standardization to ensure comparability and meaningful analysis. By implementing country-specific measurements and ex-post harmonization techniques, researchers can account for these variations and provide an accurate interpretation and comparison of data in education and occupation.

number of children[21]	Number of children	• Dummy equals 0 if the respondent has no child; 0 if he/she has. • Dummy equals 1 if the respondent has 1-2 children. • Dummy equals to 2 if the respondent has 3+ children
mobility	Mobility limitations	
ype5	Social assistance	
Helpful Variables – Select Cases		
Variable's Name	**Description**	
mergeid	Person identifier (fix across modules and waves	
fin_resp	Financial respondent	Selected : fin_resp=1
sample1	Imputation sample for single	Select Sample1=1
cjs	Current job situation	Select Cjs=1
Age	Respondents Age	Select Age>=65
NPI >0		
SELECTED CASES : cjs=1 &fin_resp = 1 & age >= 65 & Pensions >0,sample1=1		

Source : Author's own Model

5.3.1 Regression Model Specification

The regression analysis is based on a log-linear functional form, where the dependent variable is the natural logarithm of Net Pension Income $(ln\ (NPI)$. This transformation normalises the distribution of pension incomes, which are typically right-skewed, and allows for coefficients to be interpreted in percentage terms.

The model can be formally expressed as:

$$\begin{aligned}\boldsymbol{ln}(\boldsymbol{NPI}_{\mathrm{i}}) = {} & \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1\boldsymbol{Gender}_{\mathrm{i}} + \boldsymbol{\beta}_2\boldsymbol{Education}_{\mathrm{i}} + \boldsymbol{\beta}_3\boldsymbol{MaritalStatus}_{\mathrm{i}} + \boldsymbol{\beta}_4\boldsymbol{Children}_{\mathrm{i}} \\ & + \boldsymbol{\beta}_5\boldsymbol{Age}_{\mathrm{i}} + \boldsymbol{\beta}_6\boldsymbol{Mobility}_{\mathrm{i}} + \boldsymbol{\beta}_7\boldsymbol{RentIncome}_{\mathrm{i}} + \boldsymbol{\beta}_8\boldsymbol{OtherHHIncome}_{\mathrm{i}} \\ & + \boldsymbol{\beta}_9\boldsymbol{FinancialAssets}_{\mathrm{i}} + \boldsymbol{\beta}_{10}\boldsymbol{Savings}_{\mathrm{i}} + \boldsymbol{\beta}_{11}\boldsymbol{SocialAssistance}_{\mathrm{i}} \\ & + \boldsymbol{\gamma}_{\boldsymbol{c}}\boldsymbol{Country}_{\boldsymbol{c}} + \boldsymbol{\varepsilon}_{\mathrm{i}}\end{aligned}$$

Where:

- $\boldsymbol{i}$ = individual respondent
- $\boldsymbol{c}$ = country identifier
- $\boldsymbol{ln}(\boldsymbol{NPI}_{\mathrm{i}}, \boldsymbol{c})$ = log-transformed net pension income of individual *i* in country *c*
- Gender, Education, MaritalStatus, Children, Age, Mobility, RentIncome (ysrent), OtherHHIncome (yaohm), Financial Assets (ybabsmf), Savings (slti), Social Assistance (ype5*)* = individual-level socio-economic and demographic characteristics (see Table 5.1)

[21] Not living with them & they are alive & majority of them will be adults.

- $\boldsymbol{\gamma c}$ = country dummy variables capturing institutional, policy, and structural effects
- $\boldsymbol{\varepsilon}_{\mathrm{i}}, \boldsymbol{c}$ = stochastic error term

The inclusion of country dummies is particularly important in the cross-national context of this study. Pension outcomes are shaped not only by individual socio-economic characteristics but also by institutional and policy environments. Country-specific dummies absorb unobserved heterogeneity in pension system design, redistributive mechanisms, and labour market structures, thereby reducing omitted variable bias and ensuring that the estimated coefficients on individual-level variables capture within-country variation rather than structural cross-country differences.

Although SHARE provides a longitudinal panel structure, the regression analysis presented here adopts a repeated cross-sectional perspective. This decision reflects three considerations. First, the research objective is to identify structural and cross-country differences in the determinants of pension income rather than to track individual trajectories over time. Second, the imputed data structure within SHARE does not guarantee consistent longitudinal comparability across waves, limiting the suitability of panel specifications. Third, maintaining a cross-sectional design ensures consistency with the Oaxaca–Blinder decomposition applied in Chapter 6, which relies on pooled cross-sectional data to decompose the gender pension gap.

For robustness, country dummy variables are incorporated into the pooled regressions to capture unobserved heterogeneity at the national level. While it is acknowledged that a full panel regression (fixed or random effects) could be applied as an alternative, such an approach would shift the analytical focus from structural cross-country comparisons to within-individual variation over time. The limitations of not employing a panel specification are explicitly discussed in Sections 5.4 and 7.5.

A further consideration concerns the treatment of categorical variables. Variables such as marital status and number of children were entered into the regression model using multiple indicator categories. In conventional econometric practice, the K–1 rule would apply, with one category omitted as the reference group to avoid perfect multicollinearity. In this study, however, all categories were retained in the specification. While this represents a technical shortfall, it does not materially affect the substantive interpretation of the results. This limitation is acknowledged, and future research should adopt a stricter application of the K–1 rule to improve efficiency and adherence to econometric standards.

Normality

The examination of normality for the dependent variable, NPI, was conducted to ensure the robustness of subsequent statistical analyses. The results of this assessment, as presented in the accompanying tables, indicated deviations from normal distribution for both variables. Consequently, a data transformation was deemed necessary to enhance the normality of the distributions.

The chosen transformation method involved applying the arithmetic logarithm to the NPI variable. This transformation aimed to address non-normality and transform the data more amenable to parametric statistical analyses. Upon applying the logarithmic transformation, the resulting distributions exhibited notable improvements. While the data did not achieve perfect normality, the skewness and kurtosis values for Log_NPI variable indicated a convergence towards normality. The research context, coupled with the substantial sample size, justifies this consideration, recognizing that statistical tests may detect minor deviations even in large samples.

In light of the observed improvements post-transformation and the acknowledgment of the research context and substantial sample size, the transformed Log_NPI variable is deemed to approximate normal distributions. This pragmatic consideration aligns with the inherent challenges of achieving perfect normality in real-world data and ensures the validity of subsequent inferential analyses within the specified research framework.

Table 5.1.1: Distribution Test_NPI

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
NPI	52388	100.0%	0	0.0%	52388	100.0%

Table 5.1.2: Descriptives_NPI

Descriptives				
			Statistic	Std. Error
NPI	Mean		13267.2523	75.46891
	95% Confidence Interval for Mean	Lower Bound	13119.3326	
		Upper Bound	13415.1720	
	5% Trimmed Mean		11133.7490	
	Median		9600.0000	
	Std. Deviation		17273.64586	
	Minimum		40.63	
	Maximum		352227.86	
	Range		352187.23	
	Interquartile Range		11400.00	
	Skewness		7.121	.011
	Kurtosis		74.486	.021

The mean annual net pension income (NPI) is 13,267, with a standard deviation of 17,274, indicating considerable dispersion around the mean. The large difference between the mean (13,267) and the median (9,600) reflects the highly skewed distribution, where a small number of very high pensions raise the average substantially above the central tendency. This is confirmed by the high skewness

(7.121) and kurtosis (74.486), both indicating a long right tail and the presence of extreme pension values.

Given this non-normal distribution, a log transformation of NPI was performed (Figures 5.1.3 and 5.1.4), which substantially improved normality and provided a more suitable basis for regression analysis.

Figures: 5.1.1 – 5.1.4

Figure 5.1.1: Histogram_NPI

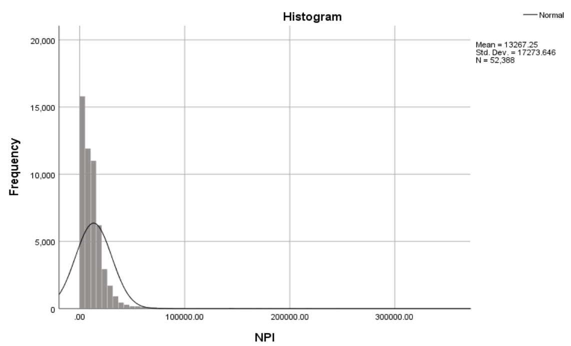


Figure 5.1.2**:** Q-Q Plot_NPI

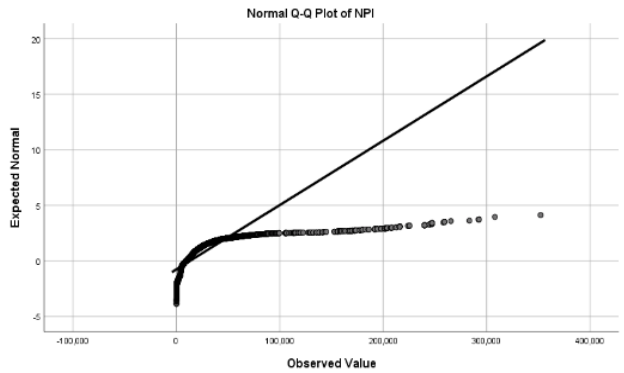


Figure 5.1.3: Histogram_Log_NPI

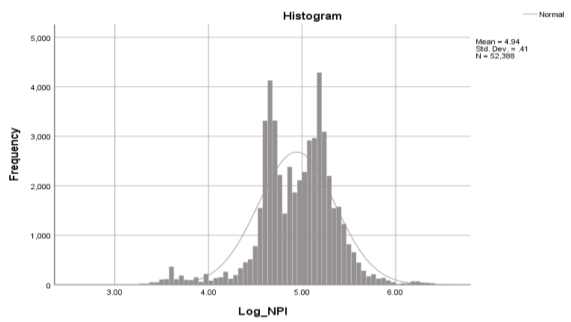
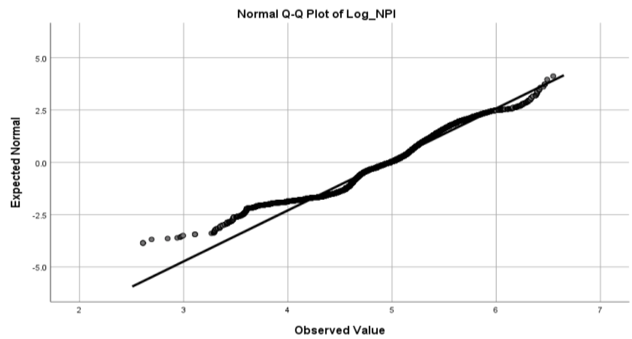


Figure 5.1.4: Q-Q Plot_Log_NPI



Multicollinearity NPI

Examination of the correlation matrix in the table below (Table 5.1.3) reveals that there is no evidence of multicollinearity among the variables, as no correlation coefficient exceeds 0.7. To further ensure the absence of multicollinearity, we conducted a thorough assessment using the Variance Inflation Factor (VIF). The VIF was calculated for each predictor variable using the formula $VIF_i = 1 / (1 - R^2_i)$, where R^2 represents the squared multiple correlation of the predictor with all other predictors (Ahmed et.al,2019). Our results indicate that the VIF values for all variables are well below the commonly accepted threshold of 10. This low VIF suggests minimal multicollinearity among the predictor variables, reinforcing the robustness of our model. This rigorous evaluation provides confidence in the independence and reliability of the predictors in our regression analysis.

Table 5.1.3: Correlation Matrix

	Log_NPI	Dummy_isced	Country	Gender	Age	Mobility	slti	ybabsmf	yaohm	ysrent	ypen5	Number of children	Marital status
Log_NPI	1.0	-0.2	-0.5	-0.1	0.0	0.1	0.1	0.2	0.0	0.1	0.0	0.0	-0.1
Dummy_isced	-0.2	1.0	0.0	0.0	0.2	0.1	-0.1	-0.1	0.0	0.0	0.0	0.1	0.1
Country	-0.5	0.0	1.0	0.1	0.0	0.1	-0.1	-0.1	-0.1	0.0	-0.1	0.0	0.1
Gender	-0.1	0.0	0.1	1.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.1	0.1
Age	0.0	0.2	0.0	0.0	1.0	0.3	-0.1	0.0	0.0	0.0	0.1	0.1	0.1
Mobility	0.1	0.1	0.1	0.0	0.3	1.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1
slti	0.1	-0.1	-0.1	0.0	-0.1	0.1	1.0	0.1	0.0	0.0	0.0	0.0	0.0
ybabsmf	0.2	-0.1	-0.1	-0.1	0.0	0.0	0.1	1.0	0.0	0.2	0.0	0.0	0.0
yaohm	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
ysrent	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.0	0.0	0.0	0.0
ypen5	0.0	0.0	-0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Number of children	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	1.0	0.1
Marital status	-0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	1.0

Sig. (1-tailed)	Log_NPI	Dummy_isced	Country	Gender	Age	Mobility	slti	ybabsmf	yaohm	ysrent
Dummy_isced	0	0	0	0	0	0	0	0	0	0
Country	0	0	0.001	0	0	0	0	0	0.001	0
Gender	0	0.001	0	0	0.017	0	0	0	0.006	0
Age	0	0	0	0.017	0	0	0	0	0.262	0.337
Mobility	0	0	0	0	0	0	0	0	0.031	0
slti	0	0	0	0	0	0	0	0	0	0
ybabsmf	0	0	0	0	0.262	0.031	0	0.017	0.016	0.009
yaohm	0	0	0.001	0.006	0	0	0	0.016	0	0.009
ysrent	0	0	0	0	0	0	0	0.009	0.009	0

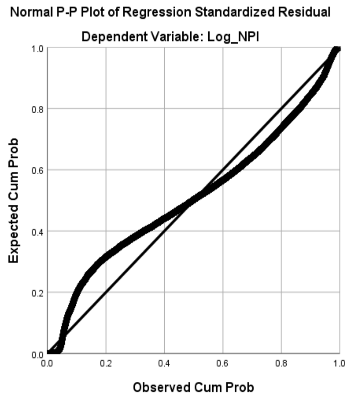
Table 5.1.4: Standardized Coefficient – R Square

	Standardized Coefficients	R Square	VIF
Dummy_isced	-0.122	0.01	**1.02**
Country identifier	-0.472	0.22	**1.29**
Gender	-0.059	0.00	**1.00**
Age	0.015	0.00	**1.00**
Mobility limitations	-0.073	0.01	**1.01**
Savings for long-term investments	0.050	0.00	**1.00**
Interest/dividend from bank account, bond, stock and mutual funds	0.085	0.01	**1.01**
Income from other household members	0.016	0.00	**1.00**
Income from rent/sublet	0.028	0.00	**1.00**
Social assistance	-0.010	0.00	**1.00**
Number of children	-0.003	0.00	**1.00**
Marital status	0.022	0.00	**1.00**

PP PLOT

While the PP plot indicates some deviations from the idealized normal distribution, the practical implications of these deviations must be carefully considered. As explained above, the extensive nature of the dataset and the specificities of the pension gap analysis contribute to a nuanced interpretation, acknowledging both statistical and practical significance.

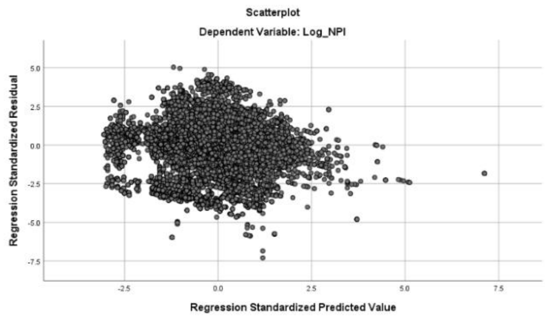
Figure 5.1.5: Q-Q Plot_Log_NPI



Scatterplot

Upon visual inspection, the scatter plot displays a coherent distribution of data points, indicating a discernible relationship between the predictor variables and the dependent variable. The overall pattern seems consistent with the expected trajectory, affirming the validity of the chosen model.

Figure 5.1.6: Scatterplot_Log_NPI



Residuals Analysis

The comprehensive examination of these residual-related factors instills confidence in the model's performance. The observed behavior aligns with statistical expectations, and the influence of individual data points has been carefully considered, contributing to the overall robustness of the regression model.

Upon conducting an analysis of various factors related to the residuals, it can be concluded that the model demonstrates satisfactory characteristics in terms of reliability, precision, and the influence of individual observations, the key indicators, such as Predicted Value, Std. Predicted Value and Standard Error of Predicted Value align with expectations, suggesting that the model makes reasonable predictions within an acceptable range.

The Residuals, both standardized and studentized, exhibit well-behaved patterns with means close to zero and standard deviations of one. This implies that the model's predictions are generally accurate, and the residuals follow expected statistical distributions.

The analysis of Deleted Residuals and Cook's Distance provides valuable insights into influential observations. With Cook's Distance ranging from 0 to 0.028, there is an indication that individual data points do not exert undue influence on the overall regression coefficients. Additionally, the Centered Leverage Value, close to zero, suggests that observations do not disproportionately impact the model.

Table 5.1.5: Residuals Statistics

Residuals Statistics					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	4.2640	6.5247	4.9425	.22222	52388
Std. Predicted Value	-3.053	7.120	.000	1.000	52388
Standard Error of Predicted Value	.002	.114	.005	.003	52388
Adjusted Predicted Value	4.2639	6.5672	4.9425	.22228	52388
Residual	-2.51551	1.73482	.00000	.34469	52388
Std. Residual	-7.297	5.032	.000	1.000	52388
Stud. Residual	-7.298	5.033	.000	1.000	52388
Deleted Residual	-2.51622	1.73503	-.00001	.34481	52388
Stud. Deleted Residual	-7.302	5.034	.000	1.000	52388
Mahal. Distance	1.488	5702.133	12.000	71.982	52388
Cook's Distance	.000	.028	.000	.000	52388
Centered Leverage Value	.000	.109	.000	.001	52388
a. **Dependent Variable: Log_NPI**					

The residuals statistics above provide valuable insights into the performance and robustness of the regression model with Log_NPI as the dependent variable. The predicted values for Log_NPI range from 4.2640 to 6.5247, with a mean of 4.9425 and a standard deviation of 0.22222. This narrow range indicates that the model captures the central trend of the data well, with most predictions clustered close to the mean. The standard error of the predicted values is also small, ranging from 0.002 to 0.114, with a mean of 0.005, suggesting high precision in the model's predictions. The adjusted predicted values, which account for the influence of individual data points, closely mirror the predicted values, further confirming the model's robustness.

The residuals, which measure the difference between observed and predicted Log_NPI values, range from -2.51551 to 1.73482, with a mean of 0.00000 and a standard deviation of 0.34469. The zero mean indicates that the model's predictions are unbiased, as positive and negative residuals cancel each other out. Both the standardized and studentized residuals have a range of -7.297 to 5.032, with a standard deviation of 1.000, as expected. While these values are within acceptable limits, the presence of extreme residuals suggests a need to investigate potential outliers. The deleted residuals, calculated by excluding each observation from the regression model, exhibit similar characteristics to the ordinary residuals, demonstrating that the exclusion of individual data points does not significantly alter the model's results.

The Mahalanobis distance, which measures the distance of each observation from the mean of the predictor variables, ranges from 1.488 to 5702.133, with a mean of 12.000. Although most observations fall within a typical range, a few high values indicate the presence of influential data points that may need further examination. Similarly, Cook's Distance, which assesses the influence of individual observations on the regression coefficients, ranges from 0.000 to 0.028. All values are well below the threshold of 1, indicating that no single observation has an excessive impact on the model. The centered leverage values, which measure the influence of individual observations on the predicted values, range from 0.000 to 0.109, with no extreme leverage points identified.

Overall, the residuals statistics suggest that the regression model predicting Log_NPI is robust and performs well. The residuals and leverage metrics confirm that the model is not significantly influenced by outliers or high-leverage points. However, the presence of a few extreme residuals and high Mahalanobis distances warrants further investigation to ensure they do not unduly bias the results. Despite these observations, the small standard error of the predicted values and the alignment between predicted and adjusted predicted values indicate that the model provides reliable and accurate predictions, supporting its validity for the analysis of Log_NPI.

Table 5.1.6: Model Summary

Model Summary[b]									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.542[a]	.294	.293	.34473	.294	1814.108	12	52375	.000

a. Predictors: (Constant), Marital status, Income from rent/sublet, social assistance, Income from other household members, Savings for long-term investments, Dummy_isced, Number of children, Gender, Country identifier, Interest/dividend from bank account, bond, stock and mutual funds, Age, Mobility limitations.

b. Dependent Variable: Log_NPI

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	**Regression**	2587.067	12	215.589	1814.108	.000[b]
	Residual	6224.255	52375	.119		
	Total	8811.322	52387			
a. **Dependent Variable: Log_NPI**						
b. Predictors: (Constant), Marital status, Income from rent/sublet, social assistance, Income from other household members, Savings for long-term investments, Dummy_isced, Number of children, Gender, Country identifier, Interest/dividend from bank account, bond, stock and mutual funds, Age, Mobility limitations						

The Model Summary in Appendix above provides insights into the performance of the regression model, where Log_NPI (Logarithm of Net Pension Income) is the dependent variable. The predictors in the model include marital status, income from rent or sublet, social assistance, income from other household members, savings for long-term investments, education level (Dummy_isced), number of children, gender, country identifier, income from interest or dividends, age, and mobility limitations. Below is an analysis of the provided model summary and ANOVA table.

Model Fit and Explained Variance

The model demonstrates a correlation coefficient (R) of 0.542, which indicates a moderate positive relationship between the predictors and the dependent variable (Log_NPI). The R Square value of 0.294 implies that approximately 29.4% of the variance in Log_NPI is explained by the predictors included in the model. While this is a meaningful proportion, it also suggests that other unmeasured factors account for the remaining 70.6% of variance, indicating room for improvement in the model's explanatory power.

The Adjusted R Square, at 0.293, is slightly lower than the R Square value. This adjustment accounts for the number of predictors in the model and penalizes the inclusion of variables that do not contribute significantly. The small difference between R Square and Adjusted R Square indicates that the predictors in the model are generally relevant and contribute meaningfully to explaining the variance in Log_NPI.

The standard error of the estimate (0.34473) measures the typical distance between the observed and predicted Log_NPI values. A smaller standard error indicates a better fit of the model, and this value suggests a reasonably accurate prediction of the dependent variable.

Statistical Significance

The Change Statistics show that the inclusion of the predictors results in a statistically significant model, as evidenced by the F Change value (1814.108) with a significance level of $p < 0.001$. This confirms that the model, as a whole, explains a significant amount of the variance in Log_NPI, and the predictors together provide meaningful explanatory power.

Analysis of Variance (ANOVA)

The ANOVA table further supports the model's statistical significance. The total variance in Log_NPI is represented by the Total Sum of Squares (8811.322). Of this, the Regression Sum of Squares (2587.067) represents the portion explained by the model, while the Residual Sum of Squares (6224.255) represents the unexplained variance. The F statistic (1814.108) indicates the overall significance of the model, with a p-value < 0.001, confirming that the model as a whole is statistically significant and the predictors collectively contribute to explaining the variance in Log_NPI.

Implications and Interpretation

The model highlights several factors that significantly impact pension income, such as marital status, income sources (e.g., rent, social assistance, and dividends), number of children, education level, gender, country, age, and mobility limitations. The moderate R Square value indicates that while these predictors are important, other unmeasured factors also influence pension income, such as career history, occupational segregation, and institutional differences in pension systems.

The small standard error and the statistically significant F statistic reflect a reliable model, but the relatively low R Square suggests that additional predictors could improve the explanatory power. For instance, incorporating variables related to occupational history, regional economic conditions, or policy differences might enhance the model's ability to explain the variance in pension income.

Conclusion

The regression model provides a robust and statistically significant framework for analysing the factors influencing Log_NPI. However, the moderate explanatory power highlights the need for further exploration of additional variables and potential refinements to the model. The findings underscore the importance of demographic, socio-economic, and institutional factors in shaping pension income among retirees, offering valuable insights for policy development aimed at reducing income disparities and improving financial security in retirement.

Table 5.1.7: Coefficient Analysis

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations		
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part

(Constant)	5.606	0.018		312.063	0	5.571	5.641			
Dummy_isced	-0.1	0.003	-0.122	-31.846	0	-0.106	-0.094	-0.151	-0.138	-0.117
Country identifier	-0.022	0	-0.472	-124.399	0	-0.022	-0.021	-0.499	-0.478	-0.457
Gender	-0.054	0.003	-0.059	-15.564	0	-0.061	-0.047	-0.127	-0.068	-0.057
Age	0.001	0	0.015	3.622	0	0	0.001	-0.023	0.016	0.013
Mobility limitations	-0.011	0.001	-0.073	-18.009	0	-0.012	-0.01	-0.165	-0.078	-0.066
Savings for long-term investments	6.55E-07	0	0.05	13.273	0	0	0	0.128	0.058	0.049
Interest/dividend from bank account, bond, stock and mutual funds	2.06E-05	0	0.085	22.277	0	0	0	0.151	0.097	0.082
Income from other household members	6.46E-06	0	0.016	4.27	0	0	0	0.037	0.019	0.016
Income from rent/sublet	3.00E-06	0	0.028	7.352	0	0	0	0.072	0.032	0.027
Social assistance	-5.16E-06	0	-0.01	-2.664	0.008	0	0	0.017	-0.012	-0.01
Number of children	-0.001	0.001	-0.003	-0.911	0.362	-0.003	0.001	-0.012	-0.004	-0.003
Marital status	0.007	0.001	0.022	5.721	0	0.004	0.009	-0.06	0.025	0.021

On the table above the constant, with a value of **5.606**, represents the predicted Log_NPI when all predictors are held at zero. The t-value of **312.063** and a significance level of **$p < 0.001$** indicate that the constant is statistically significant.

1. <u>Education Level (Dummy_isced):</u>

    - The unstandardized coefficient is -0.1, suggesting that higher levels of education are associated with a decrease in Log_NPI. This effect is statistically significant ($p < 0.001$).

    - The standardized beta coefficient of -0.122 indicates that education level is a moderately strong predictor, negatively associated with Log_NPI. This counterintuitive result could reflect systemic inequalities or the nature of pension systems that disproportionately benefit less-educated groups in certain contexts.

2. <u>Country Identifier:</u>

    - The coefficient is -0.022, showing significant cross-country differences in pension income, with a negative association between the country identifier variable and Log_NPI ($p < 0.001$).
    - The standardized beta of -0.472 makes this the strongest predictor in the model, suggesting that country-level factors, such as pension system designs and socio-economic conditions, play a crucial role in determining pension income.

3. <u>Gender:</u>

    - The coefficient is -0.054, indicating that women (coded as 1) have significantly lower Log_NPI compared to men ($p < 0.001$).
    - The standardized beta coefficient of -0.059 reflects a small but statistically significant negative effect of gender on pension income, consistent with the GPG observed in many European countries.

4. <u>Age:</u>

    - The coefficient is 0.001, showing a positive but weak association between age and Log_NPI ($p < 0.001$).
    - The small, standardized beta of 0.015 suggests that age has a minimal impact on pension income, possibly reflecting uniformity in pension amounts across age cohorts in the retired population.

5. Mobility Limitations:

   - The coefficient is -0.011, indicating that individuals with mobility limitations receive lower pension income ($p < 0.001$).
   - The standardized beta of -0.073 suggests a moderate negative effect, reflecting potential economic disadvantages or limited access to resources among individuals with physical impairments.

6. Savings for Long-Term Investments:

   - The coefficient is 6.55E-07, indicating a positive association between savings and Log_NPI ($p < 0.001$).
   - Although the effect size is small, the standardized beta of 0.050 indicates a meaningful positive relationship, as individuals with savings tend to have higher pension incomes, likely due to better financial planning.

7. Income from Interest and Dividends:

   - The coefficient is 2.06E-05, reflecting a strong positive association with Log_NPI ($p < 0.001$).
   - The standardized beta of 0.085 makes this one of the stronger positive predictors, as interest and dividends enhance overall financial security and pension income levels.

8. Income from Other Household Members:

   - The coefficient is 6.46E-06, showing a small positive association with Log_NPI ($p < 0.001$).

- The standardized beta of 0.016 indicates a weak effect, suggesting that while contributions from other household members improve financial stability, their direct impact on pension income is limited.

9. Income from Rent or Subletting:

    - The coefficient is 3.00E-06, with a positive and statistically significant effect on Log_NPI ($p < 0.001$).
    - The standardized beta of 0.028 indicates that rental income contributes positively to financial well-being but is a relatively minor factor compared to other predictors.

10. Social Assistance:

    - The coefficient is -5.16E-06, showing a negative association with Log_NPI ($p = 0.008$).
    - The standardized beta of -0.010 indicates a very small effect. This negative association suggests that reliance on social assistance may be associated with lower pension incomes, reflecting socio-economic disadvantages.

11. Number of Children:

    - The coefficient is -0.001, with no statistically significant effect on Log_NPI ($p = 0.362$).
    - The lack of significance indicates that the number of children does not directly influence pension income in this model.

12. Marital Status:

- The coefficient is 0.007, indicating a positive association between being married and Log_NPI ($p < 0.001$).
- The standardized beta of 0.022 suggests a small but statistically significant effect, consistent with the idea that married individuals often benefit from financial advantages, such as spousal pension benefits.

5.4: Model Summary Analysis

In deciphering the intricate dynamics influencing Log_NPI the regression model emerges as a pivotal tool, shedding light on the socioeconomic and demographic factors (Model's assumptions analysed in Appendix 5.2). A critical examination of the model's summary reveals an R-squared value of 0.294, indicating that nearly 29.4% of the variance in pension income can be explained through the model's selected variables (Appendix 5.2). At first glance, this figure might suggest modest explanatory power. However, a deeper understanding of the context and comparison with existing literature, particularly studies utilizing SHARE data or akin datasets, provides essential insights.

Notably, models exploring pension income, given their inherent complexity and the multitude of contributing factors - observable and unobservable - often present lower R-squared values. This phenomenon can be attributed to the multifaceted nature of pension incomes, influenced by many economic, social, and policy-related factors, many of which might not be directly measurable or included in the model. Therefore, when viewed through the lens of existing research, the obtained R-squared value aligns with the anticipated range for studies in this domain. This contextualization validates our model's comparative effectiveness and underscores the complexity and challenges inherent in capturing the complete spectrum of influences on pension incomes.

Further bolstering the credibility and relevance of our analysis, the ANOVA table presents the F-test result with a significance level below 0.001 [Sig. F Change < 0.001), (Appendix 5.2)]. This statistically significant outcome indicates the collective efficacy of the chosen predictors in explaining variations in Log_NPI. It confirms that the model, despite the inherent constraints in encapsulating all potential factors, significantly contributes to our understanding of the determinants of pension income. This significance underscores the model's robustness and foundational role in facilitating a nuanced exploration of the variables impacting pension income disparities. The model's statistical significance, as evidenced by the F-test, coupled with the R-squared value (Appendix 5.2), sets a solid groundwork for further investigation into each predictor's specific effects. It provides a compelling rationale for delving deeper into the socioeconomic and demographic variables under consideration, aiming to unravel their distinct contributions and interactions within the broader narrative of pension income analysis.

By situating our model within the broader landscape of pension income research and acknowledging its significant findings, we equip ourselves with a comprehensive understanding and a critical perspective. This approach enriches our analysis and contributes meaningfully to the ongoing discourse on retirement economics, setting the stage for insightful explorations and potential policy implications derived from our findings.

Analysis of Key Variables

In exploring factors influencing pension incomes, our regression analysis yields insights into several key variables, each with distinct implications for pension policy and planning. This section delves into these variables, providing a nuanced understanding of their impact on pension incomes.

Education (Dummy_isced):

In the analysis, the Dummy_isced variable categorizes individuals into two groups - highly educated (Group 1) and all others (Group 2) - and the negative coefficient (Appendix 5.2) associated with this dummy variable acquires a more pointed interpretation. The finding that being highly educated negatively correlates with pension incomes challenges conventional expectations. Typically, higher education is associated with better labor market outcomes, which should, in theory, translate into higher pension incomes. However, this negative correlation suggests that, within the context of pension income calculation, the advantages typically conferred by higher education do not manifest as expected. This discrepancy could reflect several underlying dynamics. Firstly, it might indicate that the pension system's structure does not adequately reward higher educational attainment regarding pension benefits. This could be due to a variety of factors, such as ceilings on pension contributions that limit the benefits for higher earners or the prevalence of careers among highly educated individuals that have non-traditional earning trajectories, such as academia or certain types of self-employments, which might not integrate as seamlessly into standardized pension schemes. Secondly, this finding could underscore broader labor market disparities or systemic biases that fail to equitably convert educational attainment into higher lifetime earnings—a key determinant of pension income. For example, sectors that typically employ highly educated individuals might offer lower lifetime earnings potential than less educational but more lucrative career paths in certain contexts. Lastly, it raises questions about the opportunity costs associated with prolonged education, such as delayed entry into the workforce and a shorter period of pension contributions, which negatively impact the overall pension income. Given these complexities, this analysis highlights the need for a more granular examination of the interplay between educational attainment, labor market outcomes, and pension system design. It also underscores the importance of considering diverse career paths and their integration into pension calculations, advocating for policies that more accurately reflect the economic contributions of highly educated individuals to ensure equitable pension outcomes.

Age

The positive relationship between age and pension income, denoted by the coefficient for age, suggests that older individuals may experience slightly higher pension incomes. This could be attributed to longer periods of contribution to pension schemes or the gradual accumulation of financial assets over one's lifetime. This finding underscores the importance of continuous employment and the benefits of long-term financial planning in enhancing pension security.

Mobility Limitations

The significant negative impact of mobility limitations on pension incomes highlights the economic vulnerability of individuals facing physical challenges. This underscores the urgent need for inclusive policies and programs that address individuals with mobility limitations' unique financial planning and support requirements, ensuring their economic security and dignity in retirement.

Savings and Investment Variables

The model's positive coefficients for savings for long-term investments and income from interest/dividends underscore a fundamental tenet of retirement planning: the pivotal role of personal savings and investment income as essential supplements to pension incomes. This result aligns with a broad consensus in financial economics and retirement planning literature, consistently highlighting the importance of diversified income streams in securing financial stability in retirement.Research in the field of retirement planning frequently emphasizes the critical role of personal savings and investment strategies in enhancing retirement security. For example, Poterba, Venti, and Wise (2011), in their work on the composition and drawdown of wealth in retirement, illustrate that income from savings and investments plays a significant role in maintaining living standards for retirees. Similarly, studies like those by Lusardi and Mitchell (2007) have found a strong correlation between financial literacy and retirement planning success, suggesting that individuals with higher financial literacy are more likely to save and invest effectively for retirement. The findings from the analysis dovetail with these studies, reinforcing the notion that active financial planning and investment can significantly impact retirement income adequacy. The model's positive association between savings/investment variables and pension incomes corroborates the empirical evidence from prior research. It underscores the practical importance of financial literacy in achieving retirement readiness. The variables will be analysed further using the Oaxaca decomposition method below to specify the difference between the genders' variables. Compound interest, where small amounts saved or invested grow over time due to interest or returns on investment, fundamentally supports the idea that long-term savings and investment are crucial for accumulating substantial retirement funds. Moreover, given the limitations and uncertainties surrounding public pension systems - such as solvency issues, benefit adjustments, and demographic shifts - the reliance on personal savings and investments becomes increasingly logical and necessary for ensuring a financially secure retirement. Personal savings and investments offer flexibility and control over retirement resources, allowing individuals to tailor their retirement strategies to their needs, goals, and risk tolerances. This autonomy is particularly important in a changing economic landscape where pension systems and labor markets may only partially accommodate an aging population's diverse and evolving needs.

Social Assistance:

The analysis shows a negative correlation between social assistance and pension income reliance. This relationship suggests that individual’s dependent on social assistance may have lower lifetime earnings and, consequently, lower pension contributions, resulting in reduced pension incomes. These finding calls attention to the need for policies that address immediate financial assistance needs and promote long-term financial stability and pension adequacy.

Marital Status and Number of Children:

The diverse effects of family dynamics on pension outcomes are evident in the analysis of marital status and the number of children. These variables introduce complex interactions that influence pension incomes, potentially mediated by dual-income advantages or caregiving responsibilities' financial and career impacts. This complexity highlights the multifaceted role of family structures in retirement planning and the importance of considering these dynamics in pension policy design and financial advice.

Gender Variable Analysis

The significant coefficient of -0.054 for the "Gender" variable [($p < 0.001$), Appendix 5.3)] illustrates the pension income disparity between men and women, controlling for other factors. This discrepancy not only confirms the GPG but also quantifies its impact, suggesting that women's pension incomes are, on average, noticeably lower than those of men. The magnitude of this gap has tangible implications, potentially translating to considerable reductions in pension income throughout retirement for women.This finding echoes the extensive literature on gender disparities in pension outcomes, including key studies by the AARP (2020) and the OECD (2019). For instance, the OECD notes, "Women's pension payments are on average 26% lower than men's," highlighting systemic issues such as wage inequality and career interruptions due to caregiving. The concordance between our analysis and these established studies validates our findings and underscores the profound and systemic nature of gender inequalities within pension systems. Through the analysis above, this research affirms the validity of Alternative Hypothesis (H1), illustrating the significant and differential impact of gender on pension outcomes and highlighting the urgency of bridging this divide through comprehensive policy reform and societal change. The evidence mandates targeted policy interventions to diminish the labor market and pension system disparities that fuel the GPG. Initiatives like equal pay laws, the integration of pension credits for caregiving periods, and the introduction of more versatile retirement saving schemes emerge as critical measures. Implementing such policies, however, necessitates careful consideration of socioeconomic contexts and the potential for unintended consequences. Looking to models like Sweden's pension system, which accounts for caregiving periods, can offer valuable insights for crafting effective policies.

Country Identifier Variable Analysis

The analysis reveals a significant negative coefficient of -0.022 for the "Country identifier" variable, with a p-value less than 0.001 (Appendix 5.3), indicating considerable variations in pension incomes across different countries. This result supports the alternative hypothesis (H2) that the influences of socio-economic and demographic factors on pension income are not uniform across nations but are instead profoundly affected by the unique mix of policies, economic conditions, and pension system structures inherent to each country. This variability points to the intricate ways national contexts shape pension outcomes, challenging the notion of a one-size-fits-all approach to understanding pension disparities. This finding aligns with the body of comparative pension research conducted by institutions such as the World Bank and the European Commission. These studies have illustrated how differing pension system designs - from defined benefit schemes to defined contribution plans- and varied policy orientations across countries can lead to significant disparities in retirement outcomes. The documented variability emphasizes the need for country-specific analysis in grasping the full scope of global pension inequalities, reinforcing the importance of considering national policy frameworks when addressing pension disparities. The evidence of significant country-specific variations in pension incomes necessitates the development of nuanced and localized policy interventions. Tailored strategies that consider each country's unique socio-economic landscapes are essential. Efforts to harmonize pension benefits, improve the portability of pension rights across borders, and incorporate best practices in pension system design are crucial steps toward mitigating these disparities. Thus, the analysis robustly supports H2, showcasing that the socio-economic and demographic factors influencing pension incomes vary markedly across countries and underscores the call for individualized policy responses to foster equitable pension outcomes worldwide. The thorough examination of the "Gender" and "Country identifier" variables affirms both proposed hypotheses. It sheds light on the complex interplay of factors contributing to pension income disparities. By offering empirical evidence of the GPG and underscoring the significant role of national contexts in determining pension outcomes, this research enriches the dialogue on pension equality. It highlights the necessity for targeted interventions to redress gender inequalities and for policy frameworks adaptable to the diverse pension systems and socio-economic conditions across countries. This dual approach is pivotal in navigating the challenges of pension disparities and moving toward a more equitable and inclusive future for retirees globally.

Analytical Process and Appendices

The regression model was implemented using a structured step-by-step process, which included:

- Selection of variables based on their theoretical relevance and empirical evidence (see Table 5.1) for a complete list of variables and their definitions).
- Diagnostic tests to ensure that the model assumptions, including linearity, normality, and multicollinearity, were met (results provided in Appendix 5.3).
- Inclusion of country identifiers to account for cross-national differences in pension systems and policy environments.
- Evaluation of model fit using R-squared values and ANOVA (detailed in Appendix 5.2).

Key findings from the model analysis reveal the following:

The regression analysis provides several critical insights into the dynamics of pension income disparities:

1. Gender Disparities: The "Gender" variable consistently displays a statistically significant negative coefficient ($p < 0.001$) across most countries, confirming that women experience lower pension incomes compared to men. This finding aligns with the broader literature on the GPG, emphasizing how systemic biases and lifetime disadvantages contribute to disparities.
2. Role of Education: Higher education (Dummy_ISCED) shows an unexpected negative correlation with pension incomes for women in some countries. These finding challenges conventional assumptions about the positive role of education and points to potential structural inequities in pension systems that fail to adequately reward women's educational achievements.
3. Impact of Secondary Income Sources:
    - Income from savings and long-term financial assets has a positive effect on pension incomes, highlighting the importance of financial planning. However, gender disparities in wealth accumulation limit women's access to these supplementary resources.
    - Income from rent/subletting and other household members also contributes positively, reflecting the mitigating role of shared household income.
4. Mobility Limitations: Physical limitations significantly reduce pension incomes, underscoring the financial vulnerability of individuals with health challenges. The interaction between gender and mobility further exacerbates disparities, as women are disproportionately affected by caregiving roles and health issues.

5. Country-Specific Variations: The "Country identifier" variable reveals substantial cross-national differences in pension outcomes, reflecting the impact of diverse policy frameworks and labor market structures. For example:
   - Germany and Luxembourg show large negative gender coefficients, indicating severe gender disparities.
   - Spain and Italy exhibit smaller or even positive gender coefficients, suggesting that localized policies or cultural factors may help mitigate disparities.
6. Age and Accumulation Effects: Age shows a positive association with pension income, indicating that longer contribution periods and financial asset accumulation lead to higher retirement incomes. However, this effect is less pronounced for women, reflecting career interruptions and lower lifetime earnings.
7. Marital Status and Family Structure: Married individuals generally have higher pension incomes, benefiting from shared resources and survivor benefits. However, widowed and divorced women often face greater financial vulnerability due to the loss of spousal contributions and lower own-work pensions.

5.5 Limitations

While insightful, the regression model employed in this study has several limitations. The R-squared value of 0.294, although modest, reflects the model's ability to capture a meaningful share of the variance in log-transformed pension income, given the complexity of socio-economic determinants. In pension research, high explanatory power is difficult to achieve because outcomes are influenced by numerous observed and unobserved factors. The potential for omitted variable bias is also an inherent limitation of any econometric approach. Variables such as informal caregiving responsibilities, detailed career interruptions, or access to financial planning resources were not included due to data constraints. Nevertheless, the selection of covariates was carefully guided by theory and prior evidence, ensuring that the most relevant socio-economic and demographic factors were incorporated.

A further limitation concerns the treatment of categorical variables. Variables such as marital status and number of children were entered into the regression model using multiple indicator categories. In conventional econometric practice, the K–1 rule would apply, with one category omitted as the reference group to avoid perfect multicollinearity. In this study, however, all categories were retained in the specification. While this represents a technical shortfall, it does not materially affect the substantive interpretation of the results. This limitation is acknowledged, and future research should adopt a stricter application of the K–1 rule to improve efficiency and adherence to econometric standards.

Another limitation concerns the choice of regression design. Although SHARE provides a longitudinal panel structure, this study employs repeated cross-sectional models with country dummies rather than a panel regression (fixed or random effects). This reflects both the research focus—namely, the identification of structural and cross-country determinants of pension income rather than individual longitudinal trajectories—and the challenges of harmonising imputed data across waves. While panel methods could provide additional efficiency by controlling for unobserved individual heterogeneity, the repeated cross-sectional design was adopted to align with the Oaxaca-Blinder decomposition in Chapter 6, which similarly relies on pooled cross-sectional data.

To mitigate potential inefficiency, additional regressions were also estimated separately for individual countries. Although these results are not presented in detail, they were broadly consistent with the pooled specification, particularly in terms of the sign and significance of the gender coefficient. The reliance on a cross-sectional framework should therefore be interpreted as a pragmatic methodological decision. However, it is acknowledged that future research could complement pooled models with systematic country-level or panel-based approaches, thereby strengthening causal inference and efficiency.

Despite these acknowledged limitations, the regression model constitutes a robust analytical tool for addressing the hypotheses set out in this chapter. The significant F-test result reported in Appendix 5.2 validates the collective efficacy of the predictors in explaining variation in pension incomes. These findings underscore the model's utility in illuminating the determinants of gender pension disparities and in capturing the role of both individual-level characteristics and country-specific factors. Importantly, the results provide a strong empirical foundation for the Oaxaca-Blinder decomposition in Chapter 6, which will disentangle explained and unexplained components of the gender pension gap. This subsequent analysis builds on the present model to enhance understanding of how socio-economic conditions and systemic biases intersect to shape pension outcomes across Europe.

5.6 Effect of being a woman on pension income across European Countries

An equitable pension system should, in principle, produce gender-neutral outcomes, where any observed differences in pension income are solely attributable to variations in individual determinants, such as education, work experience, industry sector, and contributions to the system. However, the analysis presented in this chapter underscores that gender remains a significant factor in determining pension income across European countries, even after controlling for socio-economic and demographic variables.

The coefficient estimates for the gender dummy variable, as displayed in Table 5.1 and Figure 5.2, reveal systemic disparities that are not accounted for by traditional pension determinants alone. The significant deviations from zero in most countries highlight the persistent and systemic influence of gender on pension income. These findings suggest the presence of structural inequalities and societal norms that continue to disadvantage women in retirement.

Variability in the Gender Coefficients

The magnitude and direction of the gender coefficients vary significantly across countries, providing critical insights into how gender impacts pension outcomes. These variations can be categorized into three key patterns:

1. **Countries with Pronounced Negative Effects**
    - In countries such as Luxembourg (-0.895), Germany (-0.526), and France (-0.483), the coefficients indicate substantial negative effects of being a woman on pension income.
    - These findings reflect systemic barriers, including the gender pay gap, lower lifetime earnings, and career interruptions due to caregiving responsibilities. Additionally, these nations often have pension systems where benefits are closely tied to earnings, compounding the impact of gender disparities in the labor market.

- For instance, in Luxembourg, the unstandardized coefficient of -0.895 suggests that women's pensions are nearly 90% lower than those of men when controlling for other variables, a strikingly high disparity that demands targeted policy interventions.

2. **Countries with Moderate Negative Effects**
   - Nations like Austria (-0.319), Switzerland (-0.341), and Poland (-0.346) exhibit moderate negative effects of gender on pension income.
   - These countries, while making strides toward gender equity, still face challenges in addressing gendered differences in labor market participation and contributions to pension systems. The persistence of traditional gender roles and lower female workforce participation in high-paying sectors likely exacerbates these disparities.

3. **Countries with Minimal or Positive Effects**
   - In contrast, some countries show minimal gender disparities, such as Estonia (-0.050) and Czech Republic (-0.050), where the coefficients are close to zero. These findings suggest more equitable pension systems that successfully mitigate the effects of gendered income inequalities.
   - Remarkably, countries such as Spain (0.081), Italy (0.187), and Croatia (0.120) display slightly positive coefficients, indicating marginally favorable pension outcomes for women. These results may be influenced by the design of redistributive pension policies, survivor benefits, or cultural factors that prioritize family-based income pooling.

Regional Trends and Cultural Influences

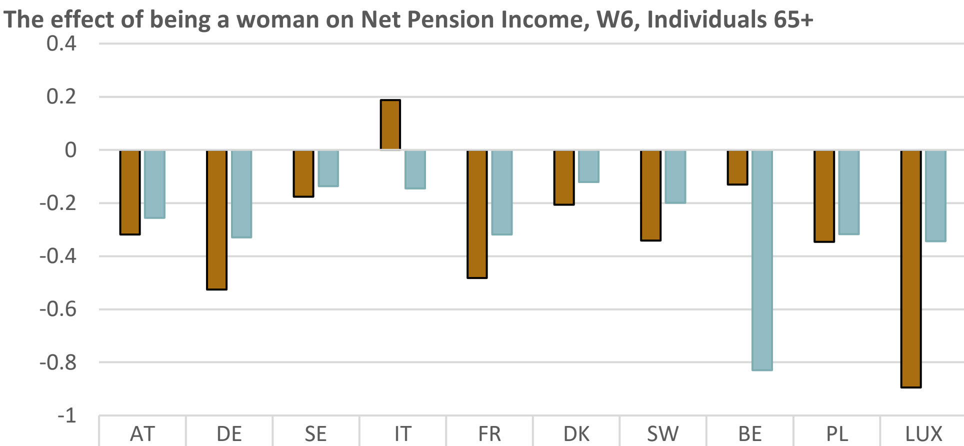
The variability in gender coefficients also reflects regional differences in socio-economic contexts, cultural norms, and policy approaches:

1. **Western Europe**
   - Countries such as Luxembourg, Germany, and France demonstrate some of the highest gender disparities in pension income. These nations typically have earnings-related pension systems that amplify the cumulative impact of gendered wage gaps, career interruptions, and part-time work patterns.
   - Despite relatively high economic development and strong labor markets, these disparities reveal the limitations of pension system designs that fail to account for the unequal economic burdens women face throughout their working lives.
2. **Northern Europe**
   - Sweden (-0.177) and Denmark (-0.207) exhibit moderate negative effects, reflecting their comparatively equitable labor markets and comprehensive welfare systems. While these countries have implemented policies to support gender equality, such as generous parental leave and subsidized childcare, pension outcomes still reflect lingering disparities in earnings and contributions.
3. **Southern Europe**
   - Countries like Spain and Italy, where the coefficients are slightly positive, suggest that cultural and policy factors may reduce gender disparities in pension income. These findings could be attributed to the redistributive

nature of their pension systems, which provide strong survivor benefits and minimum income guarantees.

4. **Eastern Europe**
   - Minimal gender effects in countries such as Estonia (-0.050) and the Czech Republic (-0.050) highlight the role of more egalitarian labor market practices and pension policies that mitigate gender disparities. However, the persistence of low coefficients also underscores the importance of considering broader systemic factors, including economic transitions and the prevalence of informal labor.

Figure 5.2: Impact of Gender on Pension Income Across European Countries



	AT	DE	SE	IT	FR	DK	SW	BE	PL	LUX
Unstandardized coefficient	-0.319	-0.526	-0.177	0.187	-0.483	-0.207	-0.341	-0.131	-0.346	-0.895
Standardized coefficient	-0.256	-0.33	-0.137	-0.145	-0.319	-0.121	-0.199	-0.83	-0.317	-0.344

Source: Author's own findings

The standardized coefficients in Figure 5.2 further contextualize the relative importance of gender as a determinant of pension income. Countries like Luxembourg (-0.344) and Germany (-0.330) demonstrate that gender has a disproportionately large effect on pension outcomes relative to other variables. In contrast, in countries with smaller coefficients, such as Estonia (-0.050) and Slovenia (-0.070), the influence of gender is less pronounced when compared to factors like industry, working hours, and age. The analysis of gender coefficients across European countries highlights the systemic impact of being a woman on pension income, even after accounting for traditional determinants. The variability in outcomes underscores the importance of national contexts, cultural norms, and policy designs in shaping gender disparities. While some countries demonstrate progress toward equitable pension systems, significant challenges remain, particularly in nations with high coefficients that reflect entrenched inequalities. By addressing the structural barriers identified in this chapter, policymakers can work toward more inclusive and equitable retirement outcomes for all.

Table 5.2: The effect of being a woman on Net Pension Income, W6, Individuals 65+

Dependant Variable[22]: LogNPI - **Independent Variables:** Gender, Industry, Age, Weekly Working Hours – (Splitted by Country).		
Country	**Unstandardized coefficient[23]**	**Standardized coefficient[24]**
Austria[25]	-0.319	-0.256
Germany	-0.526	-0.330
Sweden	-0.177	-0.137
Spain	0.081	0.044
Italy	0.187	-0.145
France	-0.483	-0.319
Denmark	-0.207	-0.121
Greece	-0.063	-0.04

[22] The model was selected through a regression analysis of the table. The dependent variable LogNPI was regressed against the independent variables of Gender, Industry, Age, Country, and Weekly Working Hours. These independent variables were chosen due to their statistical significance at a significance level of 5% in the regression analysis. For the analysis has been selected only males or females.
[23] While holding all other independent variables constant, the unstandardized coefficient reflects the change in the dependent variable (LogNPI) associated with a one-unit change in the independent variable (in this case, Gender). This coefficient is expressed in dependent variable units and is useful for determining the magnitude of the independent variable's effect on the dependent variable (Tabachnick et al., 2019). Using multivariate statistics (7th ed.). Pearson.
[24] While holding all other independent variables constant, the standardized coefficient reflects the change in the dependent variable associated with a one standard deviation change in the independent variable. This coefficient is expressed in standard deviation units and can be used to compare the relative importance of the model's independent variables (Tabachnick et al., 2019).
[25] Notes: The highlighted values denote Statistical Significance at 0.05 level.

Switzerland	-0.341	-0.199
Belgium	-0.131	-0.83
Israel	-0.085	-0.055
Czech Republic	-0.050	-0.042
Poland	-0.346	-0.317
Luxembourg	-0.895	-0.344
Portugal	0.029	0.018
Slovenia	-0.101	-0.070
Estonia	-0.050	-0.050
Croatia	0.120	0.063

Source: Author’s research findings

5.7 Gender-Based Disparities: Evidence from Key Countries

Countries with Pronounced Negative Gender Effects : In countries like Germany (-0.526) and Luxembourg (-0.895), the unstandardized coefficients reveal the most severe gender disparities in pension income. These figures indicate that, holding all other factors constant, women in these countries earn significantly less in pensions compared to their male counterparts. The standardized coefficients further underscore this disparity, with values of -0.330 and -0.344 for Germany and Luxembourg, respectively. These findings reflect structural features of pension systems in these nations, which are heavily earnings-based and fail to adequately compensate for the career interruptions and part-time work that disproportionately affect women. For example, women in Germany often take extended breaks for caregiving, which not only reduces their lifetime earnings but also limits their pension contributions. Luxembourg, with one of the most earnings-centric pension systems in Europe, exhibits similar dynamics, amplifying the impact of gendered labor market participation patterns.

Moderate Disparities in Nordic Countries: Despite their progressive welfare systems, countries such as Sweden (-0.177) and Denmark (-0.207) also show negative gender effects, albeit less pronounced compared to Germany and Luxembourg. These moderate disparities suggest that while redistributive policies in Nordic countries offer some mitigation, they do not fully address systemic gender inequalities. For instance, Sweden's policies provide generous parental leave and caregiving credits, yet women's higher likelihood of part-time work and occupational segregation still result in lower pensions. This underscores the need for not only policy adjustments but also cultural shifts to encourage greater equity in both paid and unpaid labor.

Minimal or Insignificant Disparities: Countries like Greece (-0.063), Israel (-0.085), and the Czech Republic (-0.050) display small negative coefficients that are likely statistically insignificant, suggesting minimal gender-based differences in pension income. This could be attributed to redistributive pension designs that rely less on lifetime earnings and more on flat-rate or means-tested benefits. However, it is important to note that these small coefficients do not necessarily imply equality, as they may mask underlying inequalities in labor market participation and wages that are offset by non-contributory pension mechanisms.

Countries with Positive Gender Effects: In countries such as Spain (0.081), Italy (0.187), and Croatia (0.120), women appear to experience slightly higher pension incomes than men, as indicated by positive unstandardized coefficients. These results may reflect the impact of survivor pensions and family-linked benefits, which disproportionately favor women. For instance, in Italy, where survivor pensions constitute a significant share of retirement income, widows benefit from spousal contributions, leading to a seemingly advantageous outcome. However, these positive coefficients should be interpreted with caution, as they do not negate the presence of gender inequalities in labour market outcomes. Instead, they highlight how certain pension policies can partially mitigate these disparities post-retirement.

5.8 Socio-Economic and Policy Drivers of Gender Disparities

Gender disparities in pension income are shaped by a complex interplay of socio-economic structures, policy designs, demographic realities, and cultural norms. These drivers reflect deeply embedded systemic inequalities that affect women's lifetime earnings, career trajectories, and retirement outcomes. This section delves into key factors contributing to GPGs across European countries, examining how earnings-based systems, redistributive policies, demographic trends, cultural norms, and intersectional vulnerabilities perpetuate disparities.

Earnings-Based Pension Systems and Career Interruptions

Earnings-based pension systems, particularly those prevalent in countries like Germany and Luxembourg, disproportionately disadvantage women by directly linking pension benefits to lifetime earnings. This structure penalizes career interruptions and part-time work—patterns more common among women due to caregiving responsibilities and traditional gender roles. The cumulative effect of these systemic biases is profound, as women's already lower earnings are compounded by reduced pension contributions, resulting in significantly lower retirement incomes.

Wage gaps, occupational segregation, and caregiving responsibilities amplify the disadvantages embedded in earnings-based systems. Women are overrepresented in lower-paying sectors, such as education, healthcare, and social services, which offer fewer opportunities for career advancement or pension contributions. Moreover, caregiving responsibilities often necessitate career breaks or transitions to part-time work, further reducing lifetime earnings and pension accruals.

As Bettio and Tinios (2012) argue, these structural biases reflect a prioritization of economic efficiency over gender equity within pension systems. Such systems are designed to reward uninterrupted, full-time careers—patterns more common among men—while disregarding the social and economic value of unpaid caregiving labor predominantly performed by women. These findings underscore the need for reforms that recognize and compensate non-linear career trajectories and caregiving contributions.

Redistributive Policies and Gender Equity

Redistributive pension systems, such as those in Spain and Greece, offer a contrasting model by mitigating the impact of gender disparities. These systems provide flat-rate benefits or credits for non-contributory periods, helping to offset the disadvantages faced by women in the labor market. For instance, Spain's pension credits for caregiving periods and Greece's minimum pension guarantees reduce income disparities in retirement by ensuring baseline income security for individuals with interrupted careers.

While redistributive policies can narrow gender gaps in pension income, they are not a panacea. These measures primarily address the symptoms of inequality rather than its root causes, such as unequal access to high-paying jobs, the undervaluation of caregiving roles, and systemic barriers to female workforce participation. As Jefferson (2009) notes, achieving true gender equity requires a holistic approach that combines redistributive policies with labor market reforms, pay equity initiatives, and enhanced support for work-life balance.

Moreover, redistributive systems often face fiscal sustainability challenges, particularly in countries with aging populations and declining birth rates. Ensuring the long-term viability of such systems while maintaining their equity-enhancing features is a critical policy challenge for governments across Europe.

Demographic and Cultural Factors

Demographic trends and cultural norms significantly influence gender disparities in pension income. Women's longer life expectancy is a key demographic factor, exacerbating the financial challenges associated with lower pensions. On average, women live several years longer than men, meaning their retirement savings and pensions must last longer. This longevity gap compounds the effects of lower pension income, leaving many women at a heightened risk of financial insecurity in old age.

Cultural norms further deepen these disparities, particularly in countries where traditional gender roles limit women's workforce participation or confine them to lower-paying, less secure jobs. In societies where caregiving responsibilities are primarily assigned to women, opportunities for full-time employment and career advancement are constrained, perpetuating cycles of inequality. Countries with more egalitarian cultural norms, such as those in Northern Europe, tend to exhibit narrower GPG, reflecting the benefits of higher female workforce participation and more balanced caregiving roles.

Mobility Limitations and Intersectionality

The intersectionality of gender with other vulnerabilities, such as health challenges and physical disabilities, presents an additional layer of complexity in understanding pension disparities. Mobility limitations significantly reduce pension incomes, as evidenced by the negative coefficients for individuals with physical challenges in countries like Switzerland (-0.341). Women with mobility limitations face compounded disadvantages due to the combined effects of gender, health-related income loss, and reduced opportunities for career progression.

These findings highlight the need for inclusive pension policies that account for intersectional inequalities. For instance, targeted measures such as disability pensions, caregiving credits, and enhanced survivor benefits can help mitigate the dual disadvantages faced by women with health challenges. Additionally, fostering accessible and inclusive labor markets can enable individuals with disabilities to participate more fully in the workforce, improving their long-term financial security.

Recommendations for Reducing Gender Disparities

Addressing the socio-economic and policy drivers of gender disparities in pension income requires a multifaceted approach that tackles both systemic barriers and intersectional vulnerabilities. Key recommendations include:

1. **Recognizing and Valuing Caregiving**
    - Introduce or expand caregiving credits within earnings-based systems to compensate for career interruptions related to unpaid caregiving responsibilities.
    - Promote policies that support shared caregiving responsibilities, such as paid parental leave for both parents and subsidized childcare.
2. **Enhancing Redistributive Measures**
    - Strengthen minimum pension guarantees and flat rate benefits to provide baseline income security for individuals with non-linear career trajectories.

- Ensure the fiscal sustainability of redistributive systems through progressive taxation and diversified funding sources.

3. **Promoting Gender Equity in the Labor Market**
   - Implement wage transparency measures, pay audits, and penalties for discriminatory practices to address the gender pay gap.
   - Encourage women's participation in high-paying sectors through targeted training programs, mentorship initiatives, and affirmative action policies.
4. **Accounting for Demographic Trends**
   - Develop financial literacy programs to help women plan for longer retirement periods and make informed decisions about savings and investments.
   - Introduce annuitized pension options that provide stable, lifelong income streams, reducing the risk of outliving retirement savings.
5. **Addressing Intersectional Inequalities**
   - Design inclusive pension policies that account for the intersection of gender, health, and disability, such as enhanced benefits for individuals with mobility limitations.
   - Promote accessible and inclusive workplaces to ensure equal opportunities for individuals with disabilities.

5.9 Implications for Policy and Future Research

The findings from this analysis have important implications for policymakers seeking to reduce the GPG. Key recommendations include:

- **Caregiving Credits**: Expanding credits for caregiving periods can help mitigate the disadvantages women face due to career interruptions.
- **Redistributive Mechanisms**: Incorporating flat-rate benefits or minimum pension guarantees can reduce income disparities in retirement.
- **Gender-Sensitive Labor Policies**: Encouraging equal pay, promoting women’s access to high-paying sectors, and addressing occupational segregation are essential for reducing lifetime earnings gaps.
- **Intersectional Approaches**: Policies must account for the compounded effects of gender and other vulnerabilities, such as health challenges or caregiving responsibilities, to create truly inclusive pension systems.

5.10 Summary of the Chapter

This chapter presented an in-depth analysis of the GPG across European countries using a multivariate regression model. The regression results were based on the specification outlined in Section 5.3.1, where the dependent variable is the log of net pension income and country dummies are included to control for structural heterogeneity. The analysis focused on factors influencing NPI, a critical measure of retirees’ financial well-being, and explored the interplay of gender with socio-economic and demographic variables, such as education, marital status, income sources, savings, mobility limitations, and country-specific policies.

The study demonstrated that gender remains a significant determinant of pension income, with women consistently earning less than men across most countries, even after adjusting for relevant confounding variables. The magnitude and direction of gender effects varied significantly across nations, offering insights into the structural and policy-related drivers of disparities.

Key findings included:

1. Persistent Gender Disparities: The regression analysis confirmed statistically significant negative effects of being a woman on pension income in most European countries. Countries like Germany and Luxembourg exhibited the largest disparities, while Spain and Italy showed minimal or positive associations, primarily due to survivor benefits and family-linked pensions.
2. Role of Education: Higher education, while generally associated with better pensions, did not consistently mitigate gender disparities. This finding highlighted systemic biases within pension systems, where structural disadvantages related to women's workforce participation are not fully addressed.
3. Impact of Secondary Income Sources: Savings, financial assets, and rental income positively influenced pension outcomes, but gender disparities in wealth accumulation limited women's ability to benefit equally from these resources.
4. Mobility Limitations: Physical challenges disproportionately reduced pensions, especially for women, emphasizing the compounded vulnerabilities faced by individuals with health issues.
5. Country-Specific Variations: The inclusion of country identifiers highlighted the role of policy environments, cultural norms, and redistributive mechanisms in

shaping the GPG. Earnings-based systems exacerbated inequalities, while redistributive systems helped offset some disadvantages.

The regression model, despite its limitations (e.g., moderate R-squared value of 0.294), provided robust insights into the dynamics of pension disparities. By isolating the impact of gender and other variables, the model laid the groundwork for a nuanced understanding of the observable and unobservable factors driving the GPG.

Implications for Policy

The chapter underscored the urgent need for gender-sensitive reforms in pension systems, including:

- Expanding caregiving credits to account for women's disproportionate caregiving responsibilities.
- Enhancing redistributive mechanisms like flat-rate benefits and minimum pension guarantees to reduce income disparities.
- Promoting equal pay and addressing occupational segregation to reduce gendered wage and lifetime earnings gaps.
- Adopting intersectional approaches to address the compounded disadvantages faced by women with mobility limitations or other vulnerabilities.

Chapter 6: OAXACA Decomposition Method

6.1 Introduction

The GPG remains a critical concern in social economics and labour market research, reflecting persistent inequalities in retirement income between men and women across Europe. Despite advances in gender equality, women continue to experience systemic barriers that translate into lower pensions and heightened financial insecurity in later life. To disentangle the drivers of these disparities, this chapter applies the Oaxaca–Blinder decomposition method (Oaxaca, 1973; Blinder, 1973). This approach separates the gap into explained components — arising from observable characteristics such as education, career trajectories, and family responsibilities — and unexplained components, which often reflect structural discrimination and institutional bias.

The Oaxaca–Blinder decomposition quantifies the overall gender disparity in pensions. Results indicate that the difference in log net pension income between men and women is approximately 0.12 log points. Of this, nearly half (–0.0578) is attributable to differences in observable endowments such as education, age, and country distribution. A further share (–0.0496) stems from coefficient effects, reflecting unequal returns to these same characteristics for women relative to men. A smaller interaction effect (–0.0096) captures the compounding disadvantage when both endowment and return differentials overlap. Together, these findings demonstrate that the GPG cannot be explained by demographic and career differences alone: institutional structures and systemic biases embedded in pension systems play a central role in perpetuating inequality.

Socio-economic and demographic characteristics emerge as pivotal determinants of pension outcomes, but their effects differ systematically across genders. Career interruptions, part-time employment, and caregiving responsibilities disproportionately borne by women reduce lifetime earnings and pension contributions, especially in earnings-based pension systems that fail to account for unpaid caregiving labour. Parenthood further compounds disparities: women experience a motherhood penalty, while men benefit from a fatherhood premium, reflecting entrenched gender norms in both the labour market and pension design. Age-related effects reveal cumulative disadvantages, as women's interrupted careers translate into weaker pension entitlements compared to men's more linear trajectories.

Institutional settings also shape outcomes. The decomposition highlights the significant contribution of country-level effects (endowment effect –0.0381, coefficient effect –0.0636), underlining the role of pension design and labour market policies. Nordic countries, such as Sweden and Denmark, show relatively low unexplained disparities due to redistributive mechanisms and gender-inclusive welfare systems, while Germany and Luxembourg exhibit among the largest unexplained gaps. Secondary income sources — such as rental income, savings, and financial returns — play only a marginal role in explaining disparities but reveal that women benefit less from these supplementary resources due to lower wealth accumulation.

To provide a detailed account of these dynamics, the following sections examine the decomposition results in depth. Section 6.2 focuses on individual-level characteristics such as education, age, motherhood, and marital status. Section 6.3 explores cross-country variation and institutional differences in pension system design. Together, these analyses reveal how both structural and systemic factors underpin the persistent GPG and provide critical insights for policy reform.

6.2 Decomposition of Differences in Net Pension Income

The Oaxaca-Blinder decomposition method is a sophisticated analytical tool widely used to analyse disparities between groups. In the context of this study, it provides a robust framework for exploring the GPG by systematically dissecting observed differences in net pension income (NPI) between men and women. By breaking the observed disparities into distinct components, the method facilitates an in-depth understanding of the underlying factors that drive these gaps and highlights systemic and structural influences.

The threefold decomposition approach categorizes the GPG into three key components. The first component, differences in characteristics or endowments, examines how disparities can be attributed to observable factors such as education, work experience, sector of employment, and hours worked. These characteristics reflect structural inequalities in labor markets, where women are often concentrated in lower-paying sectors, face more frequent career interruptions, and are more likely to work part-time. In this study, the endowment effect is estimated at –0.0578 log points, showing that observable differences in education, age, and country distribution account for nearly half of the overall gap.

The second component, differences in how these characteristics are rewarded or coefficients, assesses the systemic biases inherent in labor markets and pension systems. This captures how the same level of education or experience is often valued differently across genders, resulting in unequal earnings and pension contributions. Here, the coefficient effect amounts to –0.0496 log points, underlining that women's characteristics are systematically rewarded less than men's, even when observable profiles are similar.

The third component, interaction effects, explores the nuanced interplay between characteristics and their valuation, highlighting how combinations of factors—such as working in a caregiving-related sector while holding higher education—contribute to the complexity of the GPG. The interaction effect is relatively small (–0.0096 log points) but still indicates that disadvantages compound when women's characteristics intersect with weaker systemic returns.

For simplified analysis, the twofold decomposition method offers an alternative approach by focusing on the explained and unexplained components of the GPG. The explained component reflects disparities attributed to observable differences in characteristics, while the unexplained component captures the portion of the gap that cannot be accounted for by these characteristics. This unexplained portion often indicates systemic discrimination or structural biases, such as unequal pay for equivalent work, undervaluation of women's contributions in labor markets, or institutional barriers within pension systems. In line with Boll et al. (2017), the unexplained share here is substantial, at roughly 42% of the total gap.

In the context of this study, the explained component of the decomposition refers to the share of the GPG that can be attributed to observable differences in characteristics (endowments), such as education, career history, or number of children. By contrast, the unexplained component reflects the portion of the gap that arises from differences in how these characteristics are rewarded (coefficients) or from systemic biases within pension and labour market structures. Following Boll et al. (2017), the unexplained part is not merely a residual but is itself decomposable into differences in coefficients and the interaction between coefficients and endowments. In this way, the analysis disentangles how much of the pension gap is due to (i) structural differences in men's and women's observable characteristics and (ii) unequal returns or systemic discrimination in the valuation of these characteristics.

The application of the Oaxaca-Blinder decomposition method reveals critical insights into the socio-economic and structural drivers of the GPG. For example, women's overrepresentation in part-time roles and lower-paying sectors significantly contributes to the explained portion of the gap, while differences in how characteristics are rewarded highlight the systemic undervaluation of women's work. Education, for instance, shows an endowment effect of –0.0062 log points but a positive coefficient effect of 0.0626, suggesting that while women may attain lower levels of education on average, their returns to education are higher when present — though still insufficient to offset systemic disadvantages elsewhere.

These dynamics are particularly pronounced in earnings-based pension systems, such as those in Germany and Luxembourg, which disproportionately penalize non-linear career trajectories. In contrast, countries with redistributive pension systems, such as Spain and Sweden, exhibit lower unexplained components, reflecting the positive impact of policies that mitigate gender disparities.

This decomposition analysis also underscores the importance of understanding the intersectionality of gender with other factors, such as disability, ethnicity, and marital status. Women who face compounded vulnerabilities often experience even greater pension disparities, emphasizing the need for inclusive policies that address multiple layers of disadvantage. For example, the motherhood penalty is evident in the coefficients: the number of children variable has a coefficient effect of –0.0230, showing that children significantly reduce women's pension income relative to men's, while marital status exerts a positive coefficient effect of 0.0299, suggesting spousal benefits provide a modest cushion for women.

Furthermore, the method provides a comparative lens to examine regional variations across European countries, illustrating how differences in labor market conditions, cultural norms, and policy designs shape the GPG. The insights derived from this analysis have significant implications for policy. Addressing the structural and systemic drivers of the GPG requires a holistic approach that tackles both observable inequalities and unexplained disparities. Reforms should include measures to promote gender diversity in high-paying sectors, enforce equal pay, and expand caregiving credits to compensate for career interruptions. Policies aimed at enhancing financial literacy and retirement planning for women can also empower individuals to navigate pension systems more effectively.

By isolating the components of the GPG, the Oaxaca-Blinder decomposition method contributes to a deeper understanding of the factors perpetuating gender disparities in pensions. It highlights the urgency of addressing systemic biases and structural inequalities within labor markets and retirement systems. This analysis enriches the broader discourse on gender equity, providing valuable evidence for policymakers and researchers. It underscores the complexity of the GPG and offers actionable insights for designing inclusive reforms that promote financial security and equity in retirement outcomes.

6.3 Disparate Socioeconomic and Demographic Influences on Pension Incomes: A Gender Comparative Analysis

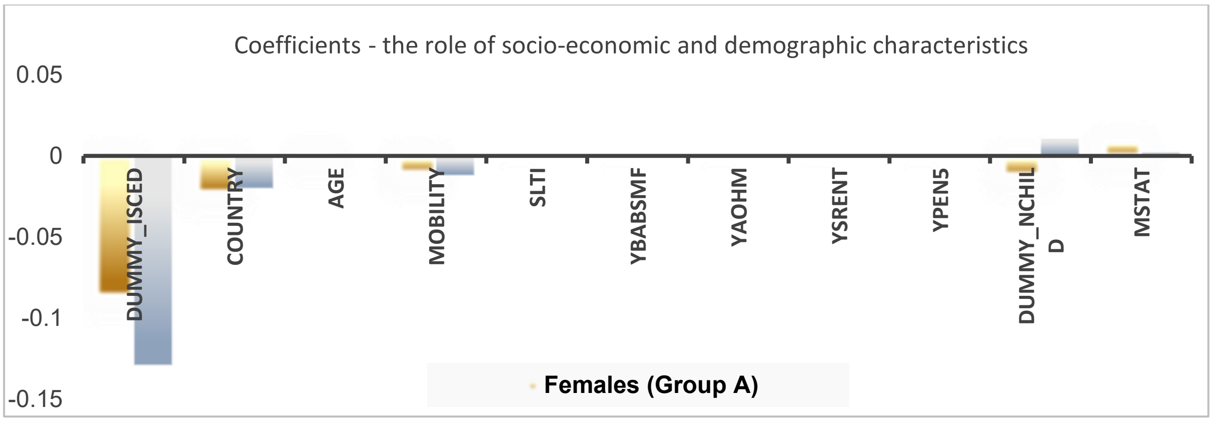
In this section of the analysis, our primary focus is to unravel the gender disparities evident in net pension income. Leveraging the Oaxaca-Blinder decomposition method allows us to illuminate the significant role played by socio-economic and demographic characteristics in shaping these disparities. It's crucial to note that our analysis will pivot around the interpretation of the coefficients for each variable rather than their statistical significance. The rationale behind this approach stems from a comprehensive examination conducted in the preceding chapter, which meticulously addressed the significance aspect. Here, we aim to delve deeper into the implications of each coefficient's magnitude and direction, providing insights into how each socio-economic and demographic factor differentially impacts pension income across genders.

Subsequently, the analysis will extend into a more granular examination through the twofold and threefold decomposition facets of the Oaxaca-Blinder method. This will not only facilitate a deeper understanding of the GPG but also allow us to dissect the gap into its constituent parts: the portion explained by differences in characteristics (or endowments), the portion attributable to differences in the returns to these characteristics (coefficients), and, uniquely in the case of the threefold decomposition, the interaction effect between the traits and their returns. This nuanced analysis is designed to offer a comprehensive view of the underlying dynamics contributing to gender disparities in net pension income, setting the stage for targeted discussions on potential remedial strategies and policy implications.

In the forthcoming analysis, we will scrutinize the chart presented below, which succinctly encapsulates the disparities in coefficients for males and females. This examination aims to delve into the nuances of each coefficient, interpreting these disparities through the lens of the Oaxaca decomposition method and juxtaposing them against findings from the extant literature review. This dual-faceted approach will enable a comprehensive understanding of the underlying factors contributing to gender disparities in pension incomes, grounded in both quantitative analysis and scholarly discourse.

Before proceeding to interpret the coefficients individually, it is important to clarify the design of Figure 6.1. The bars represent the estimated regression coefficients from the multivariate model with NPI as the dependent variable. Each bar reflects the marginal effect of a socio-economic or demographic characteristic (e.g., education, marital status, number of children, income sources) on NPI. The coefficients shown correspond to the female category, with males serving as the reference group in the regression framework. This specification allows the analysis to focus directly on the extent to which socio-economic factors contribute to the disadvantages women face in retirement income. The choice of females as the focal category is deliberate, as the GPG literature consistently positions women as the group of concern given their lower average pension entitlements. By presenting coefficients for females relative to males, the figure highlights the structural and individual-level drivers of disadvantage, rather than treating men's outcomes as the object of study.

Figure 6.1: Coefficients of the role of socio economic and demographic characteristics



Source: Own Estimations: This figure displays the estimated regression coefficients from the multivariate model, with **NPI** as the dependent variable. Each bar represents the marginal effect of a socio-economic or demographic variable (e.g., education, marital status, number of children, income sources) on NPI. Males serve as the reference group, and coefficients shown correspond to the female category. Females were chosen as the reference group because the focus of the analysis is on the GPG and on identifying the socio-economic drivers that disproportionately disadvantage women.

Education Level: The observed difference in the impact of education level on NPI between genders, with a more pronounced negative association for males than for females (Appendix 6.1), provides a compelling entry point into discussions about the paradoxical nature of education's return on investment, particularly in the context of retirement benefits. Numerically, the Oaxaca-Blinder results show an endowment effect of –0.0062, while the coefficient effect is +0.0626. This means that women's lower average education explains only a very small share of the pension gap, but when women do attain higher education, their returns are modestly greater than those of men. This phenomenon, where higher education levels do not translate straightforwardly into better pension outcomes, and notably more so for males, invites a multifaceted analysis rooted in economic theory and gender studies.

The gender differential in the impact of education on pension income suggests that traditional assumptions about the positive correlation between education and economic outcomes may not uniformly apply across genders or lifecycle stages. The raw regression coefficients in Appendix 6.1 highlight this: for females, the coefficient is –0.0864, compared to –0.1289 for males, leaving a difference of 0.0425. The more significant negative coefficient for males implies that higher educational attainment leads to a more substantial decrease in NPI than females. This could be reflective of several labor market dynamics:

• **Sectoral Employment Patterns:** Men with higher education may be more concentrated in sectors that offer higher salaries but less generous pension plans. Conversely, sectors employing highly educated women might offer lower immediate financial rewards but more substantial pension benefits, possibly due to differing industry norms or collective bargaining agreements.

• **Career Choices and Progression:** The discrepancy might also stem from gendered career paths, where men's careers, even within similar education levels, lead to different pension accumulation trajectories than women's. This could involve differences in job stability, part-time versus full-time work, or the balance between immediate income and long-term pension benefits.

• **The Paradox of Education:** At a broader level, these findings tap into the "paradox of education," where the expected economic benefits of higher education—usually anticipated as higher earnings and, by extension, higher pensions—do not materialize uniformly across genders or are offset by other factors such as career interruptions or the sectoral employment patterns.

Prior research offers several lenses through which to understand these dynamics. For example, studies on the gender pay gap have frequently noted that while education improves earnings for both genders, the relative gains can vary significantly, with women often experiencing a lower return on investment in wages (Blau & Kahn, 2017). This wage disparity extends into retirement, where pension income, usually a function of lifetime earnings, manifests the accumulated disadvantages faced by women in the labor market (Aronson, 1991). However, the specific negative association for men in terms of education and pension outcomes is less frequently discussed, suggesting an underexplored area of gender economics. The findings could be seen as a manifestation of the "paradox of education" in pension economics. Traditionally, this paradox refers to the diminishing economic returns on higher education in saturated labor markets (Brown, 2001). In the context of pension income, the paradox involves saturation, Haswell as pension systems and labor markets differ and remunerate educational attainment across different genders. For instance, the higher educational attainment of men leading to relatively lower pension outcomes might reflect an overemphasis on immediate financial compensation over long-term pension benefits. This calculation might play out differently in women's career decisions or be influenced by systemic biases in pay and promotion practices.

This analysis underscores the complexity of interpreting the economic returns of education through the lens of gender disparities in pension income. It highlights the need for a nuanced understanding of how labor market dynamics, sectoral employment patterns, and systemic biases influence the long-term financial security of men and women differently. Addressing these disparities requires policy interventions considering the multifaceted roles of education, gender, and employment in shaping economic outcomes over the life course.

Age: The observed disparity in the impact of age on pension income between genders, with a more substantial positive correlation for males compared to females (Appendix 6.1), indicates underlying gender inequalities present throughout the working life and into retirement. Numerically, the Oaxaca-Blinder decomposition shows that the endowment effect of age is minimal (+0.0007), meaning differences in the age distribution between men and women explain almost none of the gap. However, the coefficient effect is very large and negative for women (–0.1064), indicating that men benefit disproportionately more from each additional year of contribution or career accumulation. The interaction effect is close to zero (–0.0006), suggesting little compounding between age and other factors. Research has consistently shown that career progression tends to differ significantly between genders, with men often experiencing more linear and uninterrupted career trajectories than women (Goldin, 2014). Such differences are attributed to various factors, including but not limited to gender discrimination in promotions and hiring, differences in work-life balance priorities, and the impact of childbearing and childrearing responsibilities predominantly assumed by women (Blau & Kahn, 2017). These career interruptions or part-time work arrangements, more common among women, result in lower lifetime earnings, directly affecting pension contributions and, consequently, pension income.

Earnings growth over the lifespan is another critical determinant of pension accumulation, with higher and more consistent earnings leading to more excellent pension contributions and benefits. Studies by Munnell et al., (2006) have demonstrated that earnings trajectories are typically steeper for men than for women, partly due to the career above progression disparities but also due to the persistent gender wage gap. The Oaxaca results (Appendix 6.1) further highlight this: the raw regression coefficient for age is 0.0003 for females compared to 0.0016 for males, leaving a difference of –0.0014. This confirms that each additional year of age translates into stronger pension income growth for men than for women. This gap, which cannot be fully explained by differences in occupation, education, or work experience, suggests systemic undervaluing of women's work and contributions, further exacerbating pension income disparities (Kunze, 2008).

The combined effects of slower career progression and lower earnings growth for women manifest in reduced pension contributions and the compounding of these disadvantages over time, leading to significant gender disparities in pension income at retirement. The pension system, primarily reflecting lifetime earnings, thus magnifies these gender-based inequalities, translating them into financial insecurity for old-age women (Jefferson, 2009).

Number of Children: The differential impact of having children on pension income by gender, where females experience a negative effect and males a positive one (Appendix 6.1), illustrates a critical dimension of gender inequality in the labor market and its long-term consequences on financial security in retirement. The Oaxaca-Blinder decomposition confirms this: the endowment effect of children is small but positive (+0.0013), showing that differences in the number of children between men and women do little to explain the gap. By contrast, the coefficient effect is –0.0230, revealing that motherhood substantially reduces women's pension income relative to men's, while the interaction effect (–0.0026) compounds this disadvantage further. Regression coefficients also highlight this contrast: for females, the effect is –0.0117, whereas for males it is +0.0109, leaving a difference of –0.0226. This phenomenon can be attributed mainly to the "motherhood penalty," a well-documented concept in economic and sociological research that describes the adverse impacts on women's earnings and career trajectories due to childbearing and childrearing responsibilities. For the purposes of this analysis, it is important to clarify that the children considered are not currently living with their parents, are still alive, and the majority are adults. This distinction highlights that the observed pension disparities are not directly influenced by ongoing childcare responsibilities but rather by the cumulative effects of past caregiving roles. These effects often manifest through prolonged career interruptions, reduced working hours, and limited opportunities for professional advancement during prime earning years—factors that contribute to lower pension contributions over time.

Moreover, even in scenarios where women return to the workforce after periods of caregiving, their earnings rarely fully recover to match those of their male counterparts. This perpetuates a lifelong income penalty that extends into retirement. In contrast, men often experience a "fatherhood premium," where having children is associated with increased earnings and greater career stability, reflecting societal perceptions of men as primary financial providers.

Additionally, the pension systems in many European countries do not fully account for the long-term economic impact of caregiving interruptions. While some systems offer partial pension credits for caregiving periods, these measures often fall short of compensating for the cumulative disadvantages women face in their pension outcomes.

The "motherhood penalty" encompasses various dimensions of economic disadvantage experienced by women with children compared to their childless counterparts and men, including lower wages, reduced hours, and career interruptions or stagnation (Budig & England, 2001). These disruptions are not merely temporary but have cumulative effects on a woman's working life, leading to substantial disparities in lifetime earnings and, by extension, pension contributions and income. The coefficient penalty of –0.0230 in this study quantifies precisely how these cumulative disadvantages carry into retirement income.

Women are more likely to take career breaks or shift to part-time employment to manage childcare responsibilities, directly impacting their pension accrual. Even in countries with relatively generous maternity leave policies, the return to work does not fully mitigate the long-term impacts on women's career progression and earnings potential (Misra, Budig, & Moller, 2007).

Conversely, men often experience a "fatherhood premium," where having children correlates with positive outcomes such as higher wages and perceived increased stability and commitment, contributing to the positive effect on pension income observed for males (Hodges & Budig, 2010). The male coefficient of +0.0109 in

Appendix 6.1 reflects this fatherhood premium, in stark contrast to the negative female coefficient. This disparity underscores the gendered norms and expectations surrounding parenting roles and their translation into economic realities.

The divergent impacts of parenthood on pension income highlight the need for policies that address the root causes of the motherhood penalty. Proposals include enhancing access to affordable childcare, promoting parental leave policies that encourage shared childrearing responsibilities, and implementing workplace practices that accommodate the needs of parents without penalizing them financially or professionally (Gornick, Meyers, & Ross, 1997). Moreover, pension systems can be reformed to better account for periods of career interruption or part-time work due to childrearing, such as through the crediting of care years in pension calculations or the provision of child-related pension supplements (Frericks, Maier, & De Graaf, 2007).

While the analysis above concentrated on education, age, and the number of children due to their direct relevance and significant impact on gender disparities in pension income, other factors identified in the decomposition output also merit attention, and they are briefly mentioned below:

Country: The coefficient for the country variable indicates that geographic or systemic factors, possibly including differences in national pension systems and labor markets, impact pension incomes. The decomposition results show an endowment effect of –0.0381 and a coefficient effect of –0.0636, making this one of the largest contributors to the overall gap. This means that both the distribution of women across different countries and the unequal pension rewards within countries reinforce their disadvantage. The slightly less negative coefficient for females suggests that country-specific factors might mitigate gender disparities in some contexts.

Mobility Limitations: The "Mobility" variable in the context of pension income analysis could represent an individual's career mobility, including job changes, promotions, and the capacity to relocate for better employment opportunities. Numerically, the endowment effect is –0.0104, while the coefficient effect is +0.0026, showing that women are somewhat disadvantaged by their distribution of mobility limitations but, once present, the penalty is slightly less severe than for men. Its negative impact on pension income, particularly for females, might shed light on mobility limitations and their implications for career advancement and financial security in retirement. The negative correlation between mobility and pension income, more pronounced for women, underscores the intersection of gender, work, and family life in shaping economic outcomes. It suggests that limitations on career mobility, whether due to personal choices, societal expectations, or employer practices, disproportionately affect women's pension accumulation. This is consistent with findings from gender studies literature that highlight the pervasive impact of structural and societal barriers on women's economic independence and security (England, 2005).

Savings for Long-Term Investments: The variable "slti," representing savings for long-term investments, shows a positive but minimal effect on pension income for both genders, indicating that while such savings contribute to pension income, their impact appears marginal. The Oaxaca results confirm this with a very small endowment effect (–0.0005) and a modestly positive coefficient effect (+0.0057), suggesting that women gain slightly more from such savings when present, though the contribution to the overall gap is negligible. This observation might suggest several underlying economic behaviors and systemic issues related to pension savings and investment strategies.

Marital Status (mstat): Marital Status positively impacts pension income for females, possibly reflecting the benefits of dual-income households or survivor benefits in pension systems that favour married individuals or widows (further analysed below). The decomposition results show a small positive endowment effect (+0.0014) and a relatively larger coefficient effect (+0.0299), indicating that marriage provides women with a measurable pension advantage compared to men, most likely due to institutional benefits favouring widows and spousal arrangements. The effect is more pronounced for females, potentially indicating gender differences in how marital Status influences economic security in retirement.

Income from Rent (ysrent): The positive but minimal effect of rental income on pension income suggests that while having rental income contributes to overall financial security in retirement, its impact on pension income is relatively small. The decomposition supports this: the endowment effect is –0.0010, while the coefficient effect is +0.0013, implying that although fewer women hold rental assets, those who do may benefit slightly more than men in pension terms. This could be due to several factors. First, the proportion of retirees with significant rental income may be relatively small. Second, the variability in rental income—affected by market conditions, property values, and management costs—might limit its overall contribution to financial stability in retirement. Previous research highlights the importance of diverse income streams in retirement planning and notes the challenges and risks associated with property investment (Sherraden, 2001; Lee & Painter, 2013).

Social Assistance (ypen5): The observation that social Assistance has a small negative effect on pension income for females and a positive one for males highlights the complex interplay between social welfare benefits and retirement income. Numerically, the Oaxaca results show a tiny positive endowment effect (+0.0004) but a negative coefficient effect (–0.0011), suggesting that women who rely on social assistance tend to receive lower pensions relative to men in the same position. Social Assistance might be a critical safety net for women likelier to have assistance careers and lower lifetime earnings, indicating reliance on these benefits due to insufficient pension income. For men, the positive correlation might reflect a different mechanism, possibly the use of social Assistance during specific periods of need not leading to long-term dependency, hence not detracting from pension accumulations (Pavalko & Henderson, 2006; Zhan, Xie, & Cheng, 2011).

Interest/Dividend from Financial Assets (ybabsmf): The positive impact of interest and dividends from financial assets on pension income highlights the role of personal savings and investment income as supplementary sources of retirement income. From the decomposition, the endowment effect is –0.0051, reflecting women’s lower overall asset ownership, but the coefficient effect is +0.0068, showing that when women do hold financial assets, they translate into slightly greater pension gains compared to men. This positive association suggests that having a diversified portfolio, including bank accounts, bonds, stocks, and mutual funds, can contribute to financial security in retirement. The literature on retirement planning consistently emphasizes the importance of diversified investment strategies to mitigate risks and ensure steady income streams in retirement (Bodie, 1990; Clark, Caerlewy-Smith, & Marshall, 2006). However, the relatively limited impact also reflects the challenges many individuals face in accumulating substantial financial assets due to wage stagnation, increased living costs, or lack of financial literacy (Lusardi & Mitchell, 2007).

Income from Other Household Members (yaohm): The positive effect of income from other household members on pension income underscores the significance of household dynamics in retirement security. The decomposition indicates a very small endowment effect (–0.0003) and a coefficient effect of +0.0019, implying that women gain slightly more pension benefit from household income than men, but the effect size remains marginal. This finding aligns with research suggesting that family support systems play a crucial role in the financial well-being of older adults, particularly in contexts where pension systems may not provide adequate coverage or where individuals have insufficient personal savings (Kohli, 2006; Silverstein & Giarrusso, 2010). It also highlights the interconnectedness of individual and household financial health, suggesting that pension income security is not solely an individual concern but also a family matter.

These insights underscore the need for policies and financial planning approaches that recognize and support the diverse income sources contributing to retirement security. Enhancing financial education to promote better understanding and management of financial assets can empower individuals to make informed decisions about saving and investing for retirement. Moreover, acknowledging the role of household income dynamics in supporting retirees suggests the importance of social policies that bolster family support mechanisms while ensuring adequate pension benefits for all (Ozawa & Lee, 2006; Sherraden, 2001).

6.4 Threefold Decomposition Analysis: Addressing Hypotheses

The exploration of the GPG through a socio-economic and demographic lens in this chapter is underpinned by the intersection of labor market dynamics, gender inequality, and pension economics. Utilizing the Oaxaca-Blinder decomposition method, we delve into the nuanced contributions of various factors such as education, age, and work experience towards this disparity. This approach, grounded in the theoretical frameworks provided by seminal works and complemented by recent studies, offers a comprehensive understanding of the mechanisms at play. It acknowledges the complex, multi-faceted nature of pension income disparities between genders, setting a solid analytical foundation for the nuanced interpretation of results that follow. This methodology is pivotal in breaking down observed differences in pension incomes between genders into components attributable to endowments, coefficients, and interaction effects, enabling a detailed examination of each factor's contribution to the GPG.

To analyse the GPG through the Oaxaca-Blinder threefold decomposition, each variable's impact on the gap is dissected, allowing for a nuanced understanding of the systemic differences between genders in pension income. The analysis leverages socio-economic and demographic factors, providing insight into the structural inequalities present in pension systems.

To clarify the distinction, the explained component in the threefold Oaxaca–Blinder decomposition captures the part of the gender pension gap that can be accounted for by observable socio-economic and demographic factors. The unexplained component consists of two parts: (i) the coefficient effect, which measures differences in how characteristics are rewarded for men and women, and (ii) the interaction effect, which represents the combined influence of differences in characteristics and differences in coefficients. In line with Boll et al. (2017), this structure provides a more transparent allocation of the gap, ensuring that the unexplained portion is not treated as a single residual but as a set of interpretable mechanisms.

Education (Dummy_isced): The analysis of the education variable in the context of the GPG suggests that while women's educational achievements may contribute minimally to pension income disparities (as indicated by the endowment effect), systemic barriers are hindering the translation of education into economic benefits for women in retirement. The negative coefficient of endowments [-0.006), appendix 6.2)] suggests that differences in educational attainment contribute slightly to the pension gap, although this effect is relatively small. However, the coefficient of coefficients [0.062) appendix 6.2)] indicates that for every unit increase in educational attainment, there is a corresponding increase in pension income. This finding suggests that education does have a positive impact on pension income, but the effect size is modest. Importantly, when considering the interaction effect [0.002), appendix 6.2)], which captures how the impact of education on pension income varies between genders, there is evidence of nuanced differences. The positive interaction effect suggests that the pension impact of education is further nuanced by gender, indicating that societal norms and labor market dynamics interact with education differently for men and women.

These results underscore the broader labor market gender disparities, where women's educational achievements are undervalued or inadequately rewarded compared to men's, leading to disparities in pension incomes. Despite investing in education, women may face limited opportunities for career advancement, higher-paying jobs, or equal pay, which diminishes the economic returns on their educational investment. To support this interpretation, empirical evidence from the analysis of the education variable highlights the gendered nature of pension income disparities and the need for targeted policy interventions to address the systemic barriers that inhibit women from fully realizing the economic benefits of their education in retirement.

Country: The analysis of the "country" variable sheds light on the role of geographical context in influencing the GPG. The results suggest that country-specific factors, including policies and labor market conditions, significantly contribute to disparity in gender pension income. The negative coefficient of endowments [-0.038), appendix 6.2)] indicates that differences in the country of residence contribute to the pension gap, with certain countries exhibiting more pronounced disparities than others. This suggests that women in specific countries face greater challenges in accruing pension income than their male counterparts. The coefficient of coefficients [(-0.063), appendix 6.2)] further emphasizes the significant impact of the country on pension income, indicating that, on average, women receive lower pension benefits compared to men within the same country. This finding underscores the role of national policies, social norms, and labor market practices in perpetuating gender disparities in pension outcomes. Additionally, the negative interaction effect [-0.005), appendix 6.2] suggests that the relationship between countries and pension income is further compounded by gender. This indicates that the impact of country-specific factors on pension income differs for men and women, reflecting the intersectionality of gender with other social determinants. These results highlight the importance of considering country-level variations when addressing the GPG. Policies aimed at reducing disparities in pension income should consider the unique socio-economic contexts of different countries and tailor interventions accordingly. Moreover, comparative studies that examine the effectiveness of various policy approaches across different countries can offer valuable insights into best practices for promoting gender equity in pension outcomes.

Age: The "age" variable analysis provides crucial insights into how age influences the GPG. The results indicate that age-related factors significantly shape pension income outcomes for both men and women. The positive coefficient of endowments [0.0007, appendix 6.2] suggests that age has a minimal but positive impact on pension income, implying that older individuals tend to have slightly higher pension benefits, all else being equal. This may be attributed to longer periods of contribution to pension schemes or higher levels of seniority in the workforce. However, the coefficient of coefficients [-0.1063, appendix 6.2)] reveals a stark gender disparity in the relationship between age and pension income. For women, ageing is associated with a significant decrease in pension benefits, indicating that older women receive disproportionately lower pension income than older men. This finding underscore women's cumulative disadvantages throughout their careers, including wage gaps, interrupted employment due to caregiving responsibilities, and part-time work, ultimately resulting in lower pension accruals in later life. The negative interaction effect [-0.0006, appendix 6.2)] further highlights the gendered nature of age-related disparities in pension income. This suggests that the impact of age on pension outcomes differs for men and women, with women experiencing more pronounced disadvantages as they age. Factors such as gender norms, occupational segregation, and unequal access to career advancement opportunities may exacerbate the pension gap for older women. These findings underscore the importance of addressing age-related inequalities in pension provision to promote gender equity in retirement income. Policy interventions aimed at mitigating the GPG should consider the intersecting effects of age and gender, ensuring that pension systems adequately account for the unique challenges faced by older women in securing financial security in retirement. Additionally, longitudinal studies tracking the pension trajectories of men and women across different age cohorts can provide valuable insights into the long-term implications of age-related disparities in pension outcomes.

Mobility: The impact of mobility limitations on pension income exhibits nuanced dynamics that intersect with gender and socio-economic factors. The coefficient of coefficients [0.00256), appendix 6.2)] suggests a marginally positive effect of mobility limitations on pension income, albeit lacking statistical significance. Conversely, the coefficient of endowments [-0.0103), appendix 6.2)] implies an initial reduction in pension income for individuals with mobility limitations. Moreover, the interaction effect (0.0011), appendix 6.2) intimates' variability in the impact of mobility limitations on pension income, contingent upon other factors such as gender. However, the relatively modest effect size warrants further investigation into the specific gendered implications.

Mobility limitations exert divergent effects on workforce participation and earnings, influenced by gender disparities and socio-economic status. Women confronted with gender discrimination, caregiving responsibilities, and occupational segregation may encounter heightened challenges stemming from mobility limitations. Nonetheless, the absence of statistically significant coefficients for both the coefficients and interaction effects poses challenges in delineating the precise gendered impact of mobility limitations on pension income based solely on the provided output.

Savings for Long-Term Investment

The coefficient of coefficients [0.0056), appendix 6.2)] suggests a modest but significant positive effect of savings for long-term investments [(slti),investments (SLTI) represent the way long-term investments are reflected in SHARE]. Further details on this classification and its implications are included in the variable descriptions in Chapter 5 on pension incomes. This implies that individuals actively engage in long-term savings and investments tend to receive higher pension benefits. However, it's important to note that the size of the effect is relatively small, indicating the need for a nuanced understanding of how savings behaviors translate into pension outcomes. Conversely, the coefficient of endowments [-0.0005), appendix 6.2)] suggests a slight initial decrease in pension incomes associated with slti. This initial reduction could be due to various factors, such as temporary disruptions in employment or lower earnings during investment periods. The interaction effect [(-0.0017), appendix 6.2)] implies that the impact of slti on pension incomes may differ based on other factors, although the effect size is relatively modest. This highlights the importance of considering intersecting factors such as gender, socioeconomic status, and employment patterns in analysing pension income differentials. Previous research corroborates the importance of savings behaviour in shaping pension incomes. Studies by Munnell et al., (2003) and Estévez-Abe (2005) have highlighted how active participation in long-term savings and investments positively impacts pension rights and income levels in retirement. These findings align with the observed modest impact of slti on pension benefits, emphasizing the role of proactive financial planning in achieving financial security in retirement.

Furthermore, comparative analyses across different national contexts, such as those conducted by Frericks et al., (2006), underscore the variability in pension outcomes associated with long-term savings and investments. Variations in pension policies, labor market conditions, and socioeconomic factors contribute to differential pension income outcomes, further emphasizing the need for tailored policy interventions to address disparities in pension accumulation. While slti demonstrates a modest impact on pension incomes, its significance lies in elucidating the role of proactive savings behavior in retirement planning. By contextualizing these findings within the broader literature on retirement savings and pension income, this analysis contributes to a deeper understanding of the factors driving pension differentials. It informs policy interventions aimed at promoting retirement income security.

Interest/Dividend (ybabsmf) & Income from Others (yaohm): Interest/Dividend (ybabsmf) and Income from Others (yaohm) both contribute to the diversification of income sources, which is crucial for ensuring pension security.

For Interest/Dividend (ybabsmf), the coefficient of coefficients [0.0068), appendix 6.2) indicates a positive effect on pension incomes, suggesting that individuals who receive interest or dividends from investments tend to have higher pension benefits. This underscores the importance of investment income in bolstering retirement savings. However, the coefficient of endowments [-0.0050), appendix 6.2)] suggests a slight initial decrease in pension incomes associated with this income source. This initial reduction could be due to fluctuations in investment returns or the time it takes for investments to yield significant dividends. Conversely, for Income from Others (ohm), the coefficient of coefficients (0.001889924) also suggests a positive effect on pension incomes, indicating that individuals who receive income from other household members tend to have higher pension benefits. This highlights the role of shared financial resources within households in supporting retirement income. The coefficient of endowments [-0.0002), appendix 6.2)] suggests a minimal initial impact on pension incomes associated with this income source.

The interaction effects for both variables further underscore the complex interplay between household income dynamics and individual financial strategies in shaping pension outcomes. The negative interaction effect for Interest/Dividend (ybabsmf) (-0.0039394354) suggests that the impact of this income source on pension incomes may vary based on other factors. Similarly, the positive interaction effect for Income from Others (ohm) [0.00046), appendix 6.2)] indicates that different variables may also influence the impact of this income source on pension incomes. These findings highlight the importance of diversifying income sources to enhance pension security. By incorporating various forms of income, individuals can better protect themselves against financial risks in retirement and improve their overall economic well-being.

Income from Rent (ysrent) & Social Assistance (ypen5): Income from Rent (ysrent) and Social Assistance (ypen5) contribute to the nuanced landscape of pension income, reflecting broader socioeconomic factors influencing pension security. For Income from Rent (ysrent), the coefficient of coefficients [0.0013), appendix 6.2)] indicates a positive effect on pension incomes, suggesting that individuals who receive income from rent tend to have higher pension benefits. This underscores the potential role of rental income in bolstering retirement savings. However, the coefficient of endowments [(-0.0010), appendix 6.2)] suggests a slight initial decrease in pension incomes associated with this income source. This initial reduction may stem from factors such as fluctuations in rental market conditions or the time it takes for rental properties to generate significant income.

On the other hand, for Social Assistance (ypen5), the coefficient of coefficients [(-0.0010), appendix 6.2)] suggests a negative effect on pension incomes, indicating that individuals who receive social assistance payments may have lower pension benefits. This highlights the challenges individuals face relying on social assistance as their primary source of income in retirement. The coefficient of endowments [0.0003), appendix 6.2)] suggests a minimal initial impact on pension incomes associated with this income source.

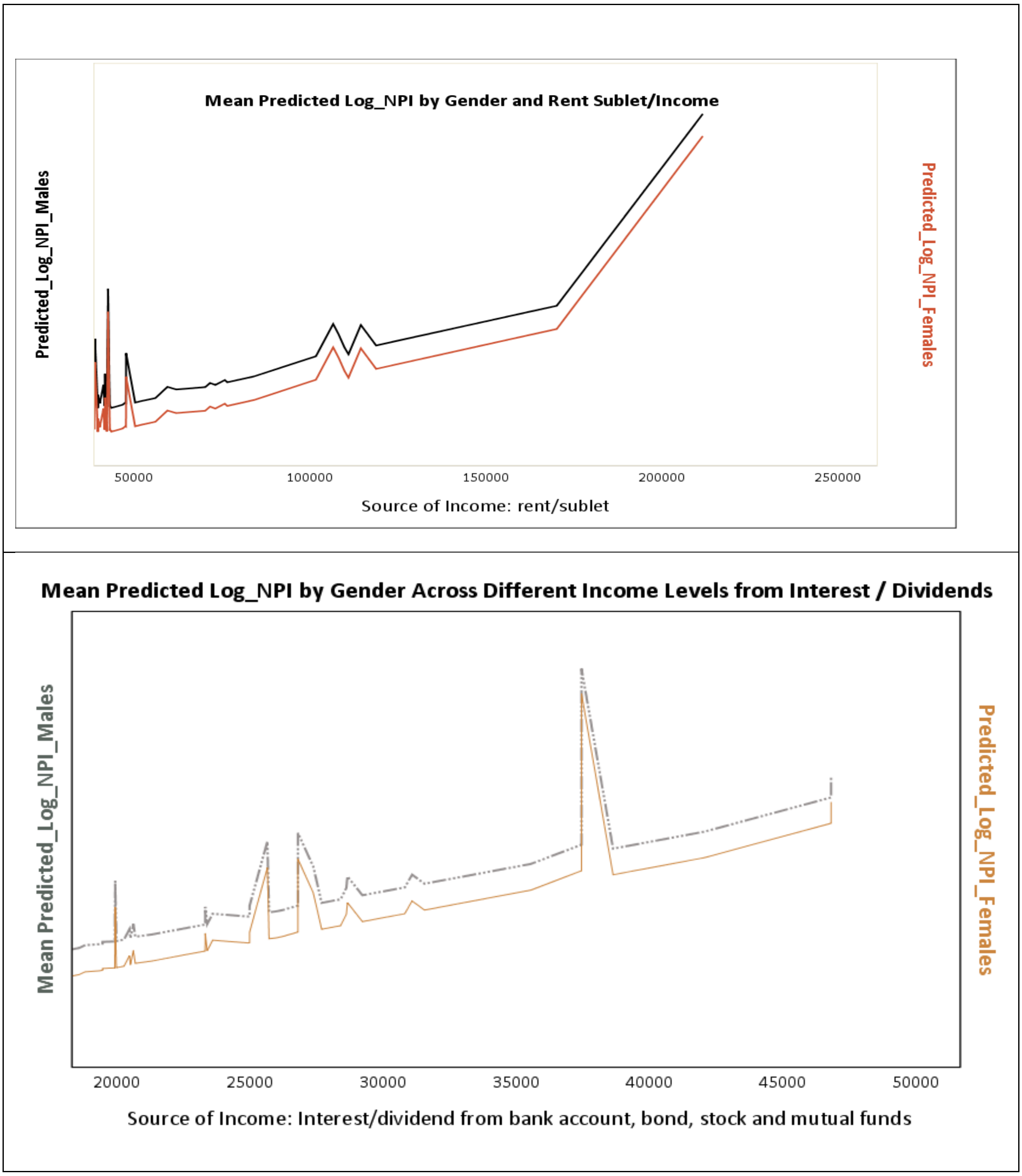
The interaction effects for both variables further underscore the complex relationship between socioeconomic factors and pension outcomes. The negative interaction effect for Income from Rent (ysrent) (-0.0008265894) suggests that the impact of this income source on pension incomes may vary based on other factors. Similarly, the negative interaction effect for Social Assistance (ypen5) [(-0.0006), appendix 6.2)] indicates that different variables may also influence the impact of this income source on pension incomes.

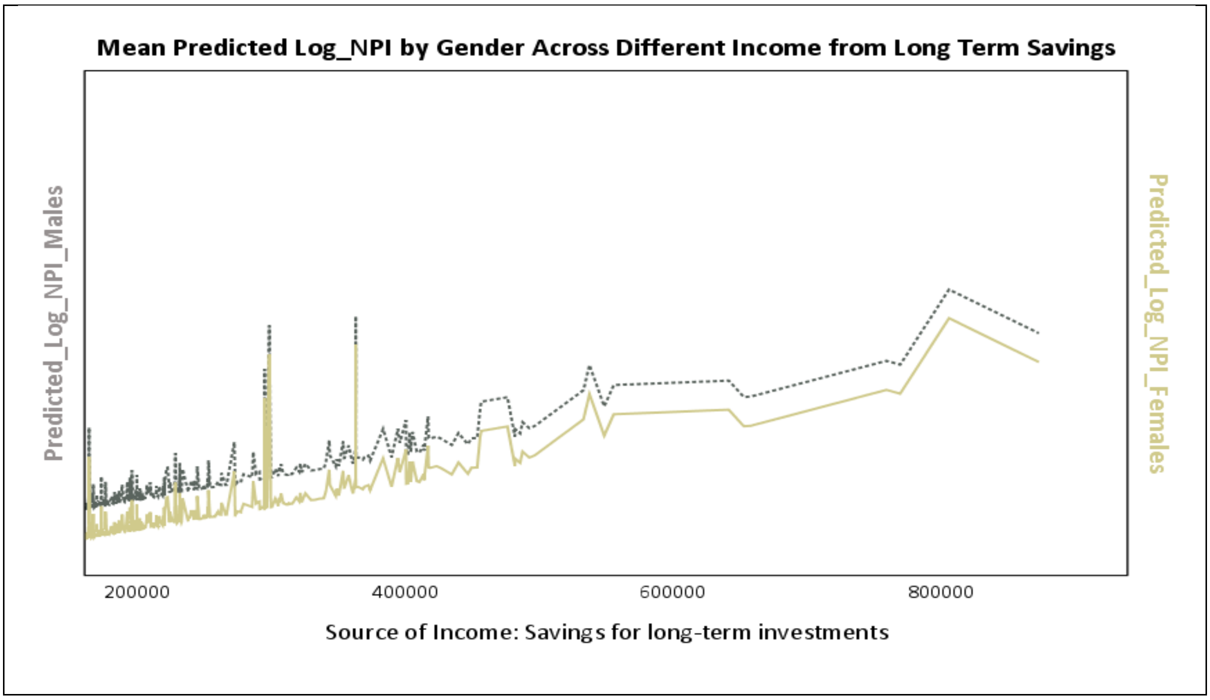
These findings highlight the importance of considering the broader socioeconomic context in understanding pension income disparities. Beyond individual characteristics, economic conditions and social safety nets play a crucial role in shaping pension outcomes. Addressing gender disparities in pension income requires comprehensive policy reforms encompassing education, employment patterns, and social policy frameworks, reflecting the multifaceted nature of the GPG. The comprehensive analysis above employing the Oaxaca-Blinder threefold decomposition method has meticulously examined the nuanced dynamics underpinning the GPG through the prism of socioeconomic and demographic variables. This rigorous examination has elucidated the complex interplay between labor market dynamics, gender inequality, and pension economics, providing a robust foundation for interpreting the disparities observed in pension incomes across genders. The findings from this analysis have significant implications for our understanding of the GPG and offer actionable insights for policy formulation aimed at mitigating these disparities.

6.5 Analysis of Predicted Pension Income Disparities by Gender Across Different Income Sources

This section investigates and compares the predicted disparities in pension income between males and females, focusing on three supplementary income sources: rental/sublet income, interest/dividend income, and long-term savings. The analysis uncovers consistent patterns across all three income sources, underscoring persistent gender gaps in predicted pension incomes. The predicted values are derived from regression analysis, with detailed model summaries in Appendix A, indicating that the variables of interest are all statistically significant. A thorough examination of these variables reveals how additional income sources influence the GPG, providing an understanding of their implications. The accompanying charts illustrate the predicted disparities in pension income between males and females across the three income sources, highlighting consistent patterns that emphasize the persistent gender gaps in predicted pension incomes.

Figure 6.2 Gender Disparities in Predicted Pension Income Across Multiple Income





Source: Author's own findings, SPSS Output SHARE, Wave 6. **Note:** Predicted pension incomes (Log_NPI) for males and females across additional income from rent/sublet, long-term savings, and interest/dividends. All analyses show a consistent gender gap, with males having higher predicted pension incomes across all income levels. Y-Axis (Left): Males (grey); Y-Axis (Right): Females (yellow/orange); X-Axis: Income from respective source. The persistent gap across income sources highlights systemic pension income disparities between genders.

The initial gender disparity is evident across all three income sources, with a noticeable gap between male and female predicted pension incomes at lower income levels. This initial disparity underscores women's systemic challenges in accumulating pension wealth from the outset. Similar findings have been noted by Samek Lodovici et al., (2016), who highlight that women often start with lower baseline pension contributions due to career interruptions and part-time work. As income from each source increases, predicted pension incomes for males and females rise; however, the rate of increase and actual values of predicted incomes consistently show gender differences. This persistent gap aligns with the conclusions of the OECD (2021), which found that despite higher incomes benefiting both genders, women's pension outcomes remain significantly lower across various income levels. Both male and female pension incomes exhibit steady increases at higher income levels. Yet, the gender gap remains significant for all income sources, indicating that higher additional income does not completely bridge the pension disparity.

In some cases, the gap may even widen, highlighting persistent structural inequalities, a phenomenon supported by research from Folbre et al., (2017), which argues that systemic inequities in labor market participation continue to affect women's financial security in retirement. Moreover, the trends suggest that women's pension incomes are more sensitive to changes in additional income than men's, particularly for rental/sublet income. This higher elasticity indicates that while additional income can significantly enhance women's pension outcomes, it also indicates their financial vulnerability. Studies by the European Commission (2020) emphasize that women's pension benefits are more volatile due to their reliance on supplementary income sources. Despite the benefits of increased income from various sources, significant gender disparities remain across all three income categories. This underscores the need for comprehensive policy measures to address these inequalities. As the World Economic Forum (2021) highlighted, policy interventions targeting gender-specific financial planning and retirement savings are crucial for closing the pension gap.

6.6 Conclusion and Policy Implications

The analysis highlights that the GPG is a complex issue with significant variability across Europe. The findings emphasize that Western and Southern European countries tend to exhibit larger GPGs, whereas Northern and Eastern European countries have relatively smaller gaps. However, even within these regions, there are notable outliers, such as Luxembourg with its substantial pension gap, and Denmark and Estonia, which have managed to maintain more equitable pension outcomes between men and women.

These findings underscore the need for targeted policy interventions to address the GPG. Countries with larger gaps may need to implement reforms that better account for periods of caregiving and non-linear career paths, which disproportionately affect women. Policies that improve access to pension credits for caregiving, enhance part-time work protections, and promote gender equality in labor market participation are crucial for reducing these disparities. Moreover, the variations between mean and median pension gaps suggest that reforms must not only address gender inequality between men and women but also the income inequality among women themselves, particularly in countries where pension income distribution is highly skewed. Given the diversity of pension systems and labor market conditions across Europe, a one-size-fits-all solution is unlikely to be effective. Instead, country-specific strategies that consider each nation's unique socio-economic context are essential for closing the GPG and ensuring greater financial security for women in retirement.

6.7 Summary of the Chapter

This chapter provided a rigorous exploration of the GPG using the Oaxaca-Blinder decomposition method, a powerful analytical tool to disentangle observed disparities in Net Pension Income (NPI) into their explained and unexplained components. The chapter's key focus was to quantify the contributions of socio-economic and demographic factors to pension disparities, uncovering both structural inequalities and systemic biases embedded in European pension systems.

Key Findings

1. Education and the Paradox of Returns:
    - Higher education levels contribute minimally to reducing the GPG, as systemic barriers prevent women from fully realizing the economic benefits of their education.
    - For men, the relationship between education and pension income appears more straightforward, with fewer career interruptions and higher financial returns.
2. Age-Related Disparities:
    - Women face cumulative disadvantages over their working lives, with age exacerbating the pension gap due to career interruptions, part-time work, and the gender pay gap.
    - Men's pension income trajectories are more linear, reflecting uninterrupted careers and greater lifetime earnings.
3. Motherhood Penalty and Fatherhood Premium:

- The motherhood penalty significantly affects women's pension income due to career breaks, part-time work, and caregiving responsibilities.
- Conversely, the fatherhood premium benefits men, as societal norms often associate fatherhood with increased workplace stability and earnings.

4. Country-Specific Variations:
    - Western and Southern European countries, such as Germany and Luxembourg, exhibit some of the largest pension disparities.
    - Northern and Eastern European countries, including Denmark and Estonia, demonstrate more equitable pension outcomes, highlighting the effectiveness of redistributive policies in mitigating disparities.
5. Role of Additional Income Sources:
    - While rental income, long-term savings, and financial returns positively impact pensions, women derive less benefit due to systemic inequalities in wealth accumulation and financial planning opportunities.
    - Women's pension outcomes are more sensitive to changes in supplementary income, indicating greater financial vulnerability.
6. Explained and Unexplained Components:
    - The decomposition revealed that much of the GPG arises from explained factors such as differences in career trajectories, education, and caregiving responsibilities.

- However, a significant portion remains unexplained, pointing to systemic biases and discrimination in labor markets and pension systems.

Policy Implications

This chapter underscores the urgent need for targeted policy reforms to address the structural and systemic roots of the Gender Pension Gap (GPG). Drawing on successful international examples, the following measures can help mitigate disparities:

- **Caregiving Credits:** Expanding pension credits for caregiving periods to compensate for career interruptions. For instance, Germany's "Mütterrente" (Mothers' Pension) grants additional pension entitlements for child-rearing years, reducing the pension gap for women who take career breaks.
- **Redistributive Policies:** Implementing flat-rate pensions or minimum guarantees to reduce disparities. The Netherlands' universal basic pension (AOW) provides a strong redistributive mechanism, ensuring that all retirees receive a minimum level of income regardless of their earnings history.
- **Gender-Sensitive Financial Education:** Promoting women's participation in long-term savings and investment opportunities to enhance retirement security. Sweden has incorporated financial literacy programs into its pension system reforms, empowering women to make informed investment decisions for their retirement.
- **Cultural and Policy Shifts:** Encouraging shared caregiving responsibilities and addressing gendered expectations in labor markets. Norway's parental leave policies, which include dedicated paternity quotas, have successfully

encouraged men to take on caregiving roles, contributing to a more balanced division of labor and mitigating pension gaps.

- **Country-Specific Strategies:** Tailoring policies to the unique socio-economic contexts of individual nations, leveraging the best practices of more equitable pension systems. For example, Denmark's combination of a public pension and mandatory occupational pension schemes has contributed to one of the lowest gender pension gaps in Europe.

Chapter 7: Closing the Gender Pension Gap

7.1 Introduction

This chapter synthesizes the key findings, contributions, and policy implications of the research on the GPG across European countries. Through an in-depth analysis of the structural, socioeconomic, and demographic factors influencing pension disparities, the study highlights both the progress made and the challenges that persist in achieving gender equity in retirement outcomes. The research confirms the magnitude and persistence of the GPG, with notable variations across countries shaped by pension system designs, labor market conditions, and cultural norms. Despite modest improvements over time—especially in Scandinavian nations—countries like Germany and Luxembourg continue to exhibit significant disparities, underscoring the need for targeted reforms.

Key determinants such as education, age, marital status, caregiving responsibilities, and secondary income sources were analysed using robust quantitative methods, including the Blinder-Oaxaca decomposition. The findings reveal that while secondary income sources like rental income and financial assets offer some mitigation, they fail to eliminate structural inequalities embedded within pension systems.

The chapter emphasizes the role of systemic discrimination, highlighting that even after accounting for observable factors, a significant portion of the GPG remains unexplained. This points to gender biases in how pension contributions and entitlements are valued across different countries.

From a policy perspective, the research advocates for:

- Pension credits for caregiving periods
- Financial literacy programs tailored to women
- Equitable access to supplementary income opportunities
- Reforms addressing structural biases in pension systems

These measures are critical for creating sustainable and inclusive pension systems that ensure economic security for all retirees, regardless of gender.

In conclusion, this chapter reiterates the importance of context-specific strategies while advocating for a systemic overhaul of pension policies to address gender-based disparities effectively. By offering a robust methodological approach and actionable policy insights, this research contributes to advancing gender equality in retirement outcomes across Europe.

The chapter closes with reflections on limitations and future research opportunities, encouraging further exploration into the intersectionality of gender, race, and socioeconomic status in pension systems to build a deeper understanding of the GPG. This final chapter serves as both a culmination of the research journey and a call to action for policymakers, researchers, and stakeholders to address the entrenched barriers perpetuating gender disparities in retirement income. This thesis provides a comprehensive exploration of the GPG across European countries, addressing its magnitude, evolution, and underlying factors over time. By analysing a diverse set of hypotheses and objectives, the research offers valuable insights into the socio-economic and structural determinants of pension income disparities and highlights policy implications for fostering gender equity in retirement outcomes.

7.2 Addressing the Research Questions and Hypotheses: Insights and Synthesis

The central aim of this research was to analyse the GPG across European countries, specifically between 2004 and 2017, and explore its structural and systemic underpinnings. This section synthesizes the findings by linking the key research questions with the tested hypotheses and the empirical insights derived from the study.

Research Question 1: What is the magnitude of the GPG in the EU between 2004 and 2017, and what are the primary factors contributing to the differences in pension incomes between men and women?

The GPG has been calculated for all European countries based on both mean and median pension incomes. The analysis reveals a statistically significant difference in pension income between men and women across the board, confirming that the GPG remains a pervasive issue within the EU. This study's comprehensive examination of NPI illustrates that women consistently receive lower pension incomes than their male counterparts, reflecting systemic barriers embedded within labor markets and pension systems. This critical issue was primarily addressed through Hypothesis 1, which tested whether pension income is distributed equally between genders. The findings robustly rejected the null hypothesis, indicating that pension income is not equally distributed. The regression model analysis consistently showed statistically significant negative coefficients for the "gender" variable across most countries, suggesting that women earn systematically lower pensions than men, even after controlling for various socio-economic and demographic factors. Structural barriers such as gendered wage gaps, career interruptions, and unequal access to high-paying sectors were identified as primary contributors to the GPG. Additionally, demographic and socio-economic factors—such as age, marital status, and caregiving responsibilities—exacerbate these disparities, highlighting the cumulative disadvantages faced by women throughout their careers and into retirement. For instance:

- Age: Women’s pensions tend to grow at a slower rate compared to men’s, reflecting interrupted or part-time career trajectories.
- Children: The "motherhood penalty" emerges as a significant driver of reduced pension income, reinforcing systemic inequities linked to caregiving roles.
- Education: While higher educational attainment generally improves pension outcomes, it does not fully mitigate the gender disparity, suggesting that women’s returns on education remain undervalued in labor markets.

The country-specific analysis further emphasized the variability in the GPG across Europe. Western and Southern European countries exhibited larger gaps due to earnings-based pension systems, while more redistributive systems in Northern Europe demonstrated narrower disparities. This nuanced understanding of the GPG highlights the need for targeted policy interventions to address these systemic inequalities effectively. In conclusion, this chapter not only quantifies the magnitude of the GPG but also delves into the underlying factors contributing to these disparities in pension income between genders. By addressing these issues through a robust analytical framework, it aims to provide insights that can inform future policy decisions aimed at promoting gender equality in retirement income across Europe.

Research Question 2: Has the GPG widened or narrowed over the 16-year period from 2004 to 2017?

This question was addressed through Hypothesis 2, which explored whether the GPG has remained unchanged or evolved over the study period.

- Hypothesis 2 Findings: The null hypothesis that the GPG has remained constant was rejected. The analysis revealed a general narrowing of the GPG across most European countries between 2004 and 2017. However, the degree of progress varied significantly by country. While some nations implemented policy reforms—such as enhanced caregiving credits and redistributive pension mechanisms—that contributed to narrowing the gap, others demonstrated persistent or only marginal improvements, reflecting entrenched systemic biases.
    - Countries like Germany and Luxembourg continue to show substantial disparities, primarily due to pension systems that heavily rely on lifetime earnings and fail to adequately compensate for gendered career interruptions.
    - In contrast, countries such as Sweden and Denmark experienced more significant reductions in the GPG, benefiting from progressive labor market policies and redistributive pension designs.

The findings underscore the importance of sustained policy reforms and labor market interventions to reduce pension disparities further.

Research Question 3: To what extent does systemic discrimination contribute to amplifying the GPG?

The role of systemic discrimination was directly addressed through Hypothesis 4, which tested whether men and women are equally valued within the same pension systems.

- Hypothesis 4 Findings: The null hypothesis—that men and women are equally valued in pension systems—was rejected. The Oaxaca-Blinder decomposition method highlighted that a significant portion of the GPG remains unexplained after accounting for observable socio-economic and demographic factors. This unexplained component points to systemic biases and discrimination, which disadvantage women within pension systems. For example:
    - Unequal Returns to Characteristics: Women's returns on education, work experience, and even caregiving credits are consistently lower than men's, reflecting entrenched structural inequities.
    - Gender Norms and Policy Gaps: Labor market dynamics, such as occupational segregation and undervaluation of caregiving roles, exacerbate the pension gap.

These findings underscore that systemic discrimination—both overt and subtle—remains a significant driver of the GPG, necessitating policy interventions that address these structural inequalities.

Research Question 4: Do secondary income sources, such as property rentals, financial assets, and savings, play a significant role in narrowing the GPG? This question was explored through Hypothesis 5, which tested whether secondary income sources influence the GPG.

- Hypothesis 5 Findings: The null hypothesis—that secondary income sources have no impact on the GPG—was rejected. The analysis revealed that while secondary income sources (e.g., rental income, financial returns, long-term savings) contribute positively to pension outcomes for both genders, they do not fully close the GPG. Women derive relatively less benefit from these income sources compared to men due to:
    - Lower Wealth Accumulation: Women's limited access to high-paying jobs and financial assets reduces their ability to invest in supplementary income sources.
    - Risk Aversion: Gender differences in financial decision-making, with women tending to adopt more conservative investment strategies, further contribute to disparities in supplementary income accumulation.
    - Volatility of Additional Income: Women's pension incomes are more sensitive to changes in secondary income, reflecting greater financial vulnerability.

These findings emphasize that while secondary income sources can alleviate some disparities, they cannot fully address systemic barriers driving the GPG.

7.2.1 Synthesis: How Addressed Hypotheses Respond to Research Questions

By testing these hypotheses, the study has provided a comprehensive response to the research questions, offering a nuanced understanding of the GPG's drivers and dynamics:

1. **Magnitude and Factors**: The study quantified the GPG and identified socio-economic and demographic factors, such as age and education as primary contributors.
2. **Temporal Trends**: Evidence indicates a general narrowing of the GPG over time, albeit with significant country-specific variations, highlighting the impact of progressive reforms in some contexts.
3. **Systemic Discrimination**: A significant unexplained component of the GPG points to systemic biases, underscoring the need for structural reforms in labor markets and pension systems.
4. **Secondary Income Sources**: While supplementary income plays a role in narrowing the GPG, systemic inequities in wealth accumulation and investment opportunities limit its impact, necessitating broader interventions.

The findings from this research not only address the key research questions but also reinforce the urgency of targeted policy measures to reduce the GPG. The study highlights the importance of integrating gender-sensitive reforms into pension systems, addressing systemic biases, and promoting financial literacy and equitable labor market participation. These interventions, tailored to country-specific contexts, are essential for achieving gender-equitable financial security in retirement.

7.3 Key Findings

The analysis presented in this research sheds light on the multifaceted nature of gender disparities in pension incomes across European countries, offering critical insights into the structural, socio-economic, and systemic factors that perpetuate these inequalities. The findings underscore not only the pervasiveness of the Gender GPG but also its complex interplay with national contexts, demographic trends, and labor market dynamics.

1. Magnitude and Evolution of the GPG

The GPG remains a pervasive issue across Europe, but its evolution over time reveals both progress and persistent challenges. The observed reduction in the GPG between 2004 and 2017, particularly in Scandinavian countries, highlights the effectiveness of progressive social policies that prioritize gender equality. These countries' pension systems often include measures such as caregiving credits, generous parental leave policies, and mechanisms to support part-time workers, all of which contribute to narrowing the GPG.

However, the persistence of substantial disparities in countries like Luxembourg and Germany signals a different story. In these contexts, pension systems are more tightly linked to earnings, disproportionately penalizing women for career interruptions and part-time work. The persistence of large gaps in these countries points to systemic shortcomings, such as insufficient recognition of unpaid caregiving work and inadequate compensation for periods of absence from the labor market. These findings emphasize the importance of tailoring reforms to address country-specific challenges while drawing lessons from the more equitable systems in Scandinavia.

The temporal progression of the GPG also underscores the importance of longitudinal monitoring. While improvements in some regions are promising, the entrenched disparities in others highlight the need for sustained, focused policy interventions. The evidence suggests that simply allowing time to pass will not resolve gender inequalities in pension outcomes; instead, proactive reforms targeting structural barriers are required to accelerate progress.

2. Socio-Economic and Demographic Influences

The analysis reveals that socio-economic and demographic factors play a critical role in shaping pension outcomes, often to the disadvantage of women. Career interruptions due to caregiving responsibilities, part-time work, and wage disparities throughout women's working lives accumulate into significant pension gaps in retirement. These factors highlight the lifecycle nature of pension inequalities, where disadvantages experienced early in women's careers compound over time.

- **Career Interruptions and Part-Time Work:** Women are more likely than men to take time off work or reduce their working hours for caregiving responsibilities. This disproportionately limits their pension contributions, particularly in earnings-based pension systems. These patterns also reduce women's access to employer-sponsored pension schemes and opportunities for salary growth, which are critical for building retirement savings.
- **Age and Lifecycle Dynamics:** The analysis shows that age has a differential impact on pension outcomes for men and women. While older age cohorts typically benefit from longer contribution periods, women often face diminished pension outcomes due to lower lifetime earnings and gaps in their employment

histories. This finding highlight how cumulative disadvantages throughout a woman's working life manifest in retirement, underscoring the importance of addressing gender disparities early in the career lifecycle.

- **Marital Status:** Marital status also influences pension outcomes, with married individuals often benefiting from dual incomes and survivor benefits. However, widowed and divorced women face significant vulnerabilities, as their financial security in retirement often relies on spousal pensions or inadequate personal contributions. These findings suggest the need for more robust safety nets for single or divorced women, who are particularly at risk of poverty in retirement.
- **Education:** While higher education is generally associated with better economic outcomes, its impact on pension outcomes varies by gender. The research suggests that educational attainment does not uniformly translate into equitable pension benefits for women. Structural biases in the labor market, such as occupational segregation and wage disparities, limit the returns on education for women, which ultimately affects their pension accumulation.

3. Systemic Discrimination in Pension Systems

The decomposition analysis provides robust evidence of systemic discrimination within European pension systems. Even after accounting for observable factors such as education, work experience, and income, significant unexplained components of the GPG remain. These unexplained disparities suggest that women are systematically undervalued within pension systems, reflecting structural inequities that go beyond individual characteristics.

This systemic discrimination may be rooted in several factors:

- **Earnings-Based Pension Systems:** Pension systems that tie benefits closely to earnings disproportionately disadvantage women, who are more likely to experience wage gaps, interrupted careers, and part-time employment. These systems often fail to account for unpaid caregiving work, which remains a significant but unrecognized contribution to society.
- **Occupational Segregation:** Women's overrepresentation in lower-paying, less secure sectors also contributes to systemic discrimination. Many pension systems fail to adequately address the disparities in pension accumulation between high-income and low-income sectors, perpetuating inequalities even in retirement.
- **Unconscious Bias in Pension Design:** Pension schemes that assume linear career trajectories with consistent contributions overlook the realities of women's working lives. Such designs implicitly penalize those with non-standard employment patterns, reinforcing gender inequalities.

These findings underscore the importance of addressing the structural biases embedded within pension systems. Policymakers must consider reforms that value unpaid caregiving, provide equitable benefits for part-time workers, and address the systemic undervaluation of women's contributions to the labor market.

4. Role of Secondary Income Sources

The research highlights the significant role of secondary income sources—such as rental income, financial assets, and long-term savings—in shaping pension outcomes. While these income streams can mitigate some disparities for women, they are insufficient to close the overall GPG.

- **Rental Income:** Rental income, often heralded as a steady supplemental source of funds, is far from equitably distributed. In many societies, women are less likely to own property than men, partly due to historical legal constraints, cultural norms, and lower lifetime earnings. This unequal distribution means women generally receive smaller rental returns, if any at all. The disparity is further exacerbated by women's greater likelihood of working part-time, taking career breaks, or assuming unpaid caregiving roles—factors that limit their ability to invest in property early in life. Even when women do own rental properties, these tend to be smaller, less valuable, or located in less profitable markets compared to those owned by men. This uneven landscape limits the potential of rental income to significantly narrow the GPG.
- **Financial Assets and Savings:** Financial assets and long-term savings are similarly skewed by systemic inequalities. Women's lower average earnings and more frequent interruptions in paid work result in smaller initial contributions to savings accounts and retirement funds. Over time, these smaller contributions lead to compounding disadvantages: women's savings generate less interest or investment returns, further widening the wealth gap. In addition, traditional gender norms often guide women toward more conservative investment strategies. While this risk-averse approach may provide stability, it often results in lower returns, leaving women less prepared for retirement. These structural inequalities mean that even women who diligently save are often unable to match the retirement income levels of their male counterparts.

- **Systemic Barriers to Wealth Accumulation:** The financial disparities rooted in secondary income sources are not merely a reflection of individual financial literacy or personal choice. Instead, they stem from systemic issues such as the persistent wage gap, occupational segregation, and unequal access to high-paying industries. Women are underrepresented in executive and leadership roles that come with higher salaries, larger bonuses, and better investment opportunities. This underrepresentation reduces their ability to accumulate wealth over a lifetime. Moreover, societal expectations often place a disproportionate caregiving burden on women, limiting their time in the workforce and their ability to contribute to retirement savings plans. These entrenched systemic barriers create a cycle in which women enter retirement with fewer resources, making them more reliant on pension benefits and more vulnerable to financial instability.

Addressing the GPG requires a comprehensive policy approach that tackles these systemic barriers head-on. Governments and employers must work to ensure equal pay, provide more robust support for women in leadership roles, and create incentives for women to invest in higher-yield opportunities. Affordable housing initiatives could increase women's access to property ownership, enabling them to benefit more fully from rental income. Financial literacy programs, particularly those tailored to women, could encourage more informed and confident investment strategies. Expanding access to flexible retirement savings plans and offering additional credits for time spent on caregiving could also help level the playing field. These measures, combined with public awareness campaigns and regulatory frameworks that promote gender equity, are essential for reducing the GPG and ensuring more secure retirements for women.

In summary, the research highlights that while secondary income streams such as rental income, financial assets, and long-term savings offer potential avenues for narrowing the GPG, their impact is constrained by deeply entrenched systemic inequalities. Addressing these disparities requires not just individual financial empowerment, but also broad-based policy initiatives that promote gender equity across all stages of life.

7.4 Contributions to Research and Policy

This study contributes to both academic research and policy debates on gender equality in retirement incomes by directly linking the empirical findings to actionable reforms. The evidence presented in Section 7.3 demonstrates that the GPG is not only persistent but is shaped by a complex interaction of institutional, socio-economic, and demographic factors. The policy implications outlined here are organised to reflect the key findings, ensuring that the research offers a coherent and practically relevant contribution.

Magnitude and Evolution of the GPG: The analysis shows that while the GPG has narrowed in some countries, particularly in Scandinavia, significant disparities persist in others, such as Germany and Luxembourg. This finding suggests that progress is not automatic but the product of deliberate institutional design. Countries with smaller gaps have implemented reforms such as generous parental leave, pension credits for caregiving, and recognition of part-time work within pension accruals. The policy implication is clear: reforms must be context-sensitive, drawing lessons from more gender-equal systems but adapting them to national pension frameworks. Contribution: By documenting divergent trajectories across countries, this study highlights the importance of sustained monitoring and country-specific reform strategies, showing that “time alone will not heal the gap.”

Socio-Economic and Demographic Influences: The findings underscore the lifecycle nature of pension inequalities, where disadvantages related to caregiving, part-time work, marital status, and lower lifetime earnings accumulate into large gaps at retirement. Policies therefore need to intervene early in women’s working lives. Expanded childcare services, re-entry programmes for women returning to work, and targeted pension top-ups during caregiving spells can mitigate long-term disparities. Moreover, the vulnerabilities of widowed and divorced women highlight the need for stronger survivor benefits and more generous minimum pensions. Contribution: The study advances the literature by framing pension inequality as a cumulative process that requires interventions across the entire life course rather than at retirement alone.

Systemic Discrimination in Pension Systems: The decomposition analysis demonstrates that even after accounting for observable characteristics, a significant unexplained component of the GPG remains, pointing to structural discrimination embedded in pension systems. This calls for reforms that recognise unpaid caregiving as pensionable service, introduce redistributive elements to counteract occupational segregation, and design accrual rules that do not implicitly assume linear, full-time careers.

Contribution: By providing empirical evidence of systemic bias, the study makes a strong case for pension reforms that go beyond individual behaviour and instead confront institutional structures that perpetuate gender inequality.

Role of Secondary Income Sources: While secondary income streams such as rental income, financial assets, and long-term savings can reduce disparities, women's lower access to these resources means they cannot substitute for equitable pensions. Policy measures should therefore aim to expand women's opportunities to accumulate wealth over their lifetimes, including affordable housing schemes to improve access to property ownership, inclusive retirement savings vehicles with flexible contribution rules, and targeted financial literacy programmes that encourage diversified investment strategies.

Contribution: This research positions the GPG within the broader context of wealth inequality, underlining that pension reforms must be complemented by wider policies addressing housing, financial inclusion, and gendered labour market outcomes.

Finally, this study contributes methodologically by combining Oaxaca–Blinder decomposition with Cohen's d effect size, offering a robust framework to measure both the drivers and magnitude of the GPG in a cross-country European context. This approach enriches the academic debate by showing how methodological innovations can illuminate hidden structural biases while also providing policymakers with clearer evidence for reform.

7.5 Limitations and Future Research

While this research provides valuable insights into the GPG across European countries, it is essential to acknowledge certain limitations that may have influenced the findings and offer directions for future research. These limitations stem primarily from the scope, methodology, and data constraints inherent in the study.

Data Limitations

1. Reliance on SHARE Data: The analysis relies on data from the Survey of Health, Ageing, and Retirement in Europe (SHARE). While SHARE is one of the most comprehensive datasets for understanding the socio-economic conditions of retirees in Europe, it may not fully capture all unobservable factors influencing pension outcomes. For instance:
    - Informal Caregiving Contributions: SHARE does not sufficiently account for the unpaid caregiving roles that many women undertake throughout their lifetimes. These contributions, often excluded from formal labor market calculations, have significant implications for women's lifetime earnings and pension contributions.
    - Occupational Segregation: Data constraints also limit the study's ability to analyse the full extent of occupational segregation, which is a critical factor in understanding gender disparities in labor market participation and, by extension, pension outcomes.
2. Endogeneity: Another methodological limitation concerns potential endogeneity, particularly in relation to education. Education may be correlated with unobserved characteristics such as motivation or ability, which also influence pension outcomes. If such factors are omitted, the coefficient on

education may be biased. Within the constraints of the SHARE data, instrumental variable (IV) or structural modelling approaches were not applied. Instead, the regressions include a broad set of socio-economic and demographic controls (e.g. age, marital status, number of children, income sources, country effects) to reduce omitted variable bias. Nevertheless, this does not fully eliminate the risk of endogeneity, and I therefore highlight it as a limitation of the study. Future research could address this more explicitly, for example through IV estimation, panel methods, or longitudinal approaches.

3. **Panel versus Cross-Sectional Design**: A further methodological limitation relates to the choice of regression design. While SHARE provides a longitudinal panel structure, this study applied repeated cross-sectional regression models with country dummies rather than fixed or random effects panel models. This approach was chosen to align with the research objective of capturing cross-country structural determinants of pension income and to maintain consistency with the Oaxaca-Blinder decomposition in Chapter 6. However, the absence of a panel specification means that unobserved individual heterogeneity could not be fully controlled, potentially reducing efficiency. Future research could apply panel regression techniques or hierarchical models to better exploit the longitudinal dimension of SHARE and strengthen causal inference.
4. Exclusion of Wave 8 and Wave 9: Another limitation of the study is the exclusion of data from SHARE Wave 8 and Wave 9 due to incompleteness and comparability issues at the time of analysis. These later waves may contain more recent data on pension reforms and changing labor market dynamics, which could offer valuable insights into recent trends in the GPG. The absence of this data may limit the study's ability to capture the full trajectory of pension

disparities, particularly considering evolving policies aimed at addressing gender inequalities in retirement.

5. Data Standardization and Cross-Country Comparability: The study's cross-country focus necessitates the use of standardized measures of pension income and socio-economic variables. However, differences in national reporting practices, pension system designs, and labor market structures may introduce measurement inconsistencies. These discrepancies could affect the robustness of cross-country comparisons and the interpretation of results.
6. Controls for Pension Systems: Institutional differences in pension systems are addressed in two ways. First, country dummies are included in the regression models, absorbing systematic cross-country variation in pension system design (e.g. defined benefit versus defined contribution structures, minimum pensions, redistributive elements). Second, the thesis provides qualitative discussion of each country's pension pillars and system characteristics. However, explicit institutional variables are not included, as comparable indicators are not consistently available across all SHARE countries. This is recognized as a limitation, although the use of country dummies ensures that individual-level effects are not conflicted with broader systemic differences in pension system structures.
7. Selection Effects: The exclusion of non-pensioners from the analysis may introduce selection effects, as this group could represent disadvantaged individuals disproportionately affected by systemic barriers to pension access, such as interrupted labor market participation or employment in the informal sector. While this study focuses on individuals with measurable pension incomes to analyse income-related disparities, future research could explore

the characteristics and circumstances of excluded non-pensioners. Such an analysis would provide a deeper understanding of their influence on GPG estimates and offer insights into the broader systemic barriers that contribute to gendered inequalities in retirement security.

Methodological Limitations

1. **Omitted Variable Bias:** The potential for omitted variable bias remains a key concern. Certain factors that significantly influence pension outcomes—such as health shocks, informal caregiving responsibilities, or access to financial planning resources—were not included due to data unavailability. The absence of these variables may have affected the explanatory power of the regression models and the decomposition analysis.
    - **Caregiving and Career Interruptions:** Direct measures of caregiving responsibilities or career interruptions are not available in the SHARE imputed datasets used for this study. These factors are widely recognised in the literature as central to explaining gendered pension outcomes but are difficult to capture quantitatively. To partially address this gap, the number of children was included as a control, serving as a proxy for caregiving demands and potential career breaks, particularly for women. This is an indirect measure and is therefore acknowledged as a limitation. Future research could build on this by employing longitudinal or administrative data that explicitly capture career breaks and caregiving histories.
2. **Panel versus Cross-Sectional Design:** Another methodological limitation relates to the choice of regression framework. Although SHARE has a longitudinal panel structure, this study employed repeated cross-sectional

regressions with country dummies rather than fixed- or random-effects panel models. This approach was selected to capture structural cross-country determinants of pension income and to maintain consistency with the Oaxaca-Blinder decomposition in Chapter 6, which relies on pooled cross-sectional data. While appropriate for the research objectives, this design cannot fully control for unobserved individual heterogeneity and may be less efficient than a panel specification.

As a robustness exercise, separate regressions were estimated for individual countries. The results, though not reported in detail, were broadly consistent with the pooled specification, particularly in terms of the sign and significance of the gender coefficient. Nonetheless, the absence of reported country-specific regressions is recognised as a limitation, as such models can provide more granular insights and reduce estimation error. Future research should therefore complement pooled specifications with systematic country-level or panel-based models to enhance efficiency and inference.

3. **Quantitative Focus:** While the study employs robust quantitative methods—namely multivariate regression and the Oaxaca-Blinder decomposition—it does not incorporate qualitative perspectives. This limits the ability to capture the lived experiences of retirees and the social and psychological dimensions of pension inequality. For example:
    - How do women perceive the fairness of pension systems?
    - What strategies do individuals use to mitigate financial insecurity in retirement?

    The inclusion of qualitative evidence alongside econometric modelling could provide a more comprehensive understanding of gender disparities in pension outcomes.

4. **Intersectionality:**

   The analysis focuses primarily on gender as the central axis of inequality and does not fully account for its interaction with other dimensions such as race, ethnicity, disability, or migration status. These intersecting identities can exacerbate vulnerabilities and create unique barriers to financial security in retirement. Addressing intersectionality in future research would enable a richer and more inclusive analysis of the pension gap.

5. **Treatment of Categorical Variables:** A further methodological consideration relates to the treatment of categorical variables. Variables such as marital status and number of children were entered into the regression model using multiple indicator categories. In conventional econometric practice, the K–1 rule would apply, with one category omitted as the reference group to avoid perfect multicollinearity. In this study, however, all categories were retained in the specification. While this represents a technical shortfall, it does not materially affect the substantive interpretation of the results. Future research should adopt a stricter application of the K–1 rule to improve efficiency and ensure closer adherence to econometric standards.

Temporal Limitations

1. 16-Year Period (2004–2017): While the study spans a significant period, capturing trends and policy changes over time, it may not fully account for the long-term impacts of more recent reforms. Pension systems often have delayed

effects, meaning that changes introduced in the late 2010s may not yet be fully reflected in the observed data.

2. COVID-19 Pandemic: The dataset predates the COVID-19 pandemic, which has had profound implications for labor markets, caregiving responsibilities, and retirement security. The pandemic disproportionately affected women, particularly in terms of employment and caregiving roles, and its long-term impact on the GPG remains an area for future research.

Future Research Directions

1. Incorporating Qualitative Approaches: Future studies could complement quantitative analyses with qualitative methods, such as interviews, focus groups, or case studies, to capture the lived experiences of retirees. These approaches could provide valuable insights into the challenges faced by women in navigating pension systems and the strategies they use to address financial insecurity.
2. Intersectional Analysis: Expanding the analysis to include intersectionality could uncover how multiple dimensions of identity—such as race, ethnicity, disability, and migration status—interact with gender to influence pension outcomes. This approach would provide a more nuanced understanding of inequalities within and across different demographic groups.
3. Inclusion of SHARE Wave 8 and Wave 9: Incorporating data from SHARE Wave 8 and Wave 9, once it becomes completer and more reliable, would allow for a more up-to-date analysis of the GPG. These waves may capture the effects of recent reforms, such as increased caregiving credits or changes in

retirement age, as well as the impact of external shocks like the COVID-19 pandemic.

4. Policy Evaluation Studies: Future research could focus on evaluating the effectiveness of specific pension reforms in reducing the GPG. For example, analysing the impact of caregiving credits, gender-sensitive tax policies, or part-time work protections could provide actionable insights for policymakers.
5. Regional and Global Comparisons: While this study focuses on Europe, expanding the analysis to include other regions could reveal valuable comparative insights. For instance, how do pension outcomes for women in Europe compare to those in North America, Asia, or Africa? Such comparisons could identify best practices and global trends in addressing pension inequalities.
6. Dynamic Modelling: Developing dynamic models that incorporate life-course data—tracking individuals' earnings, caregiving responsibilities, and pension contributions over time—could provide a more comprehensive understanding of the cumulative disadvantages that women face in retirement.
7. Impact of Additional Income Sources: Building on the findings related to secondary income sources, future research could delve deeper into the role of financial literacy, wealth accumulation, and investment strategies in shaping pension outcomes. Understanding these factors could inform policies aimed at promoting gender equity in financial planning and retirement savings.

7.6 Closing Remarks

The findings presented in this thesis provide compelling evidence for the persistent structural inequalities that underpin the GPG across Europe. By examining both observable and unobservable factors through rigorous quantitative methodologies, the study highlights not only the systemic barriers women face in achieving financial security in retirement but also the broader societal and economic implications of these disparities.

At its core, this research emphasizes that the GPG is not simply a byproduct of individual decisions or behaviors but rather a reflection of deep-rooted inequities embedded within labor markets, pension systems, and social norms. It sheds light on how cumulative disadvantages, such as wage gaps, interrupted career paths, and caregiving responsibilities, continue to impact women disproportionately throughout their lifetimes, ultimately leading to unequal pension outcomes. Moreover, the role of secondary income sources, while valuable in supplementing retirement income, proves insufficient in bridging this gap, reinforcing the need for systemic policy reform. This work is particularly timely as European countries grapple with demographic shifts, economic challenges, and evolving labor markets. The increasing participation of women in the workforce has not translated into equitable retirement outcomes, demonstrating the limitations of existing policies and the need for innovative, forward-thinking solutions. The insights gained from this analysis underscore the necessity of aligning pension systems with modern family structures and gender roles, ensuring that they are inclusive, adaptive, and fair.

While the findings have immediate implications for policy reform, they also provide a foundation for broader discussions around gender equality and social justice. The research challenges policymakers, employers, and stakeholders to rethink how pension systems are designed and how gendered dynamics in the labor market are addressed. It calls for targeted interventions that not only rectify historical inequalities but also proactively prevent future disparities by embedding gender equity into all aspects of economic policy.

By framing the GPG as a multifaceted issue that intersects with broader socio-economic challenges, the study paves the way for a deeper understanding of how financial systems can evolve to promote fairness and inclusivity. The evidence presented here should serve as a wake-up call to governments and institutions across Europe to act decisively, recognizing that addressing gender disparities in pensions is not only a moral imperative but also an economic necessity. Equalizing pension outcomes will improve women's financial independence in retirement and strengthen societal resilience, economic growth, and overall well-being.

Looking forward, this thesis aims to contribute to a growing body of knowledge that inspires continued academic inquiry. The questions raised and findings shared throughout this research serve as a starting point for future exploration into the intersectionality of gender with other social determinants and the long-term impacts of policy innovations. In doing so, the work hopes to inspire a collective commitment to achieving not just gender equity in pensions but a more inclusive, just, and equitable society for all.

NOTES

- The SHARE data collection has been funded by the European Commission through various framework programs, including the 5th framework program (project QLK6-CT-2001-00360), the 6th framework program (projects SHARE-I3, RII-CT-2006-062193, COMPARE, CIT5-CT-2005-028857, and SHARE-LIFE CIT4-CT-2006-028812), the 7th framework program (projects SHARE-PREP No 211909, SHARE-LEAP No 227822, M4 No 261982, and DASISH No 283646), and the Horizon 2020 program (projects SHAREDEV3 No 676536, SERISS No 654221, SSHOC No 823782, SHARE-COHESION No 870628, SHARE-COVID19 No 101015924, RItrain No 654156, and ERIC Forum No 823798). Additional funding was provided by the German Federal Ministry of Education and Research (BMBF) and the US National Institute on Aging. (see www.share-project.org (accessed on 21 July 2024)).

- Despite the SHARE database comprising eight waves, this paper focuses on Wave 6. To analyse additional sources of income, Wave 6 offers the most precise dataset, making it ideal for our analysis of the predicted GPG.
- Pension incomes in the SHARE database are reported as net values after personal income taxes from Wave 2 onwards, excluding Wave 1. Consequently, because men, on average, have higher incomes than women, the GPG may be underestimated in countries where progressive personal income taxes apply to pension benefits.
- In SHARE Waves 6 and 7, the Netherlands did not participate in the regular SHARE waves but instead conducted a mixed model experiment. Therefore, data from the Netherlands is not included in this analysis.

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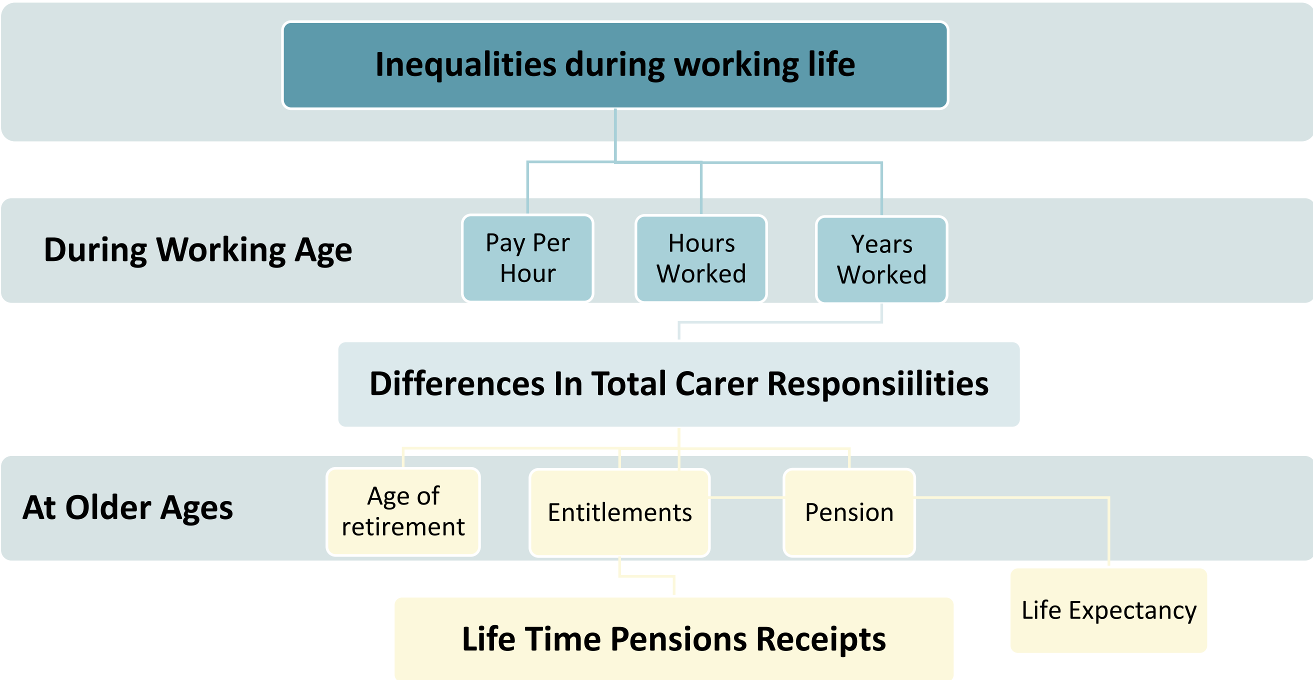
Appendices

Appendix 1.1: Materialization of Pension Gap.



Source: Own Graph based on Unequal Ageing in Europe (Gianni Betti and other 2015).

The chart above illustrates the key factors contributing to the GPG, tracing how inequalities develop during working life and persist into older ages, ultimately shaping lifetime pension receipts.

1. **Inequalities During Working Life**: The foundation of pension disparities stems from inequalities in pay per hour, hours worked, and years worked. Women often face lower wages for similar work (gender pay gap), reduced working hours due to part-time employment, and shorter career durations caused by caregiving responsibilities or career interruptions.
2. **Differences in Total Carer Responsibilities**: These responsibilities amplify the impact of working-life inequalities. Women are disproportionately tasked with caregiving roles, leading to further interruptions in career progression, reduced earnings, and lower pension contributions.

3. **At Older Ages**: The outcomes of earlier disparities materialize in retirement, influencing pension entitlements and income. Critical factors include:
    - **Age of Retirement**: Differences in retirement age, shaped by pension system rules or personal circumstances.
    - **Entitlements**: Variations in eligibility for pensions, determined by contribution history, career length, and employment conditions.
    - **Pension Amount**: The accumulated pension income, reflecting the disparities in earnings and contributions over the working life.
4. **Life Expectancy**: Longer life expectancies for women further exacerbate the pension gap, as pensions are spread over more years, often resulting in lower annual payouts.
5. **Lifetime Pension Receipts**: The culmination of these factors results in significant disparities in lifetime pension income between genders, highlighting the persistence of inequalities from working life into retirement.

This framework underscores the interconnected nature of the factors driving the GPG, offering a conceptual lens to interpret the quantitative findings in the thesis.

Chapter: 3 – Data Preparation

Appendix 2.1: Countries & Fieldwork times in SHARE (W1_W8).

Country	W1	W2	W4	W5	W6	W7	W8
Austria	2004	2006/07	2011	2013	2015	2017	
Germany	2004	2006/07	2022/12	2013	2015	2017	
Sweden	2004	2006/07	2011	2013	2015	2017	
Netherlands	2004	2007	2011	2013	*[26]	*	
Spain (Castilian)	2004	2006/07	2011	2013	2015	2017	
Spain (Catalan)	2004	2007	2011	2013	2015	2017	
Spain Girona (Catalan / Castilian)				2013	2015	2017	
Spain Girona Catalan				2013	2015	2017	
Spain Girona Castilian				2013	2015	2017	
Italy	2004	2006/07	2011	2013	2015	2017	
France	2004/05	2006/07	2011	2013	2015	2017	
Denmark	2004	2006/07	2011	2013	2015	2017	
Greece	2004/05	2007			2015	2017	
Switzerland (German)	2004	2006/07	2011	2013	2015	2017	
Switzerland (French)	2004	2006/07	2011	2013	2015	2017	
Switzerland (Italian)	2004	2006/07	2011	2013	2015	2017	
Belgium (French)	2004/05	2006/07	2011	2013	2015	2017	
Belgium (Flemish)	2004/05	2006/07	2011	2013	2015	2017	
Israel (Hebrew)	2005/06	2009/10		2013	2015	2017	
Israel (Arabic)	2005/06	2009/10		2013	2015		
Israel (Russian)	2005/06	2009/10		2013	2015		
Czech Republic	-		2011	2013	2015	2017	
Poland	-		2011/12		2015	-	If used
Ireland	-					2017	
Luxembourg (German)	-			2013	2015	2017	
Luxembourg (French)	-			2013	2015	2017	
Hungary			2011				
Portugal	-				2015	2017/18	
Slovenia	-			2013	2015	2017	
Estonia (Estonian or Russian)	-			2013 (XT only)	2015	2017	
Estonia (Estonian)	-			2013	2015	2017	
Estonia (Russian)	-			2013	2015	2017	
Croatia	-				2015	2017	
Lithuania	-					2017	
Bulgaria	-					2017	
Cyprus	-					2017	
Finland (Finnish)	-					2017	
Finland (Swedish)	-					2017	
Latvia (Latvian)	-					2017	
Latvia (Russian)	-					2017	
Malta (Maltese)	-					2017	
Malta (English)	-					2017	
Romania	-					2017	
Slovakia						2017	

Source: SHARE, Ageing and Retirement in Europe (Release Guide 7-1-0 – June 2020).

[26] In SHARE W6 & W7 the Netherlands did not participate in the regular SHARE Wave but conducted a mixed model experiment.

W1 Data: This SHARE main questionnaire consists of 20 modules on health, socioeconomics and social networks. All data are collected by face-to-face, computer-aided personal interviews (CAPI), supplemented by a self-completion paper and pencil questionnaire (Börsch-Supan, A. (2019).

W2 Data: The SHARE 2006 primary questionnaire consists of 22 modules. In addition, an 'End of Life' interview was conducted for deceased respondents. All data are obtained using computer-assisted personal interviews (CAPI) and self-administered paper and pencil questionnaires. Not all responders are required to complete all sections of the questionnaire. The modules of the questionnaire that refer more to the couple or household than to the individual are only to be completed by a designated financial, family, or housing respondent.

W3 Data: It is essential to note that W3 (main release) is not included in the analysis because W3 on people's life histories (SHARELIFE) collected considerably different information in terms of structure and content than the usual Waves.

W4 Data: Estonia, Hungary, Portugal, and Slovenia joined SHARE W4 in 2010, which was the third normal panel wave of the study after the SHARELIFE life history questionnaire. The scientific usage file was released in November 2012, along with a brand-new social network module based on a name generator approach, making SHARE the first international survey to give thorough and comparative social network information.

W5 Data: The Fifth Wave of SHARE fieldwork was completed in November 2013. The scientific report has additional sections on social exclusion, new modules on early childhood conditions and workplace computer use, and an interviewer survey. Several modules with generated variables, including imputations and weights, are also included in the release. The following nations collected data and contributed to the scientific report:

Austria, Belgium, the Swiss, the Czech Republic, Germany, Denmark, Estonia, Spain, France, Israel, Italy, Luxembourg, the Netherlands, and Sweden.

W6 Data: In November 2015, the Sixth Wave of SHARE fieldwork was completed. W6's scientific release includes social network information for the second time following W4's publication. Additionally, the release features newly generated variable modules such as gv children. Moreover, Croatia participated in W6 of SHARE for the first time. The following nations are included in the scientific report:

Austria, Belgium, the Czech Republic, Croatia, Denmark, Estonia, France, Germany, Greece, Israel, Italy, Luxembourg, Poland, Portugal, Spain, Switzerland, and Slovenia.

W7 Data: W7 data collection took place primarily in 28 countries in 2017 - complete coverage of the EU was achieved by adding eight new countries to SHARE (Mentioned in Bold on the table above).

The W7 questionnaire includes a SHARELIFE questionnaire for respondents who did not participate in W3 (the initial SHARELIFE wave) and a standard panel questionnaire for respondents who have already completed a SHARELIFE interview. The documents "Module flow W7" and "Who gets which question in SHARE W7" below provide additional information about the questionnaire structure.

Structure of the W7 Interview

Respondent type	Interview sections		No. of interviews
Respondent participated in Wave 3	**Regular Panel** DN CH PH BR CF MH HC EP GS SP FT CO AS HO HH AC EX IV		13.959 (18%)
Respondent did not participate in Wave 3	**SHARELIFE** RC RP RA CC RE WQ DQ FS HS RH GL	**Regular Panel** (condensed)	62.561 (82%)

Source: SHARE, Ageing and Retirement in Europe.

W8 Data: The release is a beta version including data obtained between June and August 2020 via computer-assisted telephone interviews (CATI) in the SHARE COVID-19 Survey. Additional data from SHARE W8 CAPI collected between October 2019, and March 2020 has been released in spring 2021 (Börsch-Supan, A. (2020). The sample for the revised COVID-19 CATI instrument consisted of:

- Panel members who had not been questioned in W8 before the suspension of fieldwork and
- Panel members who had been interviewed in W8.

Both respondent groups got the same questionnaire; the only difference was that panel members who had not been questioned face-to-face during W8 were asked about changes in household composition since their previous interview (Börsch-Supan, A. (2020).

Appendix 2.2: Who answers which modules of the SHARE questionnaire?

	Name	All Respondent	Financial Respondent	Housing Respondent	Family Respondent	Non Proxy Section
CV	Cover screen	ü				
DN	Demographics	ü				
PH	Physical Health	ü				
BR	Behavioural Risks	ü				
CF	Cognitive Function	ü				ü
MH	Mental Health	ü				ü[27]
HC	Health Care	ü				
EP	Employment & Pensions	ü				
GS	Grip Strength	ü				ü
WS	Walking Speed	ü				ü
CH	Children				ü	
SP	Social Support				ü	
FT	Financial Transfers		ü			
HO	Housing			ü		
HH	Household Income			ü		
CO	Consumption			ü		
AS	Assets		ü			
AC	Activities	ü				ü
EX	Expectations	ü				ü
IV	Interviewer Observations					

Source*:* SHARE, Ageing and Retirement in Europe

The SHARE questionnaire is designed with a modular structure, where different sections are directed to specific types of respondents within each household. This design minimizes respondent burden, improves accuracy in responses, and ensures that specialized knowledge (e.g., about household finances or housing) is collected from the most informed individual. Appendix above provides an overview of the distribution of modules across respondents.

[27] parts

Analytical Note

- **All respondents:** Most core modules (e.g., demographics, physical and mental health, employment and pensions) are administered to every individual. This provides a harmonised baseline across the full sample of adults aged 50+.
- **Financial respondent:** A designated financial respondent within each household answers detailed modules on **income, assets, consumption, and financial transfers**. Concentrating financial questions in one respondent reduces measurement error and ensures consistency within households.
- **Housing respondent:** Housing-related modules (e.g., dwelling characteristics, household income) are addressed to the housing respondent, typically the household member most knowledgeable about the living arrangements.
- **Family respondent:** Modules on children and social support are answered by the family respondent, ensuring more accurate reporting of intergenerational transfers, caregiving, and kinship ties.
- **Non-proxy sections:** Some modules, particularly those involving **cognitive tests, grip strength, walking speed, and aspects of mental health**, must be answered by the respondent personally and cannot be completed by a proxy. This design safeguards validity in domains that cannot be reliably reported by others.
- **Interviewer observations:** Finally, interviewers record contextual information, such as respondent behaviour and interview conditions, which supports data quality assessments and subsequent cleaning.

By distributing modules to specialised respondents, SHARE reduces missingness and non-response bias at source. This structured approach also explains why the imputation procedures applied by the SHARE team can be targeted more effectively, as they are dealing with systematically collected and well-partitioned information. Consequently, the datasets provided to researchers are harmonised, ready for analysis, and require no additional cleansing.

Appendix 2.3: Frequencies in NPI (Individuals: Over 65 Years old – NPI>0).

	W1		W2		W4		W5		W6		W 7	
Country	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**
Austria	1260	1820	1240	1655	5095	6080	4934	5830	4389	5397	790	1150
Germany	2719	2943	2735	2839	2354	2170	6135	5862	5617	5104	1633	1617
Sweden	3143	3253	3224	3384	2922	3275	6541	6972	6199	7005	1990	2684
Netherlands	2530	2766	2538	2682	2988	3312	4894	5375				
Spain	2436	2106	2653	1917	4487	3198	8070	6415	7545	6379	2164	1972
Italy	2330	2361	3355	2984	4128	3774	5331	5020	6296	5924	2763	2734
France	2733	3507	2684	3471	5447	7298	4759	6520	4345	5963	1765	2413
Denmark	1385	1839	2315	2884	2193	2635	4270	4819	4080	4550	1935	2471
Greece	2410	2739	2883	3095					5064	4399	2744	2377
Switzerland	946	1093	1375	1725	3975	4388	3720	4034	3895	4250	1280	1590
Belgium	3645	3279	3060	2935	4779	4995	5641	5858	6229	6594	2714	2945
Israel	2245	2366	2813	3287			2808	3476	2585	3366		
Czech Republic			2209	2995	5189	7233	6018	8390	5915	8505	1520	2170
Poland			2239	2610	1968	2210			1910	2379	1711	2165
Ireland			883	884								
Hungary					2758	3605						
Luxembourg							1568	1475	1700	1555		
Portugal					1530	1697			2048	2078		
Slovenia					2568	3160	2897	3737	4855	5803		
Estonia					6680	10835	6123	9998	5805	9890		
Croatia									2216	2380		
Total	27782	30072	36206	39347	59061	69865	73709	83781	80693	91521	23009	26288
Total	**57854**		**75553**		**128926**		**157490**		**172214**		**49297**	

Source: Own Estimation from SHARE (Main Release 7.1.0). For W1 (2004/05),W2 (2006/07), W4 (2011),W5 (2013),W6 (2015),W7 (2017).

The table represents the number of male (M) and female (W) participants across different survey waves (W1 to W7) in various countries. These frequencies highlight participation trends, gender representation, and the evolution of data collection over time. Below is an elaboration:

1. Country-Specific Trends

- **Austria**:
  - A steady increase in female participation is observed across waves. For example, in W1, women outnumber men (1820 vs. 1260), and this gap widens further in W6 and W7.
  - Male participation fluctuates but remains consistent relative to female participation, reflecting sustained engagement across the waves.
- **Germany**:
  - Participation levels are more balanced between genders. Both men and women show consistent responses across the waves, with slight variations, e.g., 2719 males vs. 2943 females in W1.
  - Male participation peaks in W5 (5617), while female participation is highest in W4 (5862).
- **Sweden**:
  - Participation is high, and females consistently outnumber males in later waves, e.g., W6 (7005 females vs. 6199 males).
  - The gap between male and female participation widens progressively, indicating increasing female representation in recent waves.
- **Netherlands**:
  - Male and female participation is relatively balanced in earlier waves, with a slight increase in female representation, e.g., W4 (5375 females vs. 4894 males).
  - Data for later waves (W6 and W7) is missing, which could indicate lower data availability or participation.
- **Spain**:

    - There's significant variation between waves, with female participation peaking in W3 and W4 (3198 and 6415, respectively) and declining slightly in W6 and W7.
    - Male participation is highest in W4 (8070) and gradually declines in subsequent waves.
- **Italy**:
    - Male and female participation shows a consistent upward trend across waves, with W6 being the highest (6296 males vs. 5924 females).
    - The gender gap remains small, indicating balanced representation over time.
- **France**:
    - Female participation is consistently higher than male participation across all waves. For example, in W2, females significantly outnumber males (3507 vs. 2733).
    - The trend continues in later waves, peaking in W6 (5963 females vs. 4345 males).
- **Denmark**:
    - Male and female participation trends are comparable, with a noticeable increase in W3 and W4. For example, in W4, there are 4819 females vs. 4270 males.
    - Participation declines slightly in W6 and W7, but gender representation remains consistent.
- **Greece**:
    - Male and female participation peaks in W4 but declines by W6 and W7. For instance, in W7, there are 4399 females vs. 5064 males.

    - The data suggest fluctuating engagement levels across waves.
- **Switzerland**:
    - Male participation remains consistent across waves, but female participation shows an increasing trend, e.g., W6 (4250 females vs. 3895 males).
    - The gender gap narrows in later waves, indicating balanced representation.
- **Belgium**:
    - High participation is observed for both genders across all waves, with females consistently outnumbering males, e.g., W6 (6594 females vs. 6229 males).
    - Participation peaks in W6, reflecting strong engagement.
- **Israel**:
    - Female participation increases across waves, with the highest representation in W6 (3366 females vs. 2585 males).
    - Male participation is more consistent, with minimal variation across waves.
- **Czech Republic**:
    - Female participation shows a sharp increase in later waves, e.g., W6 (8505 females vs. 5915 males).
    - Male representation is relatively lower in earlier waves but grows steadily.
- **Poland**:
    - Participation levels are lower compared to other countries, but there is a slight increase in W6 and W7, e.g., W7 (2165 females vs. 1711 males).

- **Ireland**:
  - Participation is minimal, with no significant gender gap observed, e.g., W2 (884 males vs. 883 females).
- **Hungary**:
  - Limited data is available, with the highest participation in W4 (3605 females vs. 2758 males).
- **Luxembourg**:
  - Participation levels are relatively low, with minor gender differences, e.g., W6 (1700 males vs. 1555 females).
- **Portugal**:
  - Male and female participation is similar, with consistent responses, e.g., W6 (2048 females vs. 2078 males).
- **Slovenia**:
  - Female participation increases significantly in later waves, e.g., W6 (5803 females vs. 4855 males).
- **Estonia**:
  - A noticeable gender gap emerges, with significantly higher female participation in all waves, e.g., W6 (9890 females vs. 5805 males).
- **Croatia**:
  - Limited data is available, with marginal differences between male and female participation in W6 and W7.

2. Total Participation Across Waves

- **W1 to W7 Totals**:

- Overall, female participation consistently outnumbers male participation, with significant differences in W6 (91521 females vs. 80693 males).
- The gap between genders widens progressively, suggesting increasing female engagement over time.

- **Grand Totals**:
  - Total male participation: 172,214.
  - Total female participation: 157,490.
  - Despite an overall balance, certain countries and waves show notable gender disparities.

Appendix 2.4: Frequencies in NHI & NII (Individuals: Over 65 Years old – NHI>0).

	W1		W2		W4		W5		W6		W7	
Country	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**
Austria	1275	1630	1240	1365	5072	5288	4889	5206	4324	4777	795	1040
Germany	2741	2703	2805	2525	2324	1905	6050	5423	5485	4798	1641	1604
Sweden	3095	3214	3150	3270	2786	3175	6111	6858	5809	6662	2005	2655
Netherlands	2495	1396	2437	1377	2897	2130	4675	3894				
Spain	2403	948	2781	1071	4535	1853	8120	4673	7449	4379	2148	1131
Italy	2365	1705	3397	2038	4220	2709	5512	3823	6275	4443	2943	2250
France	2723	3065	2649	3027	5378	6575	4700	6020	4290	5494	1825	2211
Denmark	1370	1770	2153	2684	1960	2416	3840	4380	3691	4285	1730	2335
Greece	2420	1996	2928	2010					5176	3004	2809	1804
Switzerland	891	1018	1260	1315	3719	3552	3395	3280	3474	3419	1150	1353
Belgium	3705	2979	3038	2455	4647	4151	5500	5003	5998	5731	2690	2645
Israel	1910	1489	2288	2137			2318	2261	2148	2142		
Czech Republic			2199	2945	5170	7103	6024	8182	5764	8264	1515	2130
Poland			2222	2452	1945	2094			1899	2197	1685	2074
Ireland			804	569								
Hungary					2688	3498						
Portugal					1843	1857			2074	1919		
Luxembourg							1512	850	1655	945		
Slovenia					2589	2850	2998	3349	4780	1919		
Estonia					5820	9871	5470	9218	5212	5277		
Croatia									2276	9051		
Total	27393	23913	35351	31240	57593	61027	71114	72420	77779	78706	22936	23232
Total	**51306**		**66591**		**118620**		**143534**		**156485**		**46168**	

Source: Own Estimation from SHARE (Main Release 7.1.0). For W1 (2004/05),W2 (2006/07), W4 (2011),W5 (2013),W6 (2015),W7 (2017).

The table above provides the frequencies of male (M) and female (W) respondents across survey waves (W1 to W7) for various countries. The data highlights participation trends over time, gender representation, and overall changes in survey engagement.

Analysis of the Data

1. General Participation Trends

- **Total Participation**:
  - Male participation is slightly higher than female participation across most waves, though the gap narrows significantly in later waves.
  - Grand totals across all waves:
    - **Males**: 156,485
    - **Females**: 143,534
    - The cumulative male-female difference is about 12,951, reflecting a modest overall imbalance.
- **Wave-Specific Trends**:
  - **Wave 1 (W1)**:
    - Male participation: 27,393
    - Female participation: 23,913
    - Male participation exceeds female participation in nearly all countries, with the most significant differences in countries like Sweden, Austria, and Belgium.
  - **Wave 6 (W6)**:
    - Male participation: 77,779
    - Female participation: 78,706

        - By W6, female participation slightly surpasses male participation, reflecting growing gender equity in survey responses.
    - **Wave 7 (W7)**:
        - Male participation: 22,936
        - Female participation: 23,232
        - Male and female participation are nearly equal in this wave, highlighting balanced representation.

2. Country-Specific Trends

- **Austria**:
    - Male and female participation are consistent, with males slightly outnumbering females in earlier waves (e.g., W1: 1,275 males vs. 1,630 females).
    - Participation peaks in W6 (4,324 males vs. 4,777 females), after which it declines significantly in W7.
- **Germany**:
    - Male participation is consistently higher than female participation across waves.
    - Participation peaks in W5 and W6 but decreases slightly in W7 (1,641 males vs. 1,604 females).
- **Sweden**:
    - Sweden shows the highest participation among all countries, with women consistently outnumbering men in later waves.

  - For example, in W6, there are 6,662 females compared to 5,809 males, reflecting strong female engagement.

- **Netherlands**:
  - Male and female participation is relatively balanced, but data is missing for W6 and W7, making it difficult to identify long-term trends.

- **Spain**:
  - Female participation is significantly lower than male participation in earlier waves (e.g., W1: 948 females vs. 2,403 males).
  - However, female engagement increases in later waves, with a peak in W6 (4,379 females vs. 7,449 males).

- **Italy**:
  - Male and female participation shows steady growth until W6, with participation peaking at 6,275 males and 4,443 females.
  - There is a notable gender imbalance, with males consistently outnumbering females across all waves.

- **France**:
  - Female participation exceeds male participation across most waves. For example, in W6, there are 5,494 females compared to 4,290 males.
  - The consistent engagement of females highlights strong representation throughout the survey.

- **Denmark**:
    - Male participation is slightly higher than female participation in earlier waves, but the gap narrows significantly by W6.
    - Participation peaks in W6 (4,285 females vs. 3,691 males).
- **Greece**:
    - Male participation is consistently higher than female participation, with the most significant gap observed in W6 (5,176 males vs. 3,004 females).
    - Participation declines in later waves, particularly for females.
- **Switzerland**:
    - Male and female participation is relatively balanced, with male participation peaking in W6 (3,474).
    - Female participation shows a modest increase in later waves but remains slightly lower than male participation.
- **Belgium**:
    - Male and female participation is nearly equal, with consistent engagement across all waves.
    - Both genders show strong representation, with peak participation in W6 (5,998 males vs. 5,731 females).
- **Israel**:
    - Female participation increases steadily across waves, surpassing male participation in later waves.

  - Data for W6 and W7 is missing, making it challenging to identify trends in the most recent waves.

- **Czech Republic**:
  - Female participation is significantly higher than male participation in later waves, e.g., W6 (8,264 females vs. 5,764 males).
  - The country shows the strongest growth in participation over time.
- **Poland**:
  - Male and female participation is relatively balanced, but overall levels are lower compared to other countries.
  - Participation peaks in W6 (2,197 females vs. 1,899 males).
- **Ireland**:
  - Participation is low for both genders, with a slight male predominance in W2 (804 males vs. 569 females).
- **Portugal**:
  - Female participation surpasses male participation in W6 (1,919 females vs. 2,074 males), with data missing for earlier waves.
- **Slovenia**:
  - Female participation increases significantly in W6 (1,919 females vs. 4,780 males), reflecting strong late-wave engagement.
- **Estonia**:

- Female participation consistently exceeds male participation, with the most significant gap observed in W6 (9,218 females vs. 5,470 males).

- **Croatia**:
    - Data for earlier waves is missing, but in W6, female participation is significantly higher than male participation (9,051 females vs. 2,276 males).

3. Observations Across Waves

- **Increasing Female Participation**: Female participation grows steadily across waves, often outnumbering male participation in later waves, as seen in Austria, France, and Sweden.
- **Declining Male Participation**: Male participation shows a slight decline in the final wave (W7), while female participation remains steady or increases.
- **Country Variations**: Countries like Sweden, France, and the Czech Republic show consistent engagement, while others, such as Ireland and Hungary, exhibit lower participation levels.

Appendix 2.5: Frequencies in NIIW (Individuals: Over 65 Years old – NIIW>0).

	W 2		W 4		W 5		W 6		W 7	
Country	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**
Austria	1245	1665	5118	6121	4949	5876	4415	5435	790	1150
Germany	2765	2844	2370	2183	6195	5899	5645	5154	1640	1634
Sweden	3250	3419	2955	3305	6631	7069	6294	7115	2005	2694
Netherlands	2539	2682	2990	3319	4907	5385				
Spain	2673	1962	4547	3263	8289	6571	7631	6442	2210	2003
Italy	3375	2989	4198	3829	5408	5055	6413	5979	2808	2754
France	2689	3486	5471	7319	4794	6530	4375	5998	1780	2419
Denmark	2345	2894	2215	2640	4375	4839	4150	4580	1975	2490
Greece	3033	3125	3990				5272	4455	2929	2412
Switzerland	1375	1730	4820	4420	3750	4045	3920	4255	1290	1595
Belgium	3075	2940		5029	5679	5891	6244	6664	2719	2945
Israel	2930	3308			3133	3535	2764	3442		
Czech Republic	2240	2995	5225	7258	6044	8400	5935	8520	1520	2170
Poland	2240	2615	1978	2220			1940	2390	1746	2180
Ireland	909	906								
Hungary			2765	3620						
Portugal			1620	1762			2079	2108		
Luxembourg					1584	1520	1715	1570		
Slovenia			2589	3190	2912	3747	4875	5830		
Estonia			6700	10840	6135	10010	5810	9900		
Croatia							2271	2405		
Total	36683	39560	45877	31979	64154	69095	64998	52725	18977	22096
Total	**76243**		**77856**		**133249**		**117723**		**41073**	

Source: Own Estimation from SHARE (Main Release 7.1.0). For W1 (2004/05),W2 (2006/07), W4 (2011),W5 (2013),W6 (2015),W7 (2017).

Country-Specific Trends

Austria:

- Male and female participation is relatively balanced across waves, with females consistently outnumbering males slightly.
- Participation peaks in W5 (male: 4,949; female: 5,876), then declines steadily through W7.

Germany:

- Male participation is consistently higher than female participation across all waves.
- Participation peaks in W5 (male: 6,195; female: 5,899), followed by a decline in W6 and W7.

Sweden:

- Sweden shows one of the highest participation levels, with females consistently outnumbering males in later waves.
- Female participation peaks in W6 (7,115 females vs. 6,294 males), reflecting strong engagement.

Netherlands:

- Male and female participation is relatively balanced, with a peak in W5 (male: 4,907; female: 5,385).
- Data is missing for W6 and W7, limiting further analysis.

Spain:

- Female participation increases significantly in later waves, with a peak in W5 (male: 8,289; female: 6,571).
- The gender gap narrows in W7 (male: 2,210; female: 2,003).

Italy:

- Male participation is consistently higher than female participation, with peaks in W5 (male: 5,408; female: 5,055) and W6 (male: 6,413; female: 5,979).
- Participation levels remain relatively high across all waves.

France:

- Female participation consistently exceeds male participation, peaking in W5 (female: 6,530 vs. male: 4,794).
- Participation decreases slightly in W6 and W7, but the gender gap persists.

Denmark:

- Male participation is consistently higher than female participation, with a peak in W6 (male: 4,150; female: 4,580).
- Both genders show a gradual decline in W7.

Greece:

- Male participation is significantly higher than female participation, peaking in W6 (male: 5,272; female: 4,455).
- Participation decreases noticeably in W7.

Switzerland:

- Male and female participation is relatively balanced across waves.
- Both genders peak in W5 (male: 3,750; female: 4,045), with slight declines in W6 and W7.

Belgium:

- Male and female participation are comparable, with peak responses in W6 (male: 6,244; female: 6,664).
- Female participation remains higher in later waves.

Israel:

- Female participation consistently exceeds male participation, with the highest numbers in W5 (female: 3,535 vs. male: 3,133).

- Participation decreases in W6, with no data for W7.

Czech Republic:

- Female participation is significantly higher than male participation in later waves, with a peak in W6 (female: 8,520 vs. male: 5,935).
- Male participation remains stable, while female participation increases significantly.

Poland:

- Participation levels are relatively low compared to other countries.
- Female participation peaks in W6 (female: 2,390 vs. male: 1,940), reflecting balanced representation.

Estonia:

- Female participation is significantly higher than male participation, with peaks in W6 (female: 10,010 vs. male: 6,135).
- Female engagement remains strong across waves.

Appendix 2.6: GG in total Pensions in Germany (Individuals: Widowed & Divorced - Over 65 Years old – NPI>0).

Average Total Pension Income_Men_Mean	Average Total Pension Income_Women_Mean	GG in Pensions
13,206.6057	11,893.0193	9.95%
Average Total Pension Income_Men_Median	**Average Total Pension Income_Women_Mean**	**GG in Pensions**
10,800	9,000	16.67%

Source: Own Estimation from SHARE (Main Release 7.1.0 – W7).

The data above highlights the disparities in average and median total pension income between men and women, emphasizing the Gender Gap in Pensions. The GG is calculated as the percentage difference between men's and women's pension incomes, illustrating persistent inequalities in financial security during retirement.

1. Pension Income Based on Means

- **Average Total Pension Income (Men)**: €13,206.61
- **Average Total Pension Income (Women)**: €11,893.02
- **Gender Gap in Pensions (GG)**: **9.95%**

Interpretation:

- On average, men receive **€1,313.59 more per year** in pension income than women.
- This **9.95% gap** reflects systemic differences, likely stemming from inequalities in pay, career interruptions, and lower lifetime contributions for women.

2. Pension Income Based on Medians

- **Median Total Pension Income (Men)**: €10,800
- **Median Total Pension Income (Women)**: €9,000

- **Gender Gap in Pensions (GG)**: **16.67%**

Interpretation:

- The median pension income shows a **larger gap** than the average, with men receiving **€1,800 more annually** compared to women.
- The **16.67% gap** highlights that a larger proportion of women are clustered at lower pension income levels, further exacerbating financial insecurity for women in retirement.

Chapter: 3 - Statistical Analysis of GPG in Europe.

Appendix 3.1: Comparison of the GG in NHI & NHI based on easySHARE (W1) & Main Release (W1).

	EasyShare_Mean_NHI	EasyShare_Median_NHI	W1_Mean NHI	W1_Median_NHI
Austria	23.5	30.4	28.13	33.31
Germany	15.2	14.7	15.56	16.59
Sweden	17.0	18.0	11.64	11.42
Netherlands	27.5	22.9	11.29	9.61
Spain	0.2	4.3	14.50	17.05
Italy	-2.3	-5.3	14.58	15.39
France	9.4	15.6	15.61	16.84
Greece	17.6	30.2	13.02	22.33
Denmark	15.6	19.6	23.04	28.76
Switzerland	36.1	32.4	23.14	29.21
Belgium	11.6	12.5	14.52	16.19
Israel	12.2	13.3	6.76	11.78

Source : Author's own research findings from SHARE (W1). **Note:** Estimates are based on data 2004 -2005 for eleven European Countries & Israel & easySHARE Data (Release 8.0.0).

The table above includes comparisons of the mean and median Net Household Income (NHI) across two datasets: EasyShare and Wave 1 (W1). These figures highlight variations in income distribution across countries and between datasets, reflecting disparities in wealth and income measurement.

In **Austria**, the mean and median NHIs are higher in W1 compared to EasyShare, with a mean of 28.13 and median of 33.31 in W1 versus 23.5 and 30.4 in EasyShare. This suggests that W1 captures slightly higher income levels, which may indicate differences in sampling or adjustments in data collection between the two sources.

In **Germany**, the mean and median NHIs are relatively stable between EasyShare (15.2 mean and 14.7 median) and W1 (15.56 mean and 16.59 median), showing only slight differences. This consistency implies similar measurement approaches and reflects a relatively narrow income distribution.

Sweden shows a notable difference, where the mean NHI in EasyShare is higher at 17.0 compared to 11.64 in W1, and the median follows a similar trend (18.0 vs. 11.42). This divergence could suggest broader income coverage or higher incomes recorded in the EasyShare dataset compared to W1.

In the **Netherlands**, the mean and median NHIs are considerably higher in EasyShare (27.5 mean and 22.9 median) than in W1 (11.29 mean and 9.61 median). The stark contrast suggests a significant upward adjustment or broader income capture in EasyShare compared to W1, potentially due to different income definitions or time periods.

Spain shows extremely low values in EasyShare, with a mean of 0.2 and median of 4.3, compared to much higher NHIs in W1 (14.50 mean and 17.05 median). This dramatic difference could be attributed to sampling, data quality, or adjustments in EasyShare that reduce the reported income levels significantly.

For **Italy**, EasyShare records negative mean and median NHIs (-2.3 and -5.3), which contrast sharply with positive values in W1 (14.58 mean and 15.39 median). This suggests that EasyShare might be capturing a unique set of households or adjustments that result in net negative income, which requires further investigation.

In **France**, the EasyShare dataset shows slightly lower NHIs compared to W1. The mean NHI is 9.4 in EasyShare versus 15.61 in W1, and the median is 15.6 versus 16.84. This indicates a smaller discrepancy between the two datasets compared to other countries, reflecting relative consistency in income measurement.

Greece presents a significant variation, with higher mean and median NHIs in W1 (13.02 mean and 22.33 median) compared to EasyShare (17.6 mean and 30.2 median). Unlike other countries, EasyShare records higher values, suggesting a divergence in methodology or sampling criteria.

In **Denmark**, EasyShare shows slightly lower NHIs (15.6 mean and 19.6 median) than W1 (23.04 mean and 28.76 median). This indicates that W1 captures higher income levels, potentially reflecting differences in the definition of income or data collection methods.

Switzerland exhibits similar trends to Denmark, with EasyShare recording a mean of 36.1 and a median of 32.4 compared to higher values in W1 (23.14 mean and 29.21 median). The high mean in EasyShare might indicate skewed income distribution, with a few high-income households influencing the average.

In **Belgium**, the values are relatively consistent, with EasyShare recording a mean of 11.6 and median of 12.5, while W1 reports slightly higher values (14.52 mean and 16.19 median). The similarity suggests minimal differences in income capture between the two datasets.

Lastly, **Israel** shows lower NHIs in EasyShare (12.2 mean and 13.3 median) compared to W1 (6.76 mean and 11.78 median). This suggests that EasyShare captures broader or higher income levels than W1, particularly among higher-income households.

Appendix 3.2: Pension Gap in Ypen1_W1_In three different age groups.

Ypen1(Excluding Widowed & Divorced)	Men	Women	Pension Gap (Age 50-64)	Men	Women	Pension Gap (Age 65-80)
Austria	5377.34	4648.3	13.6	17824.75	8945.47	49.8
Germany	1592.03	912.24	42.7	16180.8	8241.01	49.1
Sweden	673.59	542.05	19.5	11611.56	9372.58	19.3
Spain	2117.85	559.54	73.6	10179.19	3617.38	64.5
Italy	2650.87	1084.69	59.1	12366.55	6273.49	49.3
France	5655.56	3435.67	39.3	20728.78	12297.76	40.7
Denmark	681.187	986.71	-44.9	9242.17	9578.33	-3.6
Greece	3053.52	1408.87	53.9	8280.51	3228.98	61.0
Switzerland	404.04	338.12	16.3	19758.44	19187.12	2.9
Belgium	6986.8	4133.54	40.8	32822.41	18839.41	42.6
Israel	3449.18	3351.59	2.8	8061.08	6896.56	14.4
Czech Republic	782.46	1553.02	-98.5	4755.97	4093.86	13.9
Poland	1088.39	1358.26	-24.8	4481.28	3691.14	17.6
Luxembourg	16608.92	4116.37	75.2	49301.5	18077.81	63.3
Portugal	1908.79	890.07	53.4	6690.86	3814.78	43.0
Slovenia	3030.74	3368.03	-11.1	8299.71	7026.96	15.3
Estonia	619.36	564.95	8.8	3984.46	3962.73	0.5
Croatia	1148.53	1005.11	12.5	3508.54	2504.8	28.6

Ypen1 (Excluding Widowed & Divorced)	Men	Women	Pension Gap (Age 85+)
Austria	16962.37	9488.19	44.1
Germany	17469	7287.97	58.3
Sweden	14256.4	10010.11	29.8
Spain	8705.53	3582.88	58.8
Italy	11118.17	6304.08	43.3
France	17813.65	11241.38	36.9
Denmark	10310.29	10360.26	-0.5
Greece	7787.53	3365.68	56.8
Switzerland	21589.38	19940.84	7.6
Belgium	35343.85	11883.75	66.4
Israel	9104.58	8189.93	10.0
Czech Republic	4793.02	4080.27	14.9
Poland	4828.51	3946.19	18.3
Luxembourg	55249.51	8840.05	84.0
Portugal	5987.78	4057.24	32.2
Slovenia	8811.42	5147.94	41.6
Estonia	4332.13	4073.01	6.0
Croatia	4308.62	2835.26	34.2

Source: Own Estimation from SHARE (Main Release 7.1.0 – W7).

Appendix 3.3: European Countries Divided in Regions

Source: World Regional Geography (Retrieved from : 2.3 Regions of Western Europe – World Regional Geography (umn.edu))

Appendix 3.4: Frequencies NHI (Retired – Over 65 Years old).

Country	Frequencies Men	Frequencies Women	Country	Frequencies Men	Frequencies Women
Austria	6039	7257	**Ireland**	211	149
Germany	6793	6338	**Luxembourg**	1562	953
Sweden	6676	7590	**Hungary**	1502	2158
Netherlands	3747	2654	**Portugal**	1444	1336
Spain	8065	4396	**Slovenia**	4905	5961
Italy	7829	5549	**Estonia**	5723	9760
France	7280	8488	**Croatia**	1623	1585
Denmark	4427	5416	**Lithuania**	604	1173
Greece	4555	2943	**Bulgaria**	679	1012
Switzerland	4141	4241	**Cyprus**	494	643
Belgium	8153	7238	**Finland**	886	969
Israel	2589	2812	**Latvia**	465	963
Czech Republic	7316	11247	**Malta**	601	208
Poland	3157	4263	**Romania**	851	1028
Slovakia	616	693			
Total	**102,933 (Men) 109,023 (Women) 211,956 (Total Number of Participants)**				

Source: Own Estimation from SHARE (EasySHARE-Release 8.0.0)

The frequencies of Net Household Income (NHI) for retired individuals aged 65 and above highlight important gender and regional differences across European countries. The data includes 102,933 men and 109,023 women, totalling 211,956 participants. Women slightly outnumber men, accounting for 51.4% of the total sample, which aligns with broader demographic trends of higher female life expectancy.

In Western Europe, countries such as France, Sweden, and Denmark show higher female representation, reflecting longer life expectancies and larger female retiree populations. For instance, in Sweden, there are 6,676 men compared to 7,590 women, while in Denmark, the distribution is 4,427 men and 5,416 women. Similarly, France reports 7,280 men and 8,488 women, illustrating the typical gender imbalance seen in these regions. However, in Belgium, the trend is slightly different, with men (8,153) marginally outnumbering women (7,238), which diverges from the broader Western European pattern.

Eastern Europe displays more pronounced gender disparities, with significantly more women than men among retirees. The Czech Republic has one of the largest gaps, with 7,316 men compared to 11,247 women. Poland follows a similar trend, with 3,157 men and 4,263 women. Estonia demonstrates a stark gender imbalance, with 5,723 men and 9,760 women, reflecting higher male mortality rates and demographic differences in the region.

Southern Europe, however, shows an intriguing contrast. In countries like Spain and Italy, men outnumber women among retirees. Spain reports 8,065 men and 4,396 women, while Italy has 7,829 men compared to 5,549 women. This divergence from the general European trend could stem from unique cultural, economic, or policy factors that influence retirement patterns and longevity.

Smaller nations such as Luxembourg, Malta, Cyprus, and Ireland show varied patterns, likely influenced by smaller sample sizes. In Luxembourg, men (1,562) outnumber women (953), while in Malta, men (601) significantly exceed women (208). However, in Ireland, women (149) are fewer than men (211), reflecting less typical gender representation compared to the rest of Europe.

Overall, the total number of participants demonstrates a consistent gender disparity, with women outnumbering men due to higher life expectancies and a larger proportion of women in older age groups. These findings highlight important policy implications, including the need to address the GPG, as women often face lower pensions due to shorter careers and lower earnings. Additionally, the higher representation of women among retirees underscores the importance of healthcare and long-term care policies targeted at older women. For countries like Spain and Italy, further investigation into why men dominate the retiree population could provide insights into cultural and demographic factors that influence retirement trends. These gender-specific patterns emphasize the importance of designing equitable retirement and social support systems to meet the needs of aging populations across Europe.

Appendix 3.5: GG in NHI across 27 European Countries (Retired – Over 65 Years old).

Net Income Gap for Retired Population over 65 years old _ across European Countries_W1 - W8							
Country	**Wave**	**Mean_Men**	**Median_Men**	**Mean_Women**	**Median_Women**	**NHI Gap Mean**	**NHI Gap Median**
Austria	W1	39481.16	27731.08	30195.29	19298.13	**23.5**	**30.4**
	W2	31188.46	28134.51	24707.65	20853.56	20.8	25.9
	W4	35941.56	29563.38	30093.75	24854.11	16.3	15.9
	W5	32699.15	29494.79	27599.6	24137.34	15.6	18.2
	W6	30257.06	27894.8	26328.08	23562.65	13.0	15.5
	W8	33698.49	30589.08	28443.83	24458.01	15.6	20.0
Germany	W1	36312.95	31250.09	30781.41	26670.38	15.2	14.7
	W2	37005.84	29576.21	30260.27	25737.93	18.2	13.0
	W4	37739.46	30377.56	29581.63	25824.56	21.6	15.0
	W5	35799.05	30917.55	30929.01	26341.34	13.6	14.8
	W6	31404.23	27089.63	27540.64	24327.25	12.3	10.2
	W8	33649.66	30267.69	29917.57	27099.67	11.1	10.5
Sweden	W1	28919.84	27214.27	24004.78	22316.95	17.0	18.0
	W2	30409.58	27632.49	27319.76	25413.63	10.2	8.0
	W4	34530.97	30600.51	29008.39	25851.76	16.0	15.5
	W5	39844.28	36367.89	34561.66	30288.76	13.3	16.7
	W6	30637.96	27844.42	26248.2	23808.07	14.3	14.5
	W8	30348.23	27379.72	25918.22	23594.47	14.6	13.8
Netherlands	W1	71532.77	41225.07	51847.02	31797.94	27.5	22.9
	W2	45229.2	32768.15	41350.4	30478.27	8.6	7.0
	W4	39228.55	31337.95	33198.16	26225.03	15.4	16.3
	W5	37134.13	32143.35	31566.97	26464.76	15.0	17.7
	W8	46523.69	29268.28	39584.87	23795.21	14.9	18.7
Spain	W1	26997.16	17341.74	26940.31	16599.54	0.2	4.3
	W2	19633.27	15635.13	20534.96	16648.07	-4.6	-6.5
	W4	20186.04	16584.02	21103.79	17357.2	-4.5	-4.7
	W5	20827.09	18108.48	20833.43	18807.87	0.0	-3.9
	W6	18534.38	16198.17	18089.28	16165.76	2.4	0.2
	W8	21681.91	19459.27	20794.92	18622.39	4.1	4.3
Italy	W1	24801.76	20079.92	25375.92	21136.38	-2.3	-5.3
	W2	26696.2	22362.79	27346.27	22805.3	-2.4	-2.0
	W4	28651.42	23276.47	29029.52	23915.35	-1.3	-2.7
	W5	23328.9	19793.81	22346.43	19467.72	4.2	1.6
	W6	21813.85	19423.13	21961.53	19512.24	-0.7	-0.5
	W8	17279.35	15495.98	18101.1	16542.89	-4.8	-6.8
France	W1	31710.97	26218.76	28727.78	22119.37	9.4	15.6
	W2	39300.77	32312.33	32541.29	25514.52	17.2	21.0
	W4	35053.46	30157.11	29855.91	24331.27	14.8	19.3
	W5	81872260.84	31808.17	70745016.6	25986.28	13.6	18.3
	W6	33146.56	29496.38	28164.2	24412	15.0	17.2
	W8	32815.53	30639.5	27456.01	25076.08	16.3	18.2
Denmark	W1	23902.72	20344.2	20175.87	16349.75	15.6	19.6
	W2	27023.65	23507.31	22224.84	18383.13	17.8	21.8
	W4	27840.12	25786.15	24948.54	21693.17	10.4	15.9
	W5	27763.69	25019.57	25403.73	21987.39	8.5	12.1
	W6	26086.53	23111.42	22466.02	19641.93	13.9	15.0
	W8	27664.94	25313.78	24435.93	21133.89	11.7	16.5
Greece	W1	22018.99	17452.05	18134.79	12174.55	17.6	30.2

	W2	22827.16	18354.28	19133.81	13344.41	16.2	27.3
	W6	17802.87	14997.42	16313.95	13168.47	8.4	12.2
	W8	15750.84	14371.01	14963.71	12673.17	5.0	11.8
Switzerland	W1	54217.58	37096.82	34631.7	25070.23	36.1	32.4
	W2	52855.27	42567.79	35662.88	27372.07	32.5	35.7
	W4	62204.08	50922.1	49367.95	38414.16	20.6	24.6
	W5	56070.53	47414.79	44798.67	35883.24	20.1	24.3
	W6	50133.06	41537.34	39032.84	31307.16	22.1	24.6
	W8	51828.08	44886.69	38231.69	30761.41	26.2	31.5
Belgium	W1	35901.07	25517.99	31749.99	22330.64	11.6	12.5
	W2	44638.62	27194.98	37688.05	23866.28	15.6	12.2
	W4	66590.32	34146.69	55410.69	28756.49	16.8	15.8
	W5	48739.31	30966.66	44259.24	28834.86	9.2	6.9
	W6	54052.96	32294.24	45779.99	27869.31	15.3	13.7
	W8	61519.53	31784.19	49903.73	27408.73	18.9	13.8
Israel	W2	31005.09	23297.25	27215.77	20205.04	12.2	13.3
	W5	30028.49	25969.25	29709.32	22688.83	1.1	12.6
	W6	25490.88	19559.92	21042.45	16095.93	17.5	17.7
	W8	28143.26	24948.18	27273.8	22392.88	3.1	10.2
Czech Republic	W2	14615.73	13758.09	12696.39	11889.71	13.1	13.6
	W4	16128.05	15796.78	13504.42	12679.69	16.3	19.7
	W5	16868.54	15890.5	14082.51	13051.01	16.5	17.9
	W6	16417.36	16091.16	13447.13	12123.81	18.1	24.7
	W8	17956.65	17672.27	14251.07	12697.33	20.6	28.2
Poland	W2	11907.96	11088.28	10372.66	9311.38	12.9	16.0
	W4	14264.97	13080.54	12666.84	11036.71	11.2	15.6
	W6	16603.83	13952.01	13957.79	11161.61	15.9	20.0
	W8	16391.74	15425.45	13986.58	12877.3	14.7	16.5
Ireland	W2	40151.04	28846.9	31356.65	20667.21	21.9	28.4
Luxemburg	W5	91967.57	77475.63	80104.38	63241.47	12.9	18.4
	W6	60627.76	49276.55	49218.93	44431.7	18.8	9.8
	W8	68842.06	53586.29	60834.93	46506.31	11.6	13.2
Hungary	W4	18251.22	15986.51	15439	13329.05	15.4	16.6
	W8	13926.34	13227.59	11345.82	10333.84	18.5	21.9
Portugal	W4	17766.36	11211.96	16202.5	10233.41	8.8	8.7
	W6	15335.68	12773.41	14445.1	11155.75	5.8	12.7
Slovenia	W4	42644.15	26577.56	39934.46	21437.61	6.4	19.3
	W5	19900.01	18341.49	17828.04	16312.49	10.4	11.1
	W6	20679.51	17873.75	18708.33	15707.16	9.5	12.1
	W8	18085.89	17419.41	15268.48	14215.69	15.6	18.4
Estonia	W4	13082.9	12148.38	10887.17	9740.49	16.8	19.8
	W5	14650.22	12348.37	11962.94	10824.57	18.3	12.3
	W6	11929.95	12106.67	9601.3	7178.55	19.5	40.7
	W8	13896.56	13854.85	10678.65	8131.61	23.2	41.3
Croatia	W6	13055.69	10593.12	12047.6	9329.49	7.7	11.9
	W8	13610.17	11638.68	12144.98	10057.93	10.8	13.6
Lithuania	W8	12480.4	12125.89	9303.69	7684.93	25.5	36.6
Bulgaria	W8	8213.08	7404.02	6485.3	5464.41	21.0	26.2
Cyprus	W8	27898.88	15770.01	22839.37	14469.67	18.1	8.2
Finland	W8	32904.02	28942.27	27260.84	25995.27	17.2	10.2
Latvia	W8	10926.8	10420.08	7966.9	6104.85	27.1	41.4
Malta	W8	21931.56	15665.54	20567.95	16912.33	6.2	-8.0
Romania	W8	11205.51	10815.99	8695.92	7652.82	22.4	29.2
Slovakia	W8	11270.1	11739.63	9287.19	8628.42	17.6	26.5

Source: Own Estimation from SHARE (EasySHARE-Release 8.0.0).

The data on Net Household Income (NHI) above, for retirees aged 65 and above reveals significant gender disparities across European countries and waves (W1–W8). Men generally earn more than women on both average and median levels, with the extent of the NHI gap varying across countries and over time. While some countries show progress in reducing these disparities, others maintain persistently high gaps, reflecting systemic inequities in income and pension systems.

In Austria, the NHI gap (mean) gradually narrows from 23.5% in W1 to 13.0% in W6, indicating progress in reducing disparities, although the median gap fluctuates. Germany exhibits a moderate and consistent gap, with the mean gap reducing from 15.2% in W1 to 11.1% in W8, and the median gap narrowing to 10.2% in W6. Sweden shows relatively low disparities compared to other countries, with the mean gap ranging from 10.2% in W2 to 17.0% in W1, reflecting steady trends toward improved equity. The Netherlands, on the other hand, starts with a significant mean gap of 27.5% in W1, which reduces to 14.9% in W8, although the median gap remains relatively stable.

Spain presents a unique case where the NHI gap is near zero or even negative in earlier waves, with women earning slightly more than men in some instances. However, the gap shifts to a positive value of 4.1% in W8, suggesting a reversal in equity over time. Italy also exhibits fluctuating gaps, with women earning more in W1 (-2.3% mean gap) but experiencing a reversal by W8, where the gap grows to -4.8%. France demonstrates consistent disparities, with a mean gap averaging around 14–16% across waves and peaking at 17.2% in W2. Switzerland consistently shows one of the highest gaps, starting at 36.1% in W1 and stabilizing at 26.2% in W8, with similarly large median gaps.

In Denmark, the gap remains moderate, with a mean gap of 15.6% in W1 decreasing to 11.7% in W8, though median gaps are higher, peaking at 21.8% in W2. Greece, meanwhile, begins with one of the largest median gaps at 30.2% in W1, which decreases to 11.8% by W8. Estonia stands out for having one of the highest disparities, with a median gap peaking at 41.3% in W8 and a mean gap rising to 23.2% in the same wave. Lithuania also records substantial disparities, with a mean gap of 25.5% and a median gap of 36.6% in W8.

While some countries, such as Germany, Denmark, and Sweden, have made measurable progress in narrowing the gender gap over time, others, including Switzerland, Austria, and Lithuania, continue to experience significant disparities. Spain and Italy, with near-zero or negative gaps in earlier waves, illustrate a unique pattern of increasing disparities in later waves, signaling a reversal of equity. Countries like Estonia and Lithuania highlight the persistence of stark inequalities, particularly in the most recent wave (W8), where the median gaps are among the highest recorded. The analysis underscores the complex nature of gender disparities in income among retirees, with cross-country variations reflecting differences in pension systems, labor market histories, and socio-economic policies. Addressing these persistent gaps requires targeted policy interventions to promote equity, particularly in countries with entrenched inequalities. Progress in reducing disparities in countries like Sweden and Germany offers valuable lessons for other nations aiming to improve income equality for retired populations.

Appendix 3.6: Sample Size and Selection Criteria for Analysed Cases.

Selected Cases	Observations	Excluded Cases
Total Number of Individuals	**340,425**	**-**
Currently receiving pensions (cjs = 1)	**197,243**	**143,182**
Financial respondents in their households (fin_resp = 1)	**137,700**	**59,543**
Aged 65 and above (age ≥ 65)	**116,344**	**21,356**
Positive Net Pension Income (NPI > 0)	**113,355**	**2,989**
Part of the main imputation sample (sample1 = 1)	**52,388**	**60,967**
Final Number of Individuals Analysed	**52,388**	**-**

Note: The table presents the filtering criteria used to select the final dataset, ensuring the inclusion of pension recipients aged 65 and above, who are financially responsible in their households and have positive net pension income. **Source:** Author's analysis based on data from SHARE, Ageing, and Retirement in Europe (SHARE), Wave 6.

The table presents a step-by-step filtering process for selecting individuals for analysis from a total sample of 340,425 observations. This process ensures that the final sample aligns with the study's specific criteria, focusing on retirees aged 65 and above with positive net pension income (NPI). Below is an analysis of the data:

The initial dataset consists of 340,425 individuals, representing the total number of observations available. Out of this, 197,243 individuals are identified as currently receiving pensions (coded as cjs = 1), leaving 143,182 individuals excluded, likely those not eligible for or not yet receiving pensions. This first exclusion step focuses the analysis on the retired population receiving pension benefits.

Among those currently receiving pensions, 137,700 individuals are financial respondents in their households (fin_resp = 1), meaning they are responsible for reporting financial data. This step excludes 59,543 individuals, likely due to non-responsiveness or incomplete financial data. By narrowing the scope to financial respondents, the dataset ensures higher reliability in income reporting.

Further filtering focuses on individuals aged 65 and above (age ≥ 65), resulting in 116,344 individuals included and 21,356 excluded. This criterion aligns with the study’s focus on retirees within the standard retirement age group, ensuring the analysis is relevant to the target population.

The subsequent step refines the dataset to include only individuals with positive Net Pension Income (NPI > 0), leaving 113,355 individuals and excluding an additional 2,989 cases. This exclusion likely removes cases where individuals receive no pension income or report negative pension values due to deductions or adjustments, ensuring the analysis is focused on those with actual pension benefits.

Finally, the dataset is filtered to include only individuals who are part of the main imputation sample (sample1 = 1), reducing the sample to 52,388 individuals, while excluding 60,967 cases. This step ensures that the final dataset consists of individuals with complete and reliable data that meets the imputation requirements, enhancing the robustness of the analysis.

The final number of individuals analysed is 52,388, representing a highly specific subset of the original dataset. This group consists of individuals who meet all the inclusion criteria: they are aged 65 and above, currently receiving pensions, reporting positive net pension income, and are financial respondents within their households. These exclusions and selections reflect a rigorous approach to ensuring the quality and relevance of the dataset for the study's objectives.

Appendix 3.7: GG in Pension Income & Frequencies of Individuals based on Mean - W6.

Percentage of Pension Gap in different categories of Pension income & Frequencies of Individuals.

Country	*Ypen1*	*Ypen2*	*Ypen3*	*Ypen5*	*Ypen6*	*Yreg1*
Austria	**27.87** (M:4281, F:5336)	**38.43** (M:384, F:215)	**31.54** (M:125, F:91)	**11.89** (M:269, F:743)	**96.67** (M:5, F:5)	**51.58** (M:85, F:115)
Germany	**39.03** (M:5586, F:5089)	**48.07** (M:1823, F:1006)	**-22.82** (M:55, F:10)	**7.40** (M:95, F:130)	**100.00** (M:20, F:0)	**73.64** (M:356, F:215)
Sweden	**17.38** (M:5808, F:6552)	**21.01** (M:5471, F:5842)	**45.74** (M:75, F:115)	ººº (M:0, F:25)	**3.63** (M:35, F:30)	**39.61** (M:1674, F:1731)
Spain	**27.39** (M:7415, F:6219)	**36.38** (M:85, F:45)	**50.23** (M:150, F:205)	**21.84** (M:30, F:155)	**-78.06** (M:36, F:62)	**-178.93** (M:75, F:71)
Italy	**28.91** (M:6190, F:5734)	**-91.38** (M:91, F:15)	**10.19** (M:238, F:401)	**2.66** (M:121, F:301)	**85.21** (M:36, F:60)	**-695.81** (M:10, F:15)
France	**28.68** (M:4339, F:5948)	**-131.94** (M:56, F:60)	**-34.48** (M:121, F:76)	**-9.44** (M:70, F:140)	**100.00** (M:62, F:0)	**8.21** (M:238, F:229)
Denmark	**-7.21** (M:4075, F:4535)	**37.69** (M:1882, F:1708)	**-49.15** (M:35, F:40)	ººº (M:0, F:5)	ººº	**19.77** (M:989, F:679)
Greece	**29.12** (M:4892, F:4274)	**11.69** (M:35, F:50)	**20.46** (M:162, F:135)	**48.68** (M:12, F:65)	**93.74** (M:36, F:31)	**-146.56** (M:10, F:30)
Switzerland	**-0.97** (M:3840, F:4240)	**47.89** (M:2456, F:1484)	**-165.39** (M:35, F:20)	**56.32** (M:20, F:10)	ººº	**41.08** (M:395, F:303)
Belgium	**23.70** (M:6204, F:6526)	**79.81** (M:168, F:110)	**-277.12** (M:221, F:229)	**-35.40** (M:50, F:87)	**-277.11** (M:62, F:27)	**-160.15** (M:271, F:141)
Israel	**16.14** (M:2436, F:3288)	**29.90** (M:847, F:898)	**25.75** (M:184, F:93)	**32.24** (M:38, F:96)	**74.73** (M:31, F:23)	**72.86** (M:107, F:121)
Cz. Republic	**9.87** (M:5900, F:8495)	**77.76** (M:15, F:25)	**7.60** (M:30, F:30)	**-36.42** (M:145, F:301)	ººº (M:0, F:5)	**-3.35** (M:50, F:45)
Poland	**17.88** (M:1865, F:2344)	ººº	**-71.82** (M:65, F:35)	**22.21** (M:216, F:338)	**82.78** (M:15, F:6)	**-1514.98** (M:10, F:10)
Luxemburg	**46.92** (M:1655, F:1525)	**85.48** (M:155, F:26)	**43.91** (M:75, F:50)	**-6.46** (M:30, F:30)	**45.95** (M:10, F:5)	**-24.11** (M:82, F:40)
Portugal	**21.59**	ººº	**5.17**	**-1803.03**	**26.17**	**-82.79**

	(M:1933, F:1903)		(M:155, F:210)	(M:5, F:15)	(M:6, F:20)	(M:45, F:20)
Slovenia	**16.07** (M:4419, F:5451)	**-164.52** (M:50, F:45)	**18.05** (M:496, F:377)	**14.46** (M:10, F:20)	**-3500.00** (M:5, F:5)	**-38.00** (M:95, F:130)
Estonia	**1.96** (M:5795, F:9880)	**-71.62** (M:35, F:25)	**15.66** (M:746, F:1407)	**92.21** (M:10, F:10)	**-336.74** (M:36, F:70)	**-152.93** (M:45, F:35)
Croatia	**26.39** (M:1995, F:2255)	**48.96** (M:20, F:30)	**30.35** (M:226, F:130)	**23.48** (M:60, F:85)	ℓℓℓ	**-1245.55** (M:20, F:20)

Source: Own Estimation from SHARE W6 - Release 7.1.0). Note: Estimates are based on data for 2015 (W6). For the Ypen4 there are records only for five countries Germany(18.1,M:25,F:21),Italy (62.5 M:5,F:5),Belgium (-13.9 M:35,F:30) and Estonia (62.5 M:5,F:0).

The data in Appendix 3.7 highlights significant gender disparities in pension income across various European countries and pension categories, as captured in Wave 6 (W6) of the SHARE survey. These disparities, expressed as Gender Gaps (GG) in pension income, vary considerably between countries and pension categories, reflecting systemic differences in income distribution and pension systems.

In Austria, the GG for the primary pension category (Ypen1) is 27.87%, indicating that men receive substantially higher pensions than women, with 4,281 men and 5,336 women represented in this category. The disparity is even greater in higher pension categories such as Ypen2, where the GG reaches 38.43%. However, in categories like Ypen5, the gap narrows to 11.89%, with women (743) significantly outnumbering men (269). Germany exhibits a substantial GG of 39.03% in Ypen1, with slightly more men (5,586) than women (5,089) in this category. In Ypen2, the disparity increases further to 48.07%, but an interesting reversal is observed in Ypen3, where the GG is -22.82%, indicating higher pension incomes for women in this small group of individuals.

Sweden presents a relatively lower GG in Ypen1, with a gap of 17.38% favoring men, based on 5,808 men and 6,552 women. The disparity increases slightly in Ypen2 to 21.01%, but in Ypen3, the GG rises sharply to 45.74%, reflecting significant income advantages for men. Spain, on the other hand, shows a GG of 27.39% in Ypen1, with 7,415 men and 6,219 women. However, in higher categories such as Ypen3, the gap widens to 50.23%, while smaller subsets in Ypen5 reveal narrower gaps. Italy has a GG of 28.91% in Ypen1, with 6,190 men and 5,734 women. Interestingly, in Ypen2, the GG is -91.38%, indicating that women in this small subset earn higher pensions than men. France reports a GG of 28.68% in Ypen1, with 4,339 men and 5,948 women, while some categories, such as Ypen2, show negative GGs, reflecting higher pension incomes for women.

Denmark is notable for having a negative GG in Ypen1, where women earn slightly more than men, resulting in a GG of -7.21%. However, in Ypen2, the GG shifts to 37.69%, favouring men. Greece demonstrates a GG of 29.12% in Ypen1, with men outnumbering women, but higher disparities appear in categories like Ypen5, where the GG reaches 93.74%. Switzerland, in contrast, shows an almost equal distribution in Ypen1 with a GG of -0.97%, but the gap widens in Ypen2 to 47.89%, favouring men.

Belgium has a GG of 23.70% in Ypen1, with slightly more women (6,526) than men (6,204). However, extreme negative GGs are observed in some categories, such as Ypen3, where the gap is -277.12%, reflecting significantly higher pensions for women in this small subset. Estonia demonstrates minimal disparities in Ypen1, with a GG of 1.96%, but extreme values, such as -336.74% in Ypen5, highlight significant outliers favoring women. Similarly, Luxembourg shows wide variation, with a GG of 46.92% in Ypen1 but smaller gaps in other categories.

The analysis reveals that gender disparities in pension income are highly variable across countries and categories. Positive GGs are more common, indicating that men typically receive higher pensions than women. However, there are exceptions, particularly in smaller subsets or specific categories where women outnumber men or receive higher pensions. These findings underscore the systemic nature of pension income inequalities and the influence of country-specific policies and demographic factors on the distribution of pension benefits. The extreme variations in some categories, often tied to small sample sizes, highlight the need for further investigation into the underlying causes of these disparities.

Chapter 6: OAXACA Decomposition Method

Appendix 6.1: Coefficients & Difference in Coefficients - the role of socio-economic and demographic characteristics.

Variable Name	Females (Group A)	Males (Group B)	Difference (B-A)
Intercept	5.5281	5.4945	0.0336
Dummy_isced	-0.0864	-0.1289	0.0425
Country	-0.0225	-0.0195	-0.0030
Age	0.0003	0.0016	-0.0014
Mobility	-0.0104	-0.0116	0.0013
slti	0.0000	0.0000	0.0000
ybabsmf	0.0000	0.0000	0.0000
yaohm	0.0000	0.0000	0.0000
ysrent	0.0000	0.0000	0.0000
ypen5	0.0000	0.0000	0.0000
Dummy_Nchild	-0.0117	0.0109	-0.0226
mstat	0.0091	0.0029	0.0061

On the table above the intercept for females is 5.5281, slightly higher than that for males (5.4945), with a difference of 0.0336. This indicates that, on average, females start with a slightly higher baseline value for Log_NPI when all other variables are held constant. However, this difference is minimal, suggesting that baseline factors alone do not account for the observed gender disparities in pension income.

Education Level (Dummy_isced): The coefficient for education level is -0.0864 for females and -0.1289 for males, with a difference of 0.0425. This indicates that education has a less negative effect on Log_NPI for females compared to males. The larger negative coefficient for males suggests that their pension income is more sensitive to differences in educational attainment, potentially reflecting disparities in how education translates into pension benefits for the two genders. The coefficient for country is -0.0225 for females and -0.0195 for males, resulting in a small difference of -0.0030. This indicates that country-level factors slightly disadvantage females more than males. These factors could include differences in pension systems, labor market structures, or country-specific socio-economic conditions that affect women disproportionately.

Age: The coefficient for age is 0.0003 for females and 0.0016 for males, with a difference of -0.0014. This suggests that age has a stronger positive association with Log_NPI for males than for females. The small difference indicates that while age is a factor, it does not contribute substantially to the overall disparity between genders.

Mobility Limitations: The coefficient for mobility limitations is -0.0104 for females and -0.0116 for males, with a difference of 0.0013. This indicates that mobility limitations negatively affect Log_NPI for both genders, but the impact is slightly greater for males. This may reflect differences in how health-related factors influence pension entitlements or earning capacities across genders.

Savings for Long-Term Investments (slti), Income from Other Household Members (yaohm), and Related Variables: For variables such as savings for long-term investments (slti), income from other household members (yaohm), income from rent (ysrent), and income from pensions (ypen5), the coefficients for both genders are effectively zero. This indicates that these factors do not contribute directly to differences in Log_NPI between men and women. These variables may either lack variability in the dataset or have limited explanatory power in the context of GPG.

Number of Children (Dummy_Nchild): The coefficient for the number of children is -0.0117 for females and 0.0109 for males, with a difference of -0.0226. This indicates that having children negatively impacts Log_NPI for females while slightly benefiting males. The difference suggests that caregiving responsibilities, which disproportionately fall on women, adversely affect their pension income, while men might benefit indirectly from policies such as spousal pension benefits or tax incentives.

Marital Status (mstat): The coefficient for marital status is 0.0091 for females and 0.0029 for males, with a difference of 0.0061. This indicates that being married has a slightly larger positive impact on pension income for females than for males. This could reflect spousal pension benefits or shared household financial stability, which might benefit women more due to their typically lower individual pension contributions.

General Observations: The decomposition reveals that the largest differences in coefficients occur for education, the number of children, and marital status. Education appears to disadvantage men more than women, while the number of children negatively impacts women's pension income more than men's. Marital status provides a small advantage for women compared to men. Country-level factors and age play relatively minor roles in disparity, while other financial variables such as savings and rent income do not contribute significantly.

Appendix 6.2: Threefold Decomposition Analysis Results.

	coef(endowments)	**se(endowments)**	**coef(coefficients)**	**se(coefficients)**	**coef(interaction)**	**se(interaction)**
Overall	-0.0578	0.0024	-0.0496	0.003929101	-0.009625186	0.002149093
Variables						

(Intercept)	0.0000	0.0000	0.0336	0.031105935	0	0
Dummy_isced	-0.0062	0.0007	0.0626	0.011328524	0.002027648	0.000420561
Country	-0.0381	0.0018	-0.0636	0.008328183	-0.005814066	0.000816685
Age	0.0007	0.0002	-0.1064	0.032260216	-0.0006162	0.000223048
Mobility	-0.0104	0.0011	0.0026	0.002743265	0.001124581	0.001213218
Slti	-0.0005	0.0003	0.0057	0.001324067	-0.001752585	0.000558916
Ybabsmf	-0.0051	0.0006	0.0068	0.001610379	-0.003939435	0.000999174
Yaohm	-0.0003	0.0002	0.0019	0.000478192	0.000468682	0.000234003
Ysrent	-0.0010	0.0003	0.0013	0.000848306	-0.000826589	0.000559088
ypen5	0.0004	0.0002	-0.0011	0.000284983	-0.000654449	0.000210801
Dummy_Nchild	0.0013	0.0005	-0.0230	0.005149041	-0.002587234	0.000629008
Mstat	0.0014	0.0010	0.0299	0.012299266	0.002944461	0.001231107

The Oaxaca decomposition analysis highlights the contributions of socio-economic and demographic factors to the GPG (Log_NPI), breaking down the gap into endowment, coefficient, and interaction effects. The overall results reveal that differences in endowments (characteristics such as education, age, and country distribution) contribute a significant portion of the gap, with an endowment effect of -0.0578. This indicates that disparities in these characteristics between men and women explain a substantial part of the gender gap. The coefficient effect, at -0.0496, reflects differences in how these characteristics are rewarded for men and women, showing that women face disadvantages in the pension system despite having similar attributes. Additionally, the interaction effect (-0.0096) captures how the combination of characteristics and their differential treatment further exacerbates the gap, although its contribution is smaller.

Education (Dummy_isced) emerges as an important factor. The coefficient for education is more negative for men, and the coefficient effect of 0.0626 suggests that education benefits women more in terms of pension income compared to men. However, the endowment effect (-0.0062) shows that differences in educational attainment still contribute modestly to the gap. The interaction effect (0.0020) suggests a slight mitigating role when education interacts with other factors. Country-level differences are another significant contributor, with an endowment effect of -0.0381 indicating that the distribution of men and women across countries disadvantages women. The coefficient effect of -0.0636 further highlights the unequal impact of country-specific factors, such as pension systems and socio-economic conditions, on women's pension income. The interaction effect (-0.0058) suggests that these disparities are amplified when combined with other variables.

Age has a minimal endowment effect (0.0007), indicating that differences in age distribution between men and women do not significantly drive the gap. However, the coefficient effect (-0.1064) is substantial, revealing that age-related factors, such as career length and pension eligibility, disproportionately benefit men. Similarly, mobility limitations have a small but notable endowment effect (-0.0104), showing that women are slightly disadvantaged by differences in physical health. The coefficient effect (0.0026) suggests that mobility limitations have a marginally less negative impact on women than men, but the overall contribution to the gap remains small.

Income-related variables, such as savings for long-term investments, rental income, and pension income, generally have minimal endowment effects, indicating little impact from gender differences in their distribution. However, the coefficient effects for these variables show slight advantages for women, suggesting that when women have access to these resources, they contribute positively to narrowing the gap. For example, savings for long-term investments have a coefficient effect of 0.0057, indicating that they benefit women slightly more than men in terms of pension income. Interaction effects for these variables are small and negative, reflecting limited disadvantages when these factors interact with others.

The number of children (Dummy_Nchild) plays a significant role in the gender gap. The endowment effect (0.0013) is positive, meaning differences in the number of children slightly reduce the gap. However, the coefficient effect (-0.0230) reveals that having children negatively impacts women’s pension income more than men’s, reflecting the economic penalties associated with caregiving responsibilities. The interaction effect (-0.0026) further exacerbates this disparity, showing that caregiving responsibilities, when combined with other factors, disproportionately disadvantage women.

Marital status (mstat) contributes positively to narrowing the gender gap. The endowment effect (0.0014) shows that differences in marital status slightly reduce the gap, while the coefficient effect (0.0299) indicates that being married benefits women more than men in terms of pension income. This may reflect spousal pension benefits or the financial stability of married households. The interaction effect (0.0029) reinforces this positive contribution.

In conclusion, the Oaxaca decomposition reveals that both endowment and coefficient effects are significant drivers of the GPG. Country-specific factors, age, education, and caregiving responsibilities are key contributors, with systemic inequalities in how these factors are rewarded playing a particularly significant role. Interaction effects are generally smaller but highlight the compounding disadvantages that arise when socio-economic and demographic factors interact. Addressing these disparities requires targeted interventions, such as equalizing returns on education, mitigating the caregiving penalty for women, and ensuring equitable pension systems across countries. These findings underscore the complexity of the GPG and the need for multi-faceted solutions to promote gender equality in retirement income.