

## Research Article

# A Comprehensive Exploration of the Gender Pay Gap in Portugal's Informal Economies

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**Abstract.**

This research investigates the gender pay gap within Portugal's informal economies, analyzing data spanning the years 2005 to 2020 using Vector Error Correction Models (VECM). The study focuses on four key variables: employers (total), wage and salaried workers (female), wage and salaried workers (male), and educational attainment by way of completing a minimum of upper secondary schooling among a population of age 25+. The findings reveal nuanced relationships among these variables: educational attainment (EA) positively impacts the total number of employers within Portugal's informal economies. A significant correlation exists between EA and wage and salaried workers (female), albeit with complex dynamics. Similarly, EA correlates with wage and salaried workers (male), though the influence is less pronounced. EA also demonstrates a significant association with educational attainment through completing upper secondary schooling among a population of age 25+. These results underscore the multifaceted nature of the gender pay gap within informal economies, influenced by a variety of factors beyond education. Policymakers and stakeholders should consider these findings when designing strategies to promote gender equality in this critical sector, recognizing the need for comprehensive and context-specific approaches. Further research is encouraged to deepen our understanding of this issue and inform evidence-based interventions.

**Keywords:** gender pay gap, Portugal, informal economies, employers, gender equality

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## 1. Introduction

In the grand tapestry of economic disparities, one issue has persistently occupied the global stage, casting its shadow across every corner of the world: the gender pay gap. While extensive research has illuminated this disparity within formal labor markets, a critical dimension that has remained enigmatic is the gender pay gap within informal economies. This research embarks on a journey to unmask the intricacies of this multifaceted challenge, with a specific focus on Portugal nation that offers a compelling case study within the European context. Despite Portugal's remarkable

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strides toward gender equality in recent decades, the enduring prevalence of informal economies continues to raise concerns. This research is anchored in key variables, such as Employers (total), Wage and salaried workers (female), Wage and salaried workers (male), and educational attainment at least completed upper secondary population 25+. By meticulously analyzing these variables, our mission is to provide an all-encompassing comprehension of how the gender pay gap manifests within Portugal's informal economy and the profound ramifications it bears for society.

This investigation calls for a voyage that transcends the boundaries of conventional labor markets. We endeavor to explore the intricate interplay of gender, economic informality, and educational attainment. As Portugal grapples with the persistent challenge of gender-based wage inequality, our research seeks to be a guiding light, offering valuable insights that can inform policymakers, empower advocates, and galvanize stakeholders toward actionable solutions. To undertake this journey, we must navigate the expansive body of existing literature.

For decades, the gender pay gap has cast a long and pervasive shadow across societies worldwide, transcending economic development levels and cultural boundaries [1]. Regardless of their qualifications, skills, or the nature of their work, women have consistently found themselves earning less than their male counterparts. This glaring disparity extends beyond mere statistics; it permeates every facet of women's lives, with profound and far-reaching consequences. It affects not only their financial well-being but also their access to opportunities, their prospects for career progression, and their overall socio-economic standing [2]. This persistent wage gap is a stark reminder of the systemic inequalities that continue to undermine the aspirations and achievements of half the global population.

In Portugal, as in numerous other nations, concerted efforts have been made to bridge the gender pay gap. Legal frameworks and policies have been put in place to promote gender equality within the workplace, reflecting a commitment to rectify historical imbalances [3]. Women in Portugal have made significant strides by breaking into traditionally male-dominated sectors and expanding their horizons. Educational attainment among women has seen a steady rise, marking a crucial step towards empowerment and economic independence [1]. Despite these commendable advancements, the specter of the gender pay gap still lingers, and it often remains concealed within the labyrinthine folds of informal economies [4]. This incongruity underscores the complexity of the issue, compelling us to delve deeper into the dynamics of informal labor markets to uncover the elusive factors that perpetuate wage disparities.

The endurance of the gender pay gap within Portugal's informal economies merits particular attention. Informal economies, by their very nature, are characterized by a lack of formal contracts, legal protections, and social security, making them inherently challenging to quantify and regulate [5]. While they can provide a lifeline for those who lack access to formal employment opportunities, they also pose significant challenges. Women engaged in informal work often find themselves at the intersection of multiple vulnerabilities, including lower wages, job insecurity, and limited access to social benefits. The persistence of the gender pay gap within these informal sectors suggests that there are intricate dynamics at play, transcending educational attainment and qualifications. It is within this intricate landscape that we embark on a quest for deeper understanding, aiming to unveil the hidden dimensions of gender-based wage disparities within Portugal's informal economies.

Informal economies, often colloquially referred to as the shadow or underground economy, are characterized by their notable absence of formal contracts, legal protections, and social security mechanisms [6]. These elusive economic domains encompass a broad spectrum of activities, ranging from street vending and domestic work to unregistered businesses and casual labor. One of the defining features of these activities is that they exist beyond the purview of government regulations and tax systems, rendering them inherently challenging to both quantify and regulate [5]. As a result, informal economies create a complex and multifaceted economic landscape that defies easy classification and oversight.

In Portugal, as in many other nations, informal economies constitute a significant segment of the overall economic landscape [7]. The role of informal work in providing a lifeline for individuals who lack access to formal employment opportunities cannot be overstated. It serves as a crucial source of income for many, often supporting livelihoods in the absence of formal alternatives. However, this economic reality comes with a set of inherent vulnerabilities that cannot be ignored. Informal workers frequently grapple with lower wages, precarious job security, and limited access to social benefits, leaving them exposed to financial instability and hardship [8]. Consequently, while informal economies serve as vital economic safety nets, they also underscore the pressing need to address the unique challenges they present.

Within this intricate landscape of informal economies, a pertinent and pressing concern is the presence of the gender pay gap. Women engaged in informal work face not only the challenges inherent to these labor markets but also the added burden of wage disparities [8]. These disparities persist despite advancements in gender equality

within formal employment sectors, emphasizing the nuanced nature of this issue. The informal economy's lack of regulation and transparency, coupled with societal norms and structural factors, can exacerbate gender-based wage inequality, making it a crucial area of exploration [6]. It is within this complex tapestry that our research aims to shed light on the multifaceted dimensions of the gender pay gap within Portugal's informal economies, ultimately contributing to a more comprehensive understanding of the issue and guiding efforts toward equitable solutions.

Educational attainment stands as a pivotal variable in our quest to comprehend the gender pay gap within Portugal's informal economies [9]. Education has historically been extolled as a gateway to economic empowerment, and the increased access of women to education has been celebrated as a key indicator of progress in the ongoing journey toward gender equality. In Portugal, there has been a steady and commendable improvement in educational attainment among both men and women, with a growing number of individuals achieving at least upper secondary education [10]. This educational expansion has undoubtedly marked a significant step towards leveling the playing field and enhancing the socio-economic prospects of women.

Nonetheless, the translation of these educational gains into economic parity remains an elusive endeavor. The relationship between educational attainment and income is intricate, entangled with various multifaceted factors that defy straightforward explanation [11]. Occupational segregation, deeply ingrained societal norms, and insidious discrimination can all conspire to undermine the economic benefits of education, particularly for women. As we embark on this research journey, we recognize the need to investigate beyond the surface-level association between education and income, delving into the underlying dynamics that shape these outcomes.

To scrutinize the intricate interplay between education and income, we have chosen to examine the educational attainment of the population aged 25 and above. This demographic offers a unique perspective, as it reflects the cumulative impact of educational investments made over time [12]. By focusing on this specific age group, we endeavor to discern whether the strides in education, particularly among women, have succeeded in bridging the gender pay gap within the intricate framework of Portugal's informal economies. However, we acknowledge that this examination is not limited solely to educational attainment. It requires a comprehensive exploration of the complex factors that influence income disparities within informal sectors. As we embark on this endeavor, we seek to uncover whether the educational landscape has truly transformed the economic prospects of women within Portugal's informal economies

or if additional, often elusive, forces continue to shape these outcomes. Our research aspires to contribute valuable insights to address these challenges and promote gender equality within this multifaceted context.

The gender pay gap within Portugal's informal economies is a multidimensional quest that aims to transcend conventional boundaries. It is a testament to the complexity of the issue, the resilience of gender-based wage inequality, and the enduring significance of understanding the interplay between gender, informality, and education in the modern world. As we embark on this expedition through the literature, we invite readers to join us in unraveling the intricacies of this pressing concern and to envision a future where gender equality is not just an aspiration but a tangible reality within every facet of society.

## 2. Literature Review

The exploration of the gender pay gap in informal economies is a multidisciplinary endeavor, drawing insights from economics, sociology, gender studies, and labor market research. In this literature review, we dissect the existing body of scholarship, with a particular focus on Portugal, to understand the nuanced dynamics of this pervasive issue.

To truly grasp the nuances of the gender pay gap within informal economies, it is essential to commence our exploration with a global perspective. Extensive research conducted on an international scale consistently illuminates the enduring nature of this wage disparity. A significant study provides substantial evidence that women, on average, earn roughly 20% less than their male counterparts across a sample of 33 developed countries [13]. This striking finding serves as a poignant reminder that the gender pay gap transcends geographical boundaries and manifests as a global phenomenon.

The persistence of this overarching trend is influenced by a myriad of complex factors. One key factor is occupational segregation, wherein women are often disproportionately represented in lower-paying fields and industries, while men dominate higher-paying sectors. Furthermore, unequal access to leadership roles and positions of power remains a notable impediment to women's progress in closing the wage gap. The undervaluation of work traditionally associated with women, such as caregiving and domestic labor, contributes significantly to this disparity. These deeply rooted structural

issues underscore the multifaceted nature of the gender pay gap and highlight the need for comprehensive investigations that consider both global and localized dynamics.

Portugal stands as an emblem of progress in the journey toward gender equality, with commendable strides made in recent years across various dimensions. These notable achievements are manifested in political representation, education, and labor force participation, collectively contributing to a more equitable society. One significant indicator of Portugal's commitment to gender equality is its ranking in the World Economic Forum's Global Gender Gap Report (2020), where it emerged as one of the top-performing nations, securing the 30th position out of 153 countries [14]. This recognition underscores the nation's dedication to dismantling the barriers that have historically hindered gender parity.

A crucial driver of these advancements has been the implementation of legal reforms and affirmative action policies [15]. These initiatives have sought to redress historical imbalances and promote gender parity, particularly within the workplace. Such legal reforms have contributed to a more inclusive environment where women have greater opportunities to thrive and contribute to the workforce. As we delve deeper into our exploration of the gender pay gap within Portugal's informal economies, it is essential to acknowledge the broader context of progress and reforms that have paved the way for more equitable gender relations. However, it is also critical to recognize that despite these advancements, challenges persist, particularly within the informal labor market, where the gender pay gap remains a persistent concern, often hidden beneath the surface.

The intricate world of informal economies presents a complex and multifaceted set of challenges, distinct from the structured landscape of formal labor markets. As defined by research conducted [16], the informal economy encompasses a diverse array of activities that operate outside the purview of state regulation and predominantly rely on cash transactions for their sustenance. These activities span a wide spectrum, encompassing unregistered businesses, casual labor arrangements, and street vending, among others. Informal economies often serve as a lifeline for many individuals, particularly in regions with limited formal employment opportunities, offering a means to secure a source of income in the absence of conventional job prospects. However, the very nature of these economies is marked by precarious working conditions, characterized by lower wages, job instability, and limited access to social protections [17]. This duality, where informal economies simultaneously serve as a vital economic safety net and a source of vulnerability, underscores the need to delve deeper into their intricacies.

Within informal economies, workers grapple with a unique set of challenges and opportunities that can profoundly impact their well-being. The absence of formal contracts and regulatory safeguards can leave workers vulnerable to exploitation and arbitrary treatment. Lower wages, often a hallmark of informal employment, can perpetuate poverty and economic inequality, exacerbating the very issues these economies aim to alleviate. Limited access to social protections such as healthcare, unemployment benefits, and retirement plans further amplifies the risks associated with informal labor. As we embark on our journey to explore the gender pay gap within Portugal's informal economies, we must recognize the dual role played by these economic realms – as a vital means of survival for some, but also as a landscape fraught with inequalities that warrant close scrutiny and intervention. Our research endeavors to uncover the gendered dimensions of these complexities, seeking to shed light on how gender-based wage disparities manifest within the unique context of informal economies and the implications they hold for women's economic well-being.

Portugal's laudable achievements in the realm of gender equality notwithstanding, the specter of the gender pay gap continues to loom ominously within the confines of its informal economies. Research conducted provides striking evidence of the persistent wage disparities faced by women engaged in informal employment within the Portuguese landscape [9]. Their findings revealed that women in these informal roles earned an alarming 29% less than their male counterparts. This stark and disheartening discrepancy serves as an undeniable testament to the enduring relevance of investigating and addressing the gender pay gap within the specific context of informal economies.

The persistence of the gender pay gap within Portugal's informal economies signals a multifaceted challenge that calls for a deeper understanding. It not only sheds light on the limitations of broader gender equality measures but also underscores the unique dynamics at play within these unregulated labor markets. While Portugal has made significant strides in promoting gender equality in formal sectors, these achievements have not fully permeated the informal economy, where women continue to face wage disparities. This incongruity necessitates a comprehensive exploration of the factors that contribute to these disparities, taking into account the distinctive characteristics and challenges inherent to informal employment. Our research seeks to fill this knowledge gap, delving into the intricacies of gender-based wage inequality within Portugal's informal economies, with the ultimate aim of providing insights that can guide targeted interventions and policies to rectify this persistent and pressing issue.

Educational attainment has long been heralded as a powerful lever for economic empowerment, with historical significance in narrowing the gender pay gap, particularly in formal labor markets [18]. In Portugal, the educational landscape has witnessed significant transformation, with a growing number of individuals successfully completing at least upper secondary education [19]. Data from the 2021 Census, as reported by Eurostat, underscores this upward trajectory, revealing a consistent rise in educational attainment among the population aged 25 and above [20]. These educational achievements have been viewed as pivotal milestones on the path to greater gender equality, promising enhanced economic opportunities and financial independence for women.

However, within the intricate fabric of Portugal's informal economies, the translation of these educational gains into income equality remains an elusive endeavor [21]. Compelling research conducted suggests that the gender pay gap continues to persist within informal sectors, even among individuals with comparable levels of education [22]. This intriguing finding calls attention to the multifaceted nature of wage disparities within informal labor markets, which extend beyond the realms of education and qualifications alone. It invites us to delve deeper into the complex interplay of factors that contribute to income inequality, potentially unearthing deeper-seated issues such as occupational segregation, discriminatory practices, and societal norms. As we embark on this research journey, we must navigate this intricate web of factors to gain a holistic understanding of how gender-based wage disparities manifest within Portugal's informal economies, seeking insights that can drive evidence-based interventions and policies for greater economic equity.

Occupational segregation, a deeply entrenched issue within informal economies, stands as a prominent and enduring factor contributing to the gender pay gap. Women often find themselves disproportionately concentrated in low-paying and precarious sectors, characterized by roles such as domestic work, caregiving, and street vending. These occupations, which have historically been undervalued, marginalized, and overlooked, are predominantly associated with women and tend to offer lower wages and fewer opportunities for upward mobility. The persistence of such occupational segregation within informal economies perpetuates wage inequalities, relegating women to the margins of economic opportunity.

Research conducted underscores how the undervaluation of work typically performed by women exacerbates wage disparities within these informal sectors [23]. The devaluation of caregiving and domestic work, for instance, is deeply rooted in societal norms that have long underappreciated these essential roles. As a result, wages in these



sectors remain disproportionately low, despite their critical importance to families and communities. Additionally, the presence of discrimination and implicit biases within informal labor markets further compounds the gender pay gap. A study highlights the troubling reality of discriminatory hiring practices, demonstrating that even within the informality of job markets, biases can persist, hindering women's access to higher-paying opportunities [24]. These systemic issues within informal economies, including occupational segregation, undervaluation of women's work, and discriminatory practices, create a complex and challenging environment that necessitates rigorous investigation and concerted efforts to address gender-based wage disparities. As we delve into the gender pay gap within Portugal's informal economies, we must navigate these multifaceted dynamics, seeking to uncover the underlying causes and potential remedies that can promote greater economic equity for women.

### 3. Research Method

The research methodology employed in this study seeks to comprehensively analyze the gender pay gap within Portugal's informal economies over a 16-year period, spanning from 2005 to 2020. To accomplish this, we utilize Vector Error Correction Models (VECM), a robust time-series econometric approach well-suited for modeling non-stationary data and capturing both short-term dynamics and long-term equilibrium relationships among selected variables. Table 1 contains a description of these variables. In this research we use the following equation.

$$EA_t = \beta_0 + \beta_1 WSM_t + \beta_2 WSW_t + \beta_3 ET_t + e_t \text{ eq 1}$$

$$WSM_t = \beta_0 + \beta_1 EA_t + \beta_2 WSW_t + \beta_3 ET_t + e_t \text{ eq 2}$$

$$WSW_t = \beta_0 + \beta_1 EA_t + \beta_2 WSM_t + \beta_3 ET_t + e_t \text{ eq 3}$$

$$ET_t = \beta_0 + \beta_1 EA_t + \beta_2 WSM_t + \beta_3 WSW_t + e_t \text{ eq 4}$$

Description:

EA : Educational attainment

WSM : Wage and salaried workers (Male)

WSW : Wage and salaried workers (Female)

ET : Employers total

$\beta$  : the magnitude of the effect of causality

e = Error term

t = Time period

eq1 : equation

TABLE 1: Variable description.

Variable	Explanation	Data type	Source
Educational attainment	The share of the adult population with a high school diploma or equivalent is 25 and up	Percent	World Bank
Wage and salaried workers (Male)	Salaried and wage workers (employees) are those who hold positions classified as “paid employment jobs,” where they are guaranteed a minimum wage or salary regardless of the success of the business in which they are employed (Male).	Percent	World Bank
Wage and salaried workers (Female)	Salaried and wage workers (employees) are those who hold positions classified as “paid employment jobs,” where they are guaranteed a minimum wage or salary regardless of the success of the business in which they are employed (Female).	Percent	World Bank
Employers total	Self-employed individuals (those who work for themselves or with a small number of partners and whose income is based on the sale of their products or the provision of their services) are employers if they have hired one or more people to work for them on a regular basis.	Percent	World Bank

## 4. Result and Discussion

VECM is an abbreviation for Vector Error Correction Model. This model is included in the group of vector autoregressive (VAR) models which are useful for studying long-term and short-term relationships between integrated variables. Cointegration means that there is a linear combination of non-stationary variables that are stationary, which shows that there is a long-term balance between these variables. VECM is able to describe both long-term integration and short-term adjustments resulting from deviations from equilibrium. To estimate a VECM, you must know the number of cointegrating equations and the appropriate order of lags for the model. There are several ways to determine this, for example with the Johansen test, Engle-Granger test, or information criteria.

You should also specify whether the model has deterministic terms, such as constant, trend, or seasonal dummy. Stationarity is an important characteristic of time series data. This means that the mean, variance, and autocorrelation of the data are independent of time. Stationary data is easier to model and project than non-stationary data. To test stationarity, you can use various tests, such as the Dickey-Fuller test, the augmented Dickey-Fuller test, or the Phillips-Perron test. If the data is non-stationary, you can try to make it stationary by means of differentiation or transformation. Table 2 shows that of the stationary test.

TABLE 2: Stationary test.

Variabel	Unit Root	Statistics for the Augmented Dickey Fuller	Probability	Description
Educational attainment (EA)	Level	1.056093	0.9947	Not Stationary
	First Different	-3.296969	0.0413	Stationary
Wage and salaried workers, Male (WSM)	Level	-0.265236	0.9093	Not Stationary
	First Different	-3.116286	0.0485	Stationary
Wage and salaried workers, Female (WSW)	Level	-1.153782	0.6646	Not Stationary
	First Different	-3.604312	0.0205	Stationary
Employers total (ET)	Level	-1.606407	0.4551	Not Stationary
	First Different	-3.637123	0.0242	Stationary

\*the limit value used at the significance level of 0.05

Based on the findings shown on Table 2. The fact that EA, WSM, WSW and ET stationary data are not at the same level, so that the first differencing is put into action. The results of the first differencing show that the data is stationary with a probability value  $< 0.05$ . After knowing the stationarity of the data held, then testing is carried out to calculate the best lag duration to utilize. The method used determining the optimal lag duration LogL, LR, FPE and AIC. The smaller the value of LogL, LR, FPE, AIC, the lag is the most optimum lag. The outcomes of the test are shown on the table 3.

Table 3 Shows the optimum lag testing of the VAR model using the LogL, LR, FPE and AIC criteria. Based on these results, it is known that the optimum model is found in Lag 1 because the LogL, LR, FPE and AIC values in Lag 1 are the smallest compared to the previous Lag.

TABLE 3: Maximum lag test.

Lag	LogL	LR	FPE	AIC
0	-80.68619	NA	0.942495	11.29149
1	-31.25490	5.90839*	0.012136*	6.833986*

TABLE 4: Cointegration test.

Hypothesized at Most	Eigenvalue	Trace Statistic	0.05 Value	Critical	Probability
None	0.771469	22.14126	27.58434		0.2132
1	0.488144	10.04569	21.13162		0.7404
2	0.323791	5.868797	14.26460		0.6301
3	0.003862	0.058044	3.841466		0.8096

\* Max-eigenvalue test indicates no cointegration at the 0.05 level

The cointegration test results are shown in table 4 above explain that all probability value is above 0.05. It means all the probabilities are not significant. Analysis of VAR for identify connection among the researched variables studied that one variable have influence other variables in short term. The coefficients on the VAR analysis can be used to determine the influence between variables. If the coefficient value is less than the t-statistic value, then there is an influence relationship between these variables.

TABLE 5: VECM estimation results.

Table Head	D(EA)	D(WSM)	D(WSW)	D(ET)
D(EA(-1))	0.938938 (0.49291) [ 1.90489]	0.135626 (0.15422) [ 0.87941]	0.441784 (0.34696) [ 1.27329]	-0.058857 (0.04470) [-1.31677]
D(WSM(-1))	-0.019843 (1.36786) [-0.01451]	-0.030928 (0.42798) [-0.07226]	0.277652 (0.96285) [ 0.28836]	-0.003066 (0.12404) [-0.02471]
D(WSW(-1))	0.514363 (0.69097) [ 0.74441]	-0.346934 (0.21619) [-1.60475]	-0.011827 (0.48638) [-0.02432]	-0.094907 (0.06266) [-1.51470]
D(ET(-1))	4.948204 (5.98529) [ 0.82673]	-2.191345 (1.87270) [-1.17015]	-4.237015 (4.21310) [-1.00568]	0.058092 (0.54275) [ 0.10703]
C	-140.2353 (157.946) [-0.88787]	145.3294 (49.4188) [ 2.94077]	194.1369 (111.180) [ 1.74615]	12.32449 (14.3228) [ 0.86048]

Considering what the VAR analysis revealed, could be said that relationship between EA and EA has a positive significant impact because the coefficient value's at 0.938938, this value is fewer than the -1.90489 t-statistic's value. Significant correlation exists between EA and WSM, meaning that the two variables related to each other because the coefficient value is at 0.135626 less than the 0.87941 t-statistic value. The significant correlation also found exists between EA and WSW, because the coefficient value is at 0.441784 way less than the 1.27329 t-value statistic. For the final significant association between EA and ET, we found that the coefficient value's at -0.058857 much less than the -1.31677 t-value statistic.

## 5. Conclusion, Limitation, Suggestion

### 5.1. Conclusion

The comprehensive analysis of the gender pay gap within Portugal's informal economies, spanning from 2005 to 2020, using Vector Error Correction Models (VECM), has shed light on the intricate dynamics surrounding this critical issue. Our investigation focused on four key variables: Employers (total), Wage and salaried workers (female), Wage and salaried workers (male), and Educational attainment at least completed upper secondary population 25+ (EA).

The results of our analysis, in conjunction with the VAR analysis, reveal intriguing insights into the relationships among these variables:

**Educational Attainment (EA) and Employers (Total):** The VAR analysis suggests a positive and significant impact, as indicated by a coefficient value of 0.938938. This finding implies that an increase in the population with at least upper secondary education has a favorable effect on the total number of employers within Portugal's informal economies. This relationship is reinforced by the fact that the coefficient value is lower than the t-statistic's value of -1.90489, indicating statistical significance.

**Educational Attainment (EA) and Wage and Salaried Workers (Female):** The analysis uncovers a significant correlation between EA and Wage and Salaried Workers (Female). The coefficient value of 0.135626, although positive, is notably lower than the t-statistic value of 0.87941. This suggests a complex relationship where an increase in educational attainment may have a limited impact on the number of female wage and salaried workers within the informal economy.

Educational Attainment (EA) and Wage and Salaried Workers (Male): A significant correlation is observed between EA and Wage and Salaried Workers (Male). The coefficient value of 0.441784, while positive, is considerably lower than the t-statistic value of 1.27329. This implies that the influence of educational attainment on the number of male wage and salaried workers in the informal sector is less pronounced.

Educational Attainment (EA) and Educational Attainment at least completed upper secondary population 25+ (ET): The analysis indicates a significant association between EA and ET. The coefficient value of -0.058857 is notably lower than the t-statistic value of -1.31677. This suggests a complex interplay between these two variables, with educational attainment having a modest impact on the population aged 25 and above with at least upper secondary education.

In conclusion, this research underscores the multifaceted nature of the gender pay gap within Portugal's informal economies. While educational attainment plays a role in certain aspects, such as the total number of employers, its impact on the number of female and male wage and salaried workers within the informal sector appears more nuanced. Moreover, the relationship between educational attainment and the population aged 25 and above with at least upper secondary education suggests intricate dynamics.

These findings emphasize the need for a holistic approach to address the gender pay gap within informal economies, recognizing that education is just one component of a broader landscape shaped by factors like occupational segregation, discrimination, and societal norms. Policymakers and stakeholders should consider these insights when crafting interventions aimed at promoting greater gender equality within this complex economic context. Further research and targeted policies are essential to unravel the underlying causes of the gender pay gap and foster an equitable environment for all individuals within Portugal's informal economies.

## 5.2. Limitation

This research is limited by specific data availability and research period.

## 5.3. Suggestions

For the future research, here is some of our suggestions:

**Policy Evaluation:** Evaluating the effectiveness of existing policies and interventions aimed at reducing the gender pay gap within informal economies is crucial. Research can assess the impact of policy measures and identify areas where improvements are needed.

**Comparative Studies:** Conducting comparative studies with other countries or regions can provide valuable insights into the factors contributing to the gender pay gap. Examining the experiences of Portugal in a global context can highlight unique challenges and potential best practices.

**Influence of Informal Work on Social Protections:** Investigate how participation in informal economies affects individuals' access to social protections, including healthcare, pensions, and unemployment benefits. Understanding these dynamics is essential for designing inclusive social safety nets.

**Gender Norms and Stereotypes:** Explore the influence of gender norms and stereotypes on occupational choices within informal economies. Understanding how societal expectations shape employment decisions can inform strategies for dismantling gender biases.

**Policy Implementation and Enforcement:** Research on the implementation and enforcement of gender equality policies within informal sectors can shed light on barriers and opportunities for creating more equitable working conditions.

**Impact of Economic Shocks:** Analyze how economic crises or significant events (e.g., the COVID-19 pandemic) impact the gender pay gap within informal economies. Understanding how external shocks affect vulnerable populations is essential for resilience planning.

**Interventions Targeting Employers:** Investigate the effectiveness of interventions specifically targeting employers within informal economies. Research on incentives, training programs, and awareness campaigns for employers can contribute to reducing wage disparities.

**Gender-Based Violence in Informal Economies:** Explore the prevalence and impact of gender-based violence within informal sectors and its implications for women's economic participation and the gender pay gap.

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