

**TITLE**

Subtitle

Ana Clara do Carmo St. Aubyn

Dissertation presented as partial requirement for obtaining the Master’s degree in Advanced Analytics

MAA

Title:

Subtitle:

Ana Clara do Carmo St. Aubyn

2021





**NOVA Information Management School**

**Instituto Superior de Estatística e Gestão de Informação**  
Universidade Nova de Lisboa

TITLE

by

Ana Clara do Carmo St. Aubyn

Dissertation presented as partial requirement for obtaining the Master’s degree in Advanced Analytics

**Advisor / Co Advisor:**Mauro Castelli and Maria Jordão

Month 2021

Dedication (optional)

Acknowledgements (optional)

Abstract

Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text Abstract text.

Keywords

Keyword 1; Keyword 2; Keyword 3; Keyword 4

INDEX

[1. Introduction 1](#_Toc70670237)

[1.1. Thesis Objective and Research Questions 1](#_Toc70670238)

[1.2. The Evolution of Domestic Violence in Portugal 2](#_Toc70670239)

[2. Literature Review 4](#_Toc70670240)

[3. Theoretical Background 7](#_Toc70670241)

[3.1. Panel Data 7](#_Toc70670242)

[3.2. Causal Relationships and *Ceteris Paribus* 7](#_Toc70670243)

[4. Data Exploration 9](#_Toc70670244)

[4.1. Dependent Variable 10](#_Toc70670245)

[4.2. Explanatory Variables 12](#_Toc70670246)

[5. Methodology 16](#_Toc70670247)

[6. Results and Discussion 18](#_Toc70670248)

[7. Conclusions 19](#_Toc70670249)

[8. Limitations and Recommendations for Future Works 20](#_Toc70670250)

[9. Bibliography 21](#_Toc70670251)

[10. Appendix (optional) 23](#_Toc70670252)

[11. Annexes (optional) 24](#_Toc70670253)

List of Figures

[Figure 1.1. Domestic Violence Occurrences (Portugal) 2](#_Toc70600247)

[Figure 1.2. Domestic Violence Occurrences by Category (Portugal) 3](#_Toc70600248)

[Figure 1.3. Domestic Violence Against Spouse or Analogous Occurrences (Portugal) 3](#_Toc70600249)

[Figure 2.1 - Age of Domestic Violence Victims (2013-2017) 6](#_Toc70600250)

[Figure 4.1. Absolute Change in Total and DVASA Occurrences (Portugal) 11](#_Toc70600251)

[Figure 4.2 - Are Marriages and DVASA Occurrences Related? 14](#_Toc70600252)

LIST OF TABLES

Table 4.1. Dataset Variable Description 9

Table 4.2. Descriptive Statistics for the Dependent Variable (Portugal) 10

Table 4.3. Missing Values by Domestic Violence Category (Municipalities) 12

Table 4.4. Missing Values for DVASA in Municipalities and Difference Between National Total and Municipality Total 12

List of Abbreviations and Acronyms

**APAV** *Associação Portuguesa de Apoio à Vítima*

**DGPJ** *Direção-Geral da Política de Justiça*

**DVAM** Domestic Violence Against Minors

**DVASA** Domestic Violence Against Spouse or Analogous

**IPV** Intimate Partner Violence

**OMA** *Observatório de Mulheres Assassinadas da* UMAR

# 

# Introduction

Domestic violence is a widely discussed issue. According to Portuguese news agencies, the number of victims seems to be rising each year. Given this, it certainly is of the utmost importance to identify and address the causes of this problem. It is also true that the public in general is increasingly aware of the reality about domestic violence and this topic is becoming more relevant in the official media channels.

According to the yearly report[[1]](#footnote-1) published by OMA – *Observatório de Mulheres Assassinadas da UMAR* – in 2017, during the same year there were 20 murders related to domestic violence in Portugal. Besides that, there were 28 cases of domestic violence that were considered attempted murders. The report[[2]](#footnote-2) from the following year states that the number of domestic violence related murders increased by 8, turning the reported number of murders related to domestic violence in 2018 into 28. The number of deaths related to domestic violence in 2019[[3]](#footnote-3) was even higher than in the previous years, with 31 registered deaths. It is important to acknowledge that throughout the year of 2019 there were a total of 89 willful murders registered, as stated by the official statistics provided by *Direção-Geral da Política de Justiça* (DGPJ). This number makes the previous number regarding murders related to domestic violence much more relevant and contextualized. The official report[[4]](#footnote-4) about murder victims in 2019, released by APAV – *Associação Portuguesa de Apoio à Vítima* in June 2020, also stated that, regarding the 44 willful murders that they followed, 48% of those were caused by domestic violence. **These numbers lift the veil on the sad reality Portugal is facing and clarify the need for addressing this problem**.

## Thesis Objective and Research Questions

The present project aims to develop a model that allows an understanding of the causes of domestic violence in Portugal and explains while quantifying the effect of each explanatory variable in the number of domestic violence occurrences. Taking into account the available data and the characteristics of it, the application of a panel data regression was selected as a viable solution in order to achieve the main goal.

During this research, the importance of several possible causes for domestic violence was tested. Since the objective is to explain the number of occurrences as well as possible, modifications to some variables were considered during the process as well as alternative models.

Keeping this in mind, the present dissertation proposes to answer the following questions:

* How did the number of domestic violence occurrences in Portugal evolve between 2008 and 2019?
* How well can panel data regression explain this evolution?
* What are the main causes of domestic violence?
* How does each explanatory variable affect the number of domestic violence occurrences?

## The Evolution of Domestic Violence in Portugal

In order to have a better understanding of the numbers, one can take a look at Figure 1.1. This figure represents the total number of domestic violence occurrences registered by police authorities in Portugal by year in the time interval between 2008 and 2019. From the figure we can see a rise in the number of occurrences between 2008 and 2010, followed by a decrease from 2010 to 2012. In the period between 2012 and 2018 the number of occurrences remained relatively stable. However, one can witness a new rise from 2018 to 2019. **The key point of this study is to find the causes for this evolution and explain their influence in the number of domestic violence occurrences.**



Figure 1.1. Domestic Violence Occurrences (Portugal)

In Portugal, under Article 152 of the Criminal Code, an aggression is categorized as domestic violence if the aggressor, repeatedly or not, inflicts physical or psychological ill-treatment, including physical punishment, deprivations of freedom and sexual offenses to:

* A spouse or ex-spouse.
* Someone from either the same or any other gender with whom the aggressor keeps or has kept a relationship analogous to that of spouses, even if without cohabitation.
* A parent of common offspring in first degree.
* Someone who is particularly helpless, possibly because of age, disability, illness, pregnancy or economic dependency with whom the aggressor cohabits.

Having this in mind, one can identify three categories of domestic violence as shown in the official statistics provided by DGPJ. The first one, which is called **domestic violence against spouse or analogous** includes all the topics mentioned above except for the last one. The second one, which is called **domestic violence against minors**, includes all aggressions to minors in which the aggressor cohabits with the victim. Finally, the last category, which is called **others**, includes the last of the topics mentioned above except for cases of domestic violence against minors. Figure 1.2 is a breakdown of Figure 1, splitting the total occurrences into these three categories. It becomes clear that most of the domestic violence occurrences in Portugal fit into the first category – domestic violence against spouse or analogous – represented in the figure by the green line. The minimum value for this category was 20394 in 2008, whilst the maximum value was 25129 in 2010. The second most prominent category is others, with a maximum value of 4651 in 2011 and a minimum value of 3083 in 2008. Finally, the least represented category is domestic violence against minors, with a maximum value of 680 in 2008 and a minimum value of 430 in 2017.



Figure 1.2. Domestic Violence Occurrences by Category (Portugal)

Figure 1.3. allows one to take a closer look at the evolution of the number of domestic violence against spouse or analogous occurrences and notice that not only it represents the majority of domestic violence occurrences in Portugal, as it follows the pattern detected for the total occurrences described in Figure 1.1. This is the main category for domestic violence occurrences in Portugal and will also be the one used as a dependent variable during the course of this study.



Figure 1.3. Domestic Violence Against Spouse or Analogous Occurrences (Portugal)

# Literature Review

Domestic violence is a real issue that affects countries and the people who live in them in multiple ways. A study[[5]](#footnote-5) from 2018, measuring the global prevalence of Intimate Partner Violence (IPV) against women – which tend to be the most affected by this type of violence – combines data from 141 studies in 81 countries to show that, globally, 30% (95% confidence interval) of women aged 15 or over have experienced some form of IPV. This percentage varies regionally. **In Western Europe, where Portugal is located, it is estimated that around 20% of women aged 15 or over have experienced IPV**.

In order to investigate the causes of domestic violence, one must analyze data regarding its evolution. Measuring the prevalence of domestic violence occurrences may be a hard task, as it is a sensitive topic. An article[[6]](#footnote-6) by Ellsberg et al., written in 2001, compares three studies on domestic violence in Nicaragua. Two of them are focused on urban areas of the country (León and Managua) and the remaining one is a national-wide Demographic and Health Survey that included other themes besides domestic violence. All of them are interview-based studies. When comparing the results of the studies, the authors of the article come to the conclusion that **domestic violence occurrences tend to be underestimated when the source relies on self-reporting**. This underestimation is not random, as it depends on numerous factors such as the number of individuals present in the room at the time of the interview or the way the questions are asked. In many other cases this type of violence suffers from underreporting, as it usually happens in private spaces and the perpetrator is someone close to the victim. This makes it hard for the victim to come forward and for others to realize something wrong is happening. (Ellsberg, Heise, Peña, Agurto, & Winkvist, 2001) also mentions that some groups seem to be more at risk for domestic violence than others. It seems like **women with more children are more prone to suffer assaults**. Also, **younger women were found to be at higher risk of violence**. The more fragile the victims, the more likely they are to suffer from domestic violence.

Information about domestic violence occurrences is almost always focused on women as the victims. Consequently, domestic violence against men tends to be concealed, as men are less likely to report such occurrences because of embarrassment, among other causes (Barber, 2008). This causes **the number of domestic violence occurrences against men to be systematically underreported**. The response by authorities is also at stake when it comes to men reporting domestic violence as the victim. (Barber, 2008) shows that, on a national-wide UK survey regarding domestic violence against men, only 3% of men who reported the occurrence to the police were taken seriously, whilst the remaining were threatened with arrest, ignored, or actually arrested. One can conclude that, due to the nature of the crime and to preconceptions in the way Society works, domestic violence occurrences are almost always underreported.

Healthcare workers are also key players in detecting and listening to reports of domestic violence. (Cann, Withnell, Shakespeare, Doll, & Thomas, 2001) aims to find the type of healthcare workers (by gender, role and specialty) that has better responses and knowledge facing domestic violence reporting and detection. This study contemplates healthcare workers from primary care, mental health, obstetrics and gynecology in the county of Oxfordshire, in England. A questionnaire was presented to each of the workers and they were assessed according to a rating system on both knowledge and correct response. Women, nurses and mental health workers showed better results in dealing with domestic violence. **It is possible that municipalities with more healthcare workers that fit into these categories tend to have lower domestic violence rates**. A lot of victims of abuse seek medical help, making it important for healthcare workers to have experience in handling these situations.

Domestic violence has been associated to many socioeconomic variables, such as the wealth and education of both the victim and the aggressor. It has been said that **middle-level socioeconomic and well educated groups tend to have the lowest prevalence of occurrences, whilst poorer groups tend to have the highest** (Campbell, 2002). Domestic violence can also be related to gender inequality. As explained in the 2010 article[[7]](#footnote-7) entitled *The Gender Wage Gap and Domestic Violence*, written by Anna Aizer, **there are several theories regarding wage gender inequality and domestic violence against women**. The one supported by this article states that, as the wage gap between genders decreases, women get more bargaining power and, consequently, domestic violence decreases as well. However, there are other hypotheses possible. The first one is the “male backlash” hypothesis which states that, as the wage gap decreases, violence increases against women because aggressive men feel as if their traditional gender role may be threatened. The other hypothesis, the model of exposure reduction, states that as the wage gap decreases, the labor force participation of women increases and, consequently, domestic violence against them declines because women spend less time with violent partners. Either way, **it is unquestionable that this is a variable of interest when it comes to justifying changes in domestic violence occurrences**. One of the key points of this article is that the relative or potential salary is more important in justifying violence patterns than the actual one. Keeping this in mind, if possible, it is better to use a variable that reflects the potential wage of women vs. men instead of the actual wage gap. The results of this study, conducted in the state of California, in the United States, show that the decline in the wage gap between 1990 and 2003 explains nine percent of the decrease of domestic violence against women in the same period.

Another factor that may be a possible cause of domestic violence is unemployment. A 2015 study[[8]](#footnote-8) by Anderberg et al. focuses on the theory that a rise in female unemployment increases the number of domestic violence occurrences whilst a rise in male unemployment has the opposite effect. Using data from England and Wales, the authors prove that this theory is well founded, showing that a one percentage point increase in the male unemployment rate causes a decrease of 3% in domestic violence occurrences. A corresponding increase in the female unemployment rate has the opposite effect. Keeping this in mind, **unemployment by gender may be a relevant variable to include in the present study**.

When it comes to the Portuguese reality, APAV is the strongest association on the subject. According to an APAV report[[9]](#footnote-9) published in 2018 that studies the characteristics of victims of domestic violence in Portugal between 2013 and 2017, during this period this organization registered a total of 36.528 support processes in cases of domestic violence. In 31.317 of these processes, the victim was female (representing 85,73% of the total). Following the same line of thought, in 32.134 of the processes the author of the crime was male (representing 85,93% of the total). **This suggests that it might be useful to include some measure of the gender structure of the population as an explanatory variable for the present study**. It is also mentioned in the same report that 41% of the victims had ages comprehended between 26 and 55 years. However, in another report[[10]](#footnote-10) published by APAV also in 2018 that focuses on cases of domestic violence with male victims, it is mentioned that the victim’s age group with higher frequency is the 65 years or above one, representing around 28% of the processes contemplated by the report. Figure 2.1. below shows the percentage of processes for each age group (from 18 years and to 65+) both in the general report (23.193 processes) and in the male only report (2.745 processes). One can see that the patterns for each report are different, **showing the importance of including the age structure of the population by gender in the present study**.



Figure 2.1 - Age of Domestic Violence Victims (2013-2017)

Another key finding from the general APAV report is related to the family structure of the victims. Once again, it is shown that **children are an important factor when determining the risk for domestic violence**. From the 36.528 processes considered, 41,86% of the victims were in a nuclear family with children. Finally, it is also mentioned in the report that the marital status of the victim is also a relevant factor, as around 34% of the victims were married. This is a relevant percentage when compared to the 20,8% that were single, 16% whose marital status was unknown, 11,6% who were in a non-marital partnership, 8,7% who were divorced, 5,6% who were separated and 3,3% who were widowed. Therefore, **including a measure of the number of marriages may be relevant**.

Still regarding the marital status, (Bowlus & Seitz, 2006) finds that **women who are severely abused by their husbands are significantly more likely to divorce** than women who do not face this problem. However, it is important to notice that women may be more likely to report violence in a past marriage than in a present one, causing an upward bias in this probability. This study uses data from all provinces of Canada, retrieved in 1993. The initial analysis on this data also revealed that **women who experienced abuse by their partners tend to have lower levels of education and come from more violent backgrounds** than women who did not face abuse. The same applies to the partners – **husbands who abuse their wives tend to have lower levels of education**. Another finding from this initial analysis is that **women who are not working are more likely to face abuse**, which meets the conclusions on (Anderberg, Rainer, Wadsworth, & Wilson, 2015).

# Theoretical Background

## Panel Data

Data can be collected in multiple formats. The most widely discussed ones are cross section data, pooled cross section data, time series data and panel data.

**Cross section** data is data that is collected for multiple units across the same time period. Each observation represents a unit of the population being studied. It is the “common” dataset structure. When we combine cross section data from different time periods we create a **pooled cross section** dataset. In this case, each observation represents a unit of the population in a specific period in time. It is not necessarily true that the same units are studied for the different periods. If we are studying the same unit across different periods in time, we create a **time series**. A time series shows the evolution of that unit through a specified time interval. Finally, **panel data**, also called **longitudinal data**, is a combination of cross section and time series data. In this type of data, we have one time series for each included unit. The identifier of the unit and the period the data refers to are shown as variables in the dataset. The present study focuses on panel data, as there is one yearly discrete time series for each Portuguese municipality.

## Causal Relationships and *Ceteris Paribus*

The goal in regression analysis is to find **causal relationships** between variables, that is, to determine whether a change in *x* causes a change in *y*. To express our ideas regarding the relationships between variables we use functions. For example, to express a relationship between consumption and income one can write:

The previous function is a possible notation to say that the consumption of a certain individual is a function of his income. This is the same as saying the individuals’ consumption depends on his income. However, the consumption may not only depend on income, it may depend on many other factors as well. Keeping this in mind, to understand the relationship between consumption and income it is important to set aside the impacts of the remaining factors on consumption. The idea of ***ceteris paribus*** (c.p.) means to hold all other factors constant and is a key point in establishing causal relationships. Without holding the remaining variables constant one does not prove that the change observed in *y* is caused by the change in *x*. This is also the reason why a simple correlation study is not enough to analyze causal relationships.

When we are studying the causal effect of *x* on *y*, the remaining variables that influence *y* are called the **control variables**. The reason to control these variables is simple: we believe that *x* is correlated with other factors influencing *y*, which means that not holding these variables constant will make their effects reflect on the coefficient for *x*. Since we feed data to the regression model, it is important to correctly determine the control variables that need to be held fixed. This is a critical part of regression analysis but may be hard, as usually not all factors influencing the dependent variable are observable. When one does not include an important control variable, its effects are reflected on the partial effects of other factors, making these last ones incorrect.

Stating the difference between explanatory variables and control variables may be hard. Even if some variables can be considered control variables in all occasions, all explanatory variables are eventually control variables when trying to explain the partial effects of another variable. For panel data, the variables that determine the difference between observations (in the case of this study: municipality and year) are always control variables as, even if they can explain part of the variance in the data, their main goal is to distinguish between observations.

# Data Exploration

The dataset is composed by x explanatory variables and the dependent variable (DVASA occurrences). The methods used for calculating, treating, and standardizing all of these variables are explained in the next few pages of this study. The dataset follows a panel data structure, having a column for the spatial dimension (Municipality) and one for the temporal dimension (Year). A summary of the existing variables can be found on Table 4.1, below:

|  |  |
| --- | --- |
| Variable Name | Description |
| Municipality | Spatial Dimension of the Dataset. |
| Year | Temporal Dimension of the Dataset. |
| DVASA | Number of DVASA Occurrences Registered by Police Authorities by 100 Inhabitants. |
| Divorces | Number of Divorces for 100 Marriages in that Civil Year. |
| Elderly\_Dependency | Number of People Aged 65 and Over for Every 100 People of Working Age, that is, Between 15 and 64 Years Old. |
| Female\_Doctors | Percentage of Doctors Enrolled in the Doctor’s Order Who Are Female. |
| Fertility | Average Number of Children Born for Each Woman in Fertile Age (Between 15 and 49 Years). |
| Marriages | Number of New Marriages per 100 Inhabitants. |
| Men65 | Percentage of the Total Population of the Municipality that Represents Men With 65 Years or More. |
| Middle\_Aged\_Women | Percentage of the Total Population of the Municipality that Represents Women Between 25 and 54 Years. |
| Monthly\_Gain | Average Gross Amount that the Employees in the Municipality Receive Every Month Including basic remuneration and Other Remuneration Paid by the Employer (Overtime, Holiday Pay or Premiums). |
| Unemployment\_Female | Number of Women Enrolled in Employment and Vocational Training Centers per 100 Inhabitants. |
| Unemployment\_Male | Number of Men Enrolled in Employment and Vocational Training Centers per 100 Inhabitants. |
| Unemployment\_Total | Number of people Enrolled in Employment and Vocational Training Centers per 100 Inhabitants. |
| Youth\_Dependency | Number of Children Under 15 Years Old for Every 100 People of Working Age, that is, Between 15 and 64 Years Old. |
| Wage\_Gap | Percentage of Men’s Monthly Gain that Women Receive on Average. |

Table 4.1. Dataset Variable Description

## Dependent Variable

Three datasets containing information regarding the dependent variable were retrieved from the official Statistics website by DGPJ on the 4th of March of 2021. One containing information about the number of domestic violence occurrences nationwide, one with this data split by districts and a last one with the data split by municipalities. All of them contained information regarding three categories (as explained in 1.Introduction): **domestic violence against spouse or analogous (DVASA)**, **domestic violence against minors (DVAM)** and **others**. Finally, for all three datasets, the data was collected for the period between 2008 and 2019, due to data availability.

The Portuguese Criminal Code provides for and punishes the crime of domestic violence. Domestic violence assumes the nature of a public crime, which means that the criminal procedure is not dependent on a complaint by the victim, just a complaint or knowledge of the crime is enough for the Public Ministry to promote the process. Keeping this in mind, the registered number of occurrences of domestic violence in Portugal does not depend only on self-report by the victim. However, as it is a crime that commonly takes place in the privacy of a home, many cases may depend on self-report. The dataset obtained focuses on **data registered by police authorities** and, according to (Ellsberg, Heise, Peña, Agurto, & Winkvist, 2001), may suffer from underreporting, as it depends on self-report to some extent.

The data recorded for Portugal as a whole is a discrete time series. For each category there is a set of 12 observations recorded at uniformly spaced time values, in this case, years. This remains true for the data regarding districts and municipalities, except that, for the first case, there is one time series per category and per district, and for the second case there is one time series per category and per municipality.

The evolution of the number of domestic violence occurrences in Portugal can be seen in figures 1.1 and 1.2 (1. Introduction). It becomes clear by the analysis of these figures and of the descriptive statistics on Table 4.1 that domestic violence against spouse or analogous is the most prominent category out of the three. One can see that, between 2008 and 2019, the yearly average of domestic violence occurrences was 27394. Considering the same period, the yearly average for the DVASA category was 22977,8, a value that clearly shows how relevant this category is for the total domestic violence occurrences. The remaining categories have less significant yearly averages.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **DVASA** | **DVAM** | **Others** | **Total Occurrences** |
| **Std** | 1226,32 | 75,22 | 435,55 | 1612,36 |
| **Minimum** | 20394,00 | 430,00 | 3083,00 | 24157,00 |
| **Mean** | 22977,80 | 537,92 | 3879,17 | 27394,90 |
| **Maximum** | 25129,00 | 680,00 | 4651,00 | 30340,00 |
| **Q3** | 23382,80 | 599,00 | 4039,00 | 27877,00 |
| **Median** | 22851,50 | 515,50 | 3800,00 | 27155,00 |
| **Q1** | 22457,50 | 484,00 | 3647,75 | 26683,50 |

Table 4.2. Descriptive Statistics for the Dependent Variable (Portugal)

When comparing the evolution of total occurrences in Portugal (Figure 1.1) with the evolution of occurrences for DVASA (Figure 1.3), one can detect the same patterns. By calculating the difference in the number of occurrences for subsequent years, it is possible to notice that DVASA occurrences almost always justify over half of the growth or decrease in the number of total occurrences. This is only not true for the transition between 2014 and 2015, when the number of DVASA occurrences increased by 35 but the number of total domestic violence occurrences decreased by 48 due to a decrement in the other categories. Figure 4.1 shows exactly this.



Figure 4.1. Absolute Change in Total and DVASA Occurrences (Portugal)

Since the datasets only have 12 years worth of data, it would not be possible to perform a time series regression, as there would not be enough degrees of freedom to provide powerful estimates. Keeping this in mind, a panel data regression will be performed with data regarding the years and municipalities. For this purpose, the dataset containing information about domestic violence occurrences by municipality must be analyzed.

Portugal is divided into **18 districts** and **2 autonomous regions**. Each of these are subdivided into municipalities. Currently, Portugal has **308 municipalities**. The municipality data retrieved from the official Statistics website by DGPJ measured the three domestic violence categories for the 308 Portuguese municipalities and for an extra N.E. one, meaning not specified (*não especificado* in Portuguese). Since it would not be possible to find the explanatory variables values for this special case, this extra municipality was eliminated from the dataset. Furthermore, 12 of the 308 municipalities did not have values for all the categories. Corvo, the smallest island in the Autonomous Region of the Azores, only had data for the DVASA category. The remaining 11 municipalities (Pampilhosa da Serra, Golegã, Ribeira de Pena, Vila de Rei, Barrancos, Vila Viçosa, Penela, Alcoutim, Alfândega da Fé, São Roque do Pico e Aguiar da Beira) were missing data for the DVAM category.

The statistical confidentiality principle is declared in *Diário da República* (the Portuguese official gazette) in Law nº22/2008, the law that legislates about the National Statistical System. This principle, referred to in article 6 of the mentioned law, aims to safeguard citizens' privacy and guarantee trust in the Statistical System. Therefore, in the retrieved datasets, numbers below 3 are not presented, being symbolized as missing values.

Keeping this in mind, the number of missing values was calculated for each category. As one can see from Table 4.2, there were a total of 4356 missing values among the three categories. The majority of these can be found in the DVAM and Others categories. The missing values for DVASA represent only around 2.3% of the total missing values in the dependent variable dataset.

|  |  |
| --- | --- |
| Category | Number of Missing Values |
| DVASA | 100 |
| DVAM | 2862 |
| Others | 1394 |
| Total | 4356 |

Table 4.3. Missing Values by Domestic Violence Category (Municipalities)

As mentioned before and seen on Figure 4.1, DVASA is the most prominent category in the total domestic violence occurrences in Portugal. Adding this to the facts that it is also the category with the least missing values (Table 4.2) and that it is the only category measured for all 308 municipalities, one can conclude that this is the best dependent variable for the present study.

In order to better understand the missing values and to find the best way to impute them, the difference between the national values for each year and the sum of the values for each municipality in each year was calculated (including the values for N.E.). This can be seen on Table 4.3. One can see that the number of missing values for the municipalities in each year is always very close to the number of occurrences reported on the national level but unreported on a municipal level. Keeping this in mind, these missing values were replaced by the value 1 as it was considered better to keep information about municipalities with low occurrences than to remove them from the study.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
| Missing Values | 21 | 16 | 6 | 7 | 5 | 7 | 9 | 8 | 4 | 6 | 4 | 7 |
| Difference | 27 | 21 | 8 | 7 | 6 | 10 | 7 | 12 | 4 | 10 | 3 | 10 |

Table 4.4. Missing Values for DVASA in Municipalities and Difference Between National Total and Municipality Total

It is important to keep in mind that the retrieved data was measured as an absolute value, which means that it did not consider the differences in the number of inhabitants for each municipality. Keeping the data as it was would have biased the model, forcing it into thinking that the higher number of domestic violence occurrences in municipalities with the most population was caused by factors other than the number of inhabitants. In order to avoid this problem, **the number of DVASA occurrences was standardized according to the resident population in each municipality**, as shown below. This way, the dependent variable is now **the number of DVASA occurrences per 100 inhabitants**.

The data regarding resident population by municipality used to standardize the dependent variable was retrieved from the Pordata website on the 23rd of April of 2021. The definition of resident population in this case is the group of people who, regardless of being present or absent in a particular accommodation at the time of observation, lived in their usual place of residence for a continuous period of at least 12 months prior to the time of observation, or who arrived at their usual place of residence during the period corresponding to the 12 months preceding the moment of observation, with the intention of remaining there for a minimum period of one year.

## Explanatory Variables

According to (Ellsberg, Heise, Peña, Agurto, & Winkvist, 2001) high parity is a risk factor for domestic violence. This means that **individuals belonging to families with more children are more prone to suffer assaults**. As a way to include this factor in the present study, the **synthetic fertility index** was considered as an explanatory variable. This index is the average number of children born for each woman in fertile age (between 15 and 49 years). In order for the generation renewal to be assured, the synthetic fertility index must be at 2,1. The data regarding this variable was retrieved from the Pordata website on the 15th of April of 2021 and included data from 2009 to 2019.

Another measure for the number of children is the **youth dependency index**. The data for this variable was retrieved from the Pordata website on the 6th of May of 2021. The youth dependency index is the number of children under 15 years old for every 100 people of working age, that is, between 15 and 64 years old. A value less than 100 means that there are fewer young people than people of working age. This variable had data for all the municipalities (without missing values) for the period between 2009 and 2019.

Healthcare workers play an important role in undercovering domestic violence occurrences and supporting the victims. According to (Cann, Withnell, Shakespeare, Doll, & Thomas, 2001), among healthcare workers, women, nurses and mental health workers tend to respond better to domestic violence cases. Keeping this in mind, data regarding the total number of doctors and the number of female doctors for each municipality was retrieved from the Pordata website on the 10th of May of 2021 in order to calculate the **percentage of female doctors** as below. This data covered the period between 2009 and 2019 and had missing values for some years in Pampilhosa da Serra, Oleiros and Lajes das Flores.

As mentioned in the APAV report regarding male domestic violence victims (APAV - Associação Portuguesa de Apoio à Vítima, 2018), elderly men (65 years or more) tend to be more at risk. This can be seen on Figure 2.1. Keeping this in mind, the **percentage of elderly men in the total population** was included in the present study as an explanatory variable. The data regarding the absolute number of men with 65 or more years was retrieved from the Pordata website on the 23rd of April of 2021. This data was then converted to a percentage of the resident population as following:

Still focusing on the elderly population, but this time without distinguishing between genders, the **elderly dependency index** was retrieved from the Pordata website on the 6th of May of 2021. The elderly dependency index is the number of people aged 65 and over for every 100 people of working age, that is, between 15 and 64 years old. A value less than 100 means that there are fewer elderly people than people of working age. This variable had data for all the municipalities (without missing values) for the period between 2009 and 2019.

It is also mentioned in another APAV report regarding domestic violence victims in general (APAV - Associação Portuguesa de Apoio à Vítima, 2018) that most of the victims tend to be women with ages comprehended between 26 and 55 years. Keeping this in mind and following the same logic as for the elderly men variable, the percentage of the population represented by women in these ages was included. The data regarding the absolute value of women between 25 and 54 years was retrieved from the Pordata website on the 27th of April of 2021. The boundaries of the wage gap were as close as possible to the ones mentioned in the APAV report. However, they are not exactly the same as this data was not available. The **percentage of middle-aged women** was calculated as following:

The same APAV report mentioned that a high percentage of the victims was married, showing that it might be relevant to include a measure of marriages as an explanatory variable for the present study. However, the number of marriages in a given year does not directly affect the number of domestic violence occurrences in that same year, as the marriage of the victims can happen in years before the occurrence. Nevertheless, data regarding the **number of marriages** national-wide was retrieved from the Pordata website on the 28th of April of 2021 to test for correlations with the number of DVASA occurrences national-wide. When testing for the correlation between absolute values of DVASA occurrences and absolute values for the number of marriages the result was 0,48 which is neither a weak nor a high correlation. However, these values should be standardized according to the population. This standardization was made resulting in DVASA occurrences per 100 inhabitants and the same for the number of marriages. The correlation was then 0,31. Also, the evolution of both variables was plotted to check for common patterns (Figure 4.2) which were mostly not found. One can conclude that it might not be relevant to include this variable in the study. However, it might be interesting to check how this variable behaves when included in a regression and for that purpose data regarding the number of marriages by municipality was also retrieved from the Pordata website on the same date. This data was then standardized to reflect the number of marriages per 100 inhabitants.



Figure 4.2 - Are Marriages and DVASA Occurrences Related?

Divorces are yet another controversial variable to include. However they might be important as, if this variable works as expected according to (Bowlus & Seitz, 2006), it can be a good drive for action. This is, even though divorces are a consequence of domestic violence occurrences and not a cause, they might be able to justify some of the expected underreporting in domestic violence occurrences. Also, if an increase in divorces is connected to an increase in domestic violence occurrences, the responsible entities can look for a rise in the number of divorces and, in that case, pay closer attention to domestic violence. Data regarding divorces was retrieved from the Pordata website on the 7th of May of 2021 in the form of **divorces per 100 marriages**. The data included the period from 2009 to 2019 and had some missing values, namely there were no values at all for Odivelas, no data for Castanheira de Pêra in 2013, no data for Barrancos in 2019, no data for Porto Moniz for 2016 and 2018, no data for Corvo in 2013, 2015, 2016, 2018 and 2019. This variable is calculated the following way:

Another relevant variable according to (Campbell, 2002) is a measure of income, as the poorest strata of the population tend to witness more cases of domestic violence. Keeping this in mind, the **monthly gain of employees** was included as an explanatory variable. This refers to the amount that the employee actually receives every month. In addition to the basic remuneration, it includes other remuneration paid by the employer, such as overtime, holiday pay or premiums. It is calculated as a gross amount (before deducting any discounts). This data was retrieved from the Pordata website on the 26th of April of 2021 and it contemplates the period between 2009 and 2018. There was no information for this variable when it comes to all the 19 municipalities in the Autonomous Region of the Azores for the period between 2010 and 2013, making it a total of 76 missing values out of 3080.

Using the same dataset used for the monthly gain of employees, a measure of the **wage gap between men and women** was calculated. The data from Pordata, retrieved on the 26th of April of 2021, included the average monthly gain for all employees in a municipality as well as the average monthly gain for women only and for men. Once again, this data refers to the period between 2009 and 2018 and has no values for the municipalities in Azores for the period between 2010 and 2013. The variable here referred to as wage gap is the percentage of the men’s monthly gain that women receive on average and was calculated as following:

According to (Anderberg, Rainer, Wadsworth, & Wilson, 2015) unemployment also has an effect on domestic violence occurrences. A rise in male unemployment theoretically causes a decrease in occurrences, whilst a rise in female unemployment causes the number of occurrences to increase. Since the unemployment rate by gender was only available by regions and not municipalities, the **number of people enrolled in employment and vocational training centers** was used as a proxy. The values were calculated from a simple arithmetic average of the unemployed registered monthly in the employment and vocational training centers, so they are not always whole numbers. This data was retrieved from the Pordata website on the 29th of April of 2021 and had values for the period between 2009 and 2019. In order to test different possibilities, three variables were created from this dataset – **female unemployment, male unemployment and total unemployment**. All of them came in absolute values and had to be standardized by the number of inhabitants in the municipality. This standardization was done in the same way as the standardization of the dependent variable, resulting in the number of people enrolled in employment and vocational training centers by 100 inhabitants. It is also important to notice that there were no values regarding unemployment for the Autonomous Regions of the Azores (19 municipalities) and Madeira (11 municipalities), making it a total of 30 municipalities with no information.

Education may also have an important role in explaining the evolution of domestic violence occurrences. According to (Bowlus & Seitz, 2006), women who have faced abuse by their husbands tend to have lower levels of education and so do the husbands. Unfortunately, data regarding the level of education of the population by municipality was only measured in the census of the population, that happen every 10 years. Keeping this in mind, for the period contemplated by this study, there was only data for one year (2011). *Quadros de Pessoal* (Personnel Records) is a compulsory survey of all firms, conducted annually that contains data regarding each wage-earner in Portugal apart from civil servants and independent workers. This dataset contains data regarding the education of workers, which, even though it does not represent the whole population, can be a good proxy for the **level of education of the population**. PEDIDO FEITO AO GEP-MTSS A 7 DE MAIO DE 2020 (RESPOSTA NO PRAZO DE 2 DIAS ÚTEIS – 11 DE MAIO)

# Methodology

The second step of this study, right after the data collection, was the data treatment. Some of it was already described in the previous chapters, but the remaining part will be described in the present chapter.

Some of the variables had missing values, but a lot of them were missing the entire year of 2008. Keeping this in mind, this year was removed from the study, making it a study about the evolution of DVASA occurrences between 2009 and 2019. The variables related to salaries (Wage\_Gap and Monthly\_Gain) were missing values for 2019. UTILIZAR INTERPOLAÇÃO PARA PREENCHER ESTE ANO?

# Results and Discussion

Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion Text about results and discussion.

# Conclusions

Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text Conclusion text.

# Limitations and Recommendations for Future Works

Text of limitations and recommendations for future works Text of limitations and recommendations for future works Text of limitations and recommendations for future works Text of limitations and recommendations for future works Text of limitations and recommendations for future works Text of limitations and recommendations for future works Text of limitations and recommendations for future works Text of limitations and recommendations for future works Text of limitations and recommendations for future works Text of limitations and recommendations for future works.

# Bibliography

Aizer, A. (2010). The Gender Wage Gap and Domestic Violence. *American Economic Review*, 1847-1859.

Anderberg, D., Rainer, H., Wadsworth, J., & Wilson, T. (2015). Unemployment and Domestic Violence: Theory and Evidence. *The Economic Journal*, 1947-1979.

APAV - Associação Portuguesa de Apoio à Vítima. (2018). *Homens Vítimas de Violência Doméstica 2013 - 2017.* Lisboa: Associação Portuguesa de Apoio à Vítima.

APAV - Associação Portuguesa de Apoio à Vítima. (2018). *Vítimas de Violência Doméstica 2013 - 2017.* Lisboa: Associação Portuguesa de Apoio à Vítima.

APAV - Associação Portuguesa de Apoio à Vítima. (2020). *Vítimas de Homicído Relatório APAV 2019.* Lisboa: Associação Portuguesa de Apoio à Vítima.

Barber, C. (2008). Domestic Violence Against Men. *Nursing Standard*, 35-39.

Bowlus, A., & Seitz, S. (2006). Domestic Violence, Employment and Divorce. *International Economic Review*, 1113-1149.

Brasil, E., Alves, F., & Soares, S. (2018). *Dados 2017.* Almada: OMA - Observatório de Mulheres Assassinadas da UMAR.

Brasil, E., Alves, F., & Soares, S. (2019). *Dados 2018.* Almada: OMA - Observatório de Mulheres Assassinadas da UMAR.

Campbell, J. (2002). Health Consequences of Intimate Partner Violence. *The Lancet*, 1331-1336.

Devries, M., Mak, T., Garcia-Moreno, C., Petzold, M., Child, C., Falder, G., . . . Watts, H. (2013). The Global Prevalence of Intimate Partner Violence Against Women. *Science*, 1527-1528.

Ellsberg, M., Heise, L., Peña, R., Agurto, S., & Winkvist, A. (2001). Researching Domestic Violence Against Women: Methodological and Ethical Considerations. *Studies in Family Planning*.

Soares, S., Branco, E., & Alves, F. (2020). *Relatório Anual 2019.* Almada: OMA - Observatório de Mulheres Assassinadas da UMAR.

# Appendix (optional)

# Annexes (optional)

1. (Brasil, Alves, & Soares, Dados 2017, 2018) [↑](#footnote-ref-1)
2. (Brasil, Alves, & Soares, Dados 2018, 2019) [↑](#footnote-ref-2)
3. (Soares, Branco, & Alves, 2020) [↑](#footnote-ref-3)
4. (APAV - Associação Portuguesa de Apoio à Vítima, 2020) [↑](#footnote-ref-4)
5. (Devries, et al., 2013) [↑](#footnote-ref-5)
6. (Ellsberg, Heise, Peña, Agurto, & Winkvist, 2001) [↑](#footnote-ref-6)
7. (Aizer, 2010) [↑](#footnote-ref-7)
8. (Anderberg, Rainer, Wadsworth, & Wilson, 2015) [↑](#footnote-ref-8)
9. (APAV - Associação Portuguesa de Apoio à Vítima, 2018) [↑](#footnote-ref-9)
10. (APAV - Associação Portuguesa de Apoio à Vítima, 2018) [↑](#footnote-ref-10)