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Three Essays on Health and Violence Against Women

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Preface

This doctoral dissertation is not only the outcome of my personal effort. Many people have inspired me, encouraged me, and helped me in this process.

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Finally, I am also grateful to my family and friends. To my parents, for the effort they have always made on my education, and for their understanding. To my sister, for cheering me up and balancing me so many times. And to Christian, for everything. Thank you.

I would like to dedicate this work to my grandparents: Leonida, Vicente, Margalida and Pep.

Ana Tur Prats
Barcelona
May 2014

Prefacio

Esta tesis no sólo es el resultado de un esfuerzo personal. Muchas personas me han inspirado, animado y ayudado en todo este proceso.

En primer lugar, quiero agradecer a mis directores de tesis su guía y supervisión en todas las etapas de mi formación. Gracias a Jaume Puig-Junoy me comencé a interesar por la investigación, y Marcos Vera-Hernández me dio un impulso clave al creer en mi trabajo y animarme a seguir mi propia línea de investigación. De ambos he aprendido muchísimo, tanto a nivel académico como personal.

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Me gustaría dedicar este trabajo a mis abuelos: Leonida, Vicente, Margalida y Pep.

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Prefaci

Aquesta tesi doctoral no només és el resultat d'un esforç personal. Moltes persones m'han inspirat, animat i ajudat en tot aquest procés.

En primer lloc, vull agrair als meus directors de tesi la seva guia i supervisió en totes les etapes de la meva formació. Gràcies a en Jaume Puig-Junoy em vaig començar a interessar en la recerca, i en Marcos Vera-Hernández em va donar un impuls clau al creure en la meva feina i animar-me a seguir la meva pròpia línia de recerca. Dels dos he après moltíssim, tant a nivell acadèmic com personal.

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Ana Tur Prats
Barcelona
Maig 2014

Abstract

This doctoral dissertation is divided into three chapters. The first one is related to health economics, and the second and third analyse violence against women.

In the first chapter, co-authored with Jaume Puig-Junoy and Marcos Vera-Hernández, we estimate the price-elasticity of prescription drugs exploiting three unique features of the Spanish health system (1) the co-payment of prescription drug drops from 40% (10% for chronic diseases drugs) to 0% upon retirement, while the co-payment for the rest of health care services remains constant; (2) retirement jumps discontinuously at age 65, the legal retirement age, which allows us to use a Regression Discontinuity design to disentangle price from selection effects; and (3) absence of deductibles or caps in yearly or monthly out-of-pocket expenditure, which simplifies the computation of elasticities. We use administrative data from all individuals aged 63-67 covered by the National Health System in Catalonia (Spain) from 2004-2006. We find that the price-elasticity of prescription drugs is -0.20 for non-chronic condition drugs, and -0.08 or -0.03 for chronic conditions drugs. Given the size of our estimates, they remain informative even if we interpret them as being possibly biased away from zero (for reasons discussed in the paper). We also find a small increase in the expenditure on medically inappropriate drugs due to the decrease in co-payments.

In the second chapter I explore the historical origins of violence against women. Compared to previous literature, which has only paid attention to short-term determinants of domestic violence, this study looks at long-term determinants. It analyzes the relationship between historical family types (stem vs. nuclear) and intimate-partner violence (IPV). In stem families two generations cohabitate as one son stays at the parental house with his wife and kids, whereas in nuclear families all children leave to start their independent households. I model the behavior of a traditional peasant family and show how co-residence with the mother-in-law (a feature of stem families) increased the wife's contribution to farming work. This in turn could decrease the level of violence since in the model it reduces wife's productivity. In the empirical analysis I use Spanish data as this country not only offers IPV measures of the highest quality but also stable and persistent family types. Results show that territories where stem family was socially predominant in the past have nowadays a lower IPV rate. I control for a large number of contemporaneous, historical and geographical variables. To address causality, I use the Christian "Reconquest" of the Iberian Peninsula (722-1492) as an instrument for the different family types.

Finally, in the third chapter I explore the link between unemployment

and domestic violence. Despite the general perception that domestic violence increases with recessions, the evidence is inconclusive. This study contributes to this literature by analysing the relationship between intimate-partner violence (IPV) and unemployment using individual IPV data for Spain. It also contributes by including in the analysis the gender identity, which is determined by the historical family types (stem vs. nuclear) that prevailed in each region. I exploit regional and time variation in female and male unemployment and find heterogeneous impacts of unemployment on IPV. In territories with more traditional gender roles (nuclear family), a decrease in female unemployment relative to male unemployment is associated with an increase in the IPV incidence, potentially because men feel their traditional gender role threatened. In provinces with more equal gender roles (stem family) this effect is offset. I also find that unemployment has a higher and significant impact on economic and structural abuse rather than on physical and sexual violence.

Resumen

Esta tesis doctoral se divide en tres capítulos. El primero está relacionado con la economía de la salud; el segundo y tercero con el análisis de la violencia contra las mujeres.

En el primer capítulo, realizado conjuntamente con Jaume Puig-Junoy y Marcos Vera-Hernández, estimamos la elasticidad-precio de los medicamentos utilizando aspectos únicos del Sistema Nacional de Salud (SNS) español: (1) el copago de los fármacos recetados cae del 40% (10% para los fármacos para condiciones crónicas) al 0% en el momento de la jubilación; (2) la probabilidad de jubilarse experimenta un salto a los 65 años, la edad legal de jubilación, lo que nos permite aplicar un análisis de regresión discontinua para separar el efecto precio del efecto selección. Utilizamos datos administrativos para todos los individuos entre los 63-67 años, cubiertos por el SNS en Cataluña para el periodo 2004-2006. Encontramos que la elasticidad-precio de los fármacos recetados es -0,20 para medicamentos para condiciones no crónicas, y -0,08 o -0,03 para condiciones crónicas. Dada la magnitud de nuestros estimadores, éstos siguen siendo informativos incluso si los interpretamos como potencialmente sesgados. También encontramos un pequeño aumento en el gasto en fármacos médicamente inapropiados debido al descenso en los copagos.

En el segundo capítulo exploro los orígenes históricos de la violencia contra las mujeres. Comparado en la literatura previa, que solo ha prestado atención a los determinantes a corto plazo de la violencia doméstica, este estudio se centra en los determinantes a largo plazo. Analizo la relación entre tipos de familia históricos (troncal vs. nuclear) y violencia por parte de la pareja (VP). En las familias troncales cohabitan dos generaciones -un hijo se queda a vivir con sus padres en la casa familiar, con su esposa e hijos-, mientras que en las familias nucleares todos los hijos abandonan la casa familiar para formar sus propios hogares. Modelizo el comportamiento de una familia tradicional campesina y muestro cómo la co-residencia con la suegra (característico de las familias troncales) aumentó la contribución de la esposa joven al trabajo agrícola. Esto a su vez pudo disminuir el nivel de violencia puesto que en el modelo la violencia reduce la productividad. En el análisis empírico utilizo datos españoles ya que este país proporciona medidas de VP de la máxima calidad y los tipos de familia han sido estables y persistentes. Los resultados muestran que los territorios donde la familia troncal era socialmente predominante en el pasado tienen actualmente una tasa de VP menor. Para establecer efectos causales, utilizo la Reconquista cristiana de la Península Ibérica (722-1492) como instrumento para los diferentes tipos de familia.

Por último, en el tercer capítulo analizo el vínculo entre desempleo y violencia doméstica. A pesar de la percepción general de que la VP aumenta con las recesiones, la evidencia no es concluyente. Este estudio contribuye a la literatura analizando la relación entre VP y desempleo utilizando datos individuales sobre VP para España. También contribuye incluyendo en el análisis la identidad de género, que viene determinada por el tipo de familia histórico (troncal vs. nuclear) que prevaleció en cada región. Utilizo variación regional y temporal en el desempleo femenino y masculino y encuentro impactos heterogéneos del desempleo en la VP. En provincias con roles de género más tradicionales (familia nuclear), un descenso en el desempleo femenino está asociado a un aumento en la VP, potencialmente porque los hombres sienten su masculinidad amenazada. En provincias con roles de género más igualitarios (familia troncal) este efecto queda compensado. También encuentro que el desempleo tiene un impacto mayor y más significativo sobre el maltrato económico o estructural que sobre la violencia física y sexual.

Contents

Introduction

In this doctoral dissertation I apply economics to analyse some aspects related to the health care sector and to violence against women.

In the first chapter, we estimate the price-elasticity of prescription drugs. The question of how sensitive is health care consumption to changes in prices has been at the cornerstone of the health economics literature since the late 60s. In practice, the literature has focused on estimating the price-elasticity of total health care consumption, instead of a single health care good. In this paper, we exploit some unique features of the Spanish health system in order to obtain a clean estimate of the price-elasticity of pharmaceuticals.

In the second chapter, I investigate the historical origins of violence against women. Compared to previous literature, which has only paid attention to short-term determinants of domestic violence, this paper looks at the long-term determinants of violence against women. I analyse the relationship between historical family types (stem vs. nuclear) and intimate-partner violence (IPV). This paper also contributes to the economics literature that analyses the causes of domestic violence, to the small literature on family types, and to the growing literature on culture, institutions and history.

In the third chapter I analyse the relationship between unemployment and domestic violence. The evidence on how economic recessions affect domestic violence is inconclusive. This paper tries to shed light on this question by

looking at the impact of male and female unemployment on domestic violence using individual IPV data. Its main contribution is the introduction of the gender identity in the analysis, a new approach of modeling domestic violence that takes into account the social dimension of this issue. The gender identity is determined by the historical family types (stem vs. nuclear) that prevailed in each region.

In these three essays, I conduct an empirical analysis using mainly Spanish data. Special care is taken in applying appropriate econometric techniques and finding exogenous sources of variation to identify causal effects. I complement the analysis with economic theory, and to understand better the context of my research I also use concepts from other social sciences (history, anthropology, sociology, and law).

Chapter 1

Estimates of Price Elasticities of Pharmaceutical Consumption for the Elderly

1.1 Introduction

How sensitive is health care consumption to changes in the price that individuals pay? The answer to this question has been at the cornerstone of the health economics literature since the late 60s (Pauly, 1968; Zeckhauser, 1970). Estimating the price elasticity of healthcare consumption was the main objective of the seminal RAND Health Insurance Experiment, and even the on-going Oregon Health Insurance Experiment specified the effect of insurance on health care use as its first hypothesis to test (Manning et al., 1987; Newhouse, 1993; Finkelstein et al., 2010 and Finkelstein et al., 2012). Indeed, how much over-consumption is induced by insurance depends crucially on the price elasticity of health care consumption. Not surprisingly, the optimal co-payments are a function of the price-elasticity of each health care good (e.g. hospitalization;

outpatient; inpatient) and each health care good possibly has a different price-elasticity (Besley, 1988).

In practice, the literature has focused on estimating the price-elasticity of total health care consumption, instead of a single health care good (see Zweifel and Manning, 2000; Cutler and Zeckhauser, 2000 and Cutler, 2002 for prominent reviews). Actually, it is rarely the case that the co-payment of one type of health good changes while that of others remains constant, and complementarities or substitutability among different health care goods could bias the results if the prices of different health care goods change simultaneously[1]. In this paper, we exploit a unique feature of the Spanish health system in order to estimate the price-elasticity of pharmaceuticals: during our period of study the co-payment of prescription drug drops from 40% (10% for chronic diseases drugs) to 0% upon retirement, while the co-payment for the rest of health care services remains constant (at zero)[2]. In addition, the fact that there are no deductibles or yearly out-of-pocket maximum (or "stop loss") facilitates the computation of the price-elasticities (as we do not have to deal with consumers' expectations of future expenditure)[3]. These two features of the Spanish health system provide a framework which allows us to obtain a clean estimate of the price elasticity of prescription drugs.

The possibility of selection bias when estimating the response of health care consumption to price or coverage variations has been considered paramount in the literature (Cutler and Zeckhauser, 2000; Chiappori and Salanié, 2000; Einav and Finkelstein, 2011; Chetty and Finkelstein, 2012). In this paper, we disentangle price effects from selection effects (those going into retirement might be less

[1]Note that even in the RAND Health Insurance Experiment co-payment rates varied across individuals but not across types of health care services (Manning et al. 1987, and Newhouse 1993). An exception is Chiappori et al. (1998).

[2]A law approved in April 2012 (Royal Decree-Law 16/2012) increases the co-payments from July 2012 onwards.

[3]See Keeler *et al.* (1977), Ellis (1986), Marsh (2011), and Aron-Dine *et al.* (2012).

healthy), by exploiting a jump in the probability of retirement that occurs at the legal retirement age (65 years). This allows us to apply a regression discontinuity (RD) design, which is highly regarded for its internal validity (Lee and Lemieux, 2010). Indeed, discontinuities in insurance coverage at specific ages have yielded robust estimates of the effect of health insurance on health care use and health outcomes (Card et al,. 2008; Card et al., 2009; Shigeoka, 2012 and Anderson et al., 2012). Closer to our main object of interest, Chandra et al. (2010) examined policy changes for Californian civil servants under Medicare program that increased the level of co-payment both for physician visits and prescription drugs. They provide one of the first robust estimations of price elasticity of pharmaceuticals for the elderly, as this group was excluded from the RAND Health Insurance Experiment[4].

In this paper, we combine two different data sources to obtain the price-elasticity estimates. Administrative data on individuals aged 63-67 covered by the Catalonian Health Service[5] during 2004-6 are used to estimate the change in prescription drugs consumption that takes place at age 65. For the same years, we use the Catalonian subsample of the Active Population Survey to estimate the change in the probability of retirement that takes place at age 65. By exploiting the discontinuity in the probability of retirement at age 65, we avoid comparing the drug consumption between retirees and non-retirees as ill health might trigger retirement rendering the two groups unlikely to be comparable (Dwyer and Mitchell, 1999; Disney *et al.*, 2006).

We find that the price-elasticity of prescription drugs for non-chronic conditions is -0.20. For most chronic conditions prescription drugs, the price elasticity

[4]An important issue that we will not be able to consider is the possibility of offset effects (see Puig-Junoy *et al.*, 2011; Chandra *et al.*, 2010 and Gaynor *et al.*, 2006).

[5]Due to data availability reasons, we only use data from Catalonia Autonomous Community. This represents 16% of Spanish population in 2011. The main features of the National Health System (including the co-payment scheme) are the same for the entire country.

is -0.08, while it is -0.03 for a particular subset of chronic condition drugs whose copayment is 2.64 (which represent less than 10%). These estimates are very similar across education groups. Our estimate of price-elasticity of drugs for non-chronic conditions (-0.20) is very similar to results from the RAND Health Insurance Experiment, as well as to recent estimates obtained by Chandra et al. (2010) for elderly Californian civil servants (-0.15)[6][7] [8] .

Our empirical strategy could possibly suffer from the following bias: individuals that just retire might experience a sharp drop in the opportunity cost of time, which might translate into an increase in doctor visits and prescriptions (leading to an overestimate in the price elasticity[9]). However, two pieces of evidence indicate that this is not an important bias in our context. First, we do not observe any change in the consumption of chronic drugs with the smallest pre-retirement co-payment (<10%). Second, our price-elasticity estimates are very similar across education groups but one would expect the opportunity cost of time to drop more for the most educated. Possibly, this is because the Spanish employment law provides generous allowance for doctor visits and work absences, and moreover those who are about to retire are unlikely to postpone

[6]The RAND Health Insurance Experiment only enrolled individuals below 60 and hence most of their pharmaceutical consumption is likely to be non-chronic. We have been unable to find the price elasticities for drug consumption estimated using the RAND Health Insurance Experiment, but Leibowitz et al. (1985) report that the plan response for prescription medicines was similar to that of total outpatient care in the RAND Health Insurance Experiment.

[7]Chandra *et al.* (2010)'s estimate for HMO enrollees is -0.15, and -0.08 for PPO enrolees. Because provider choice is very limited in the Spanish health system, the comparison with HMO seems more relevant. They do not provide different results for non-chronic and chronic drugs. Given that we obtain -0.08 and -0.03 as price-elasticity estimates for chronic drugs, our estimate combining both non-chronic and chronic drugs should be close to -0.15.

[8]Puig-Junoy *et al.* (2011) also estimate price-elasticity estimates of prescription drugs but they only consider individuals who were already consumers before retirement. Their identification assumption differs from ours as they use the difference in drug consumption before and after retirement (after adjusting for fixed effects and time variant characteristics). Landsman *et al.* (2005) find price elasticity estimates from -0.16 to -0.10 for asymptomatic condition drugs and from -0.6 to -0.24 for symptomatic condition drugs. See Arcidiacono *et al.* (2012) for price elasticities of ulcer and reflux drugs.

[9]We define price elasticity in absolute value.

doctor visits due to career pressures[10]. Moreover, even if this bias was present, our price elasticity estimates remain informative upper bounds because they are quite close to zero (especially in the case of drugs for chronic conditions)[11].

Comparing the elasticity of chronic and non-chronic drugs is both novel in the literature and informative from the point of view of designing insurance policies. Our result that chronic condition drugs are less price elastic than non-chronic drugs points in the direction that individuals should be better insured against chronic than non-chronic drug expenditure. Clearly, this is not a definitive conclusion, as there are other important factors that we cannot comment on: whether the probability of suffering one or another type of illness is under the individual's control (ex-ante moral hazard), the relative size of the lifetime financial loss for each type of drug, and the effects of each type of drug on health.

We decompose the increase in consumption which follows the co-payment drop into that driven by existing users and new users. We find that the latter is small in magnitude and hence most of the consumption increase comes from already users. This suggests that the higher pharmaceutical expenditure is not driven by the lower co-payments inducing more doctor visits.

According to the moral hazard hypothesis, overconsumption due to lower co-payments occurs because individuals consume health care goods whose individual's valuation is below the marginal social cost of producing them. An extreme consequence of this is when the health care goods are not medically appropriate. According to the "Beers criterion" (Beers *et al.*, 1991) 7.45% obser-

[10]Although the Workers' Rights Act (Estatuto de los Trabajadores) does not regulate doctor visits explicitly, it allows the worker to be absent "for the minimum required time, to do one's personal or public duties" (art. 37). Besides, most collective bargaining agreements establish a generous allowance of paid hours to attend health related appointments.

[11]The fall in income following retirement could possibly decrease the demand of pharmaceuticals, biasing the results in the opposite direction. However, this is very unlikely in our setting because pharmaceutical and doctor consultations are free for retirees (yielding the fall in income irrelevant).

vations in our data correspond to medically inappropriate drugs. Interestingly, we find a very small (0.174) but statistically significant increase in the quarterly expenditure on inappropriate drugs due to the decrease in the co-payment to 0%.

In the regression discontinuity (RD) design that we use in this paper, the outcome and the treatment variable are drawn from different datasets. Although this is not new (see Carpenter and Dobkin, 2009 and Card, 2008), it is still relatively uncommon and potentially very useful in applied work.

Pharmaceutical spending accounts for a significant proportion of total health costs in developed countries. Mean expenditure on pharmaceuticals and other medical non-durables in OECD countries in 2009 amounted to 16.9% of total expenditure on health; 12% in the United States and 18.9% in Spain (OECD Health Data, 2011). Moreover, in Spain, public expenditure in pharmaceuticals was 1.3% of the GDP in 2007, one the highest rates in the EU. Spanish pensioners amount to 73.9% of pharmaceutical consumption in 2010, and this percentage has been increasing in the last decades (PortalFarma, 2012). Given the magnitude of drug consumption by the elderly, raising the co-payment rates of prescription drugs is among the policy options that Spanish policy makers have considered from time to time[12].

The appropriate trade-off between inefficient drug consumption and risk spreading has also been of high importance in the US. Medicare Part D (an expansion of Medicare to prescription drug-benefits) was passed in 2003 to provide insurance against drug expenditure risk to senior American citizens. Although the effect of this program on prescription drugs utilization is shown to be significant and positive (Lichtenberg and Sun, 2007; Yin *et al.*, 2008; Dug-

[12]Eventually, a new law was enacted in April 2012 which increased co-payments for prescription drugs for both retirees and non-retirees. We do not study this change because our data are only available until 2006.

gan, Healy, and Scott Morton, 2008; Duggan and Scott Morton, 2010 and 2011), some recent studies find evidence of heterogeneous effects. Zhang *et al.* (2009) show that there was an offsetting reduction in medical spending for those who had no or minimal drug coverage before the implementation of Part D. Engelhardt and Gruber (2011) found that there were substantial risk-reduction gains for those at the highest risk of spending, even though on average welfare gain on risk-reduction was comparable to the deadweight loss cost of financing the program.

The remainder of the paper is organized as follows. Section 1.2 briefly describes the institutional framework. Section 1.3 describes the datasets and provides a graphical analysis of the data. Section 1.4 describes the evaluation method, the identification and estimation strategy. Section 1.5 is devoted to the interpretation of the econometric results. Section 1.6 discusses the implications that several sources of bias have on our estimates. In Section 1.7 the main conclusions are summarized.

1.2 Institutional Framework

In Spain, all legal residents are covered by the National Health Service (NHS) public insurance scheme which is mainly financed through general taxation. Individuals obtain access to health care in the NHS in a similar way as enrolees of a Health Maintenance Organization (HMO) in the US. Doctor visits, outpatient and inpatient treatment are free (zero co-payment) if obtained through the NHS network. If an individual seeks care outside of the NHS network, he must cover the full cost of the consultation/treatment[13]. For obvious reasons, non-NHS provided care represents a small percentage of total health care. For

[13] 15% of the population have private health insurance which will probably cover these costs. Individuals do not obtain any tax relief for buying private health insurance.

instance, amongst 63-67 years old, only 13% of doctor visits in the last fifteen days were to a non-NHS doctor.

Drugs are heavily subsidized if the prescription is written by an NHS doctor (on an NHS prescription form): Non-retired individuals pay 40% of the price of drugs for non-chronic conditions, and 10% for chronic condition drugs with a maximum of 2.64 per prescription (this maximum only applies to chronic condition drugs). Crucially for our purpose, retired individuals pay zero for their prescription drugs. It is important to emphasize that both the retired and non-retired pay zero for doctor visits, outpatient and inpatient treatment if obtained through the NHS.

Individuals who seek care from an non-NHS provider can either (1) buy the drugs directly from the pharmacy using the non-NHS prescription and pay the full price of the drugs (hence forgoing the generous public subsidy mentioned in the paragraph above) or (2) visit an NHS doctor and ask him/her to re-write the non-NHS prescription as an NHS prescription which then would be entitled to the public subsidy[14].

Regarding pension entitlements, Spain has a mandatory "pay as you go" system. In our period of analysis the legal age for retirement, although not mandatory, is 65 for both men and women[15]. Earlier retirement is penalized through a decrease in pension benefits. Later retirement increases pension benefits only for those who had contributed at least 35 years[16].

[14]Although NHS doctors are not obliged to do so, it is common knowledge that the vast majority do.

[15]In July 2011 Spanish parliament passed Law 27/2011 (*Ley sobre Adecuación, Adaptación y Modernización del Sistema de Seguridad Social*) that modifies retirement age. This law becomes effective in 2013 and extends gradually legal retirement age up to 67 years old.

[16]Law 35/2002 which was active between July 2002 and January 2008.

1.3 Data and graphical analysis

Our RD empirical strategy requires that we observe prescribed drug expenditure and labour force status: active or retired, but not necessarily in the same dataset. We combine different sources of data to access all the necessary information.

1.3.1 Pharmaceutical consumption

We combine the administrative pharmaceutical consumption record from the Catalonian NHS with the Central Register of Insured Individuals (*RCA-Registre Central d'Assegurats*) to obtain data from all individuals covered by the Catalonian NHS who were between 60-64 years-old on 31/12/2003 (n=281589). We follow these individuals three years until 31/12/2006. This data is also combined with the "Nomenclator DIGITALIS-INTEGRA" database from the Spanish Ministry of Health to obtain information on the characteristics of the prescribed drugs. Our database only contains drugs acquired using an NHS prescription form (see section 2). In section 6, we consider in detail the possible implications of this for our estimates. In the worst possible scenario, it might imply that our estimates are biased away from zero (although given how close they are to zero, they remain quite informative).

We use the following three variables to measure pharmaceutical consumption: total expenditure (the sum of the retail prices of all prescribed drugs bought), number of prescriptions, and "Defined Daily Dose" (DDD)[17]. We present our estimates using all three measures although we highlight our results using total expenditure as this is the most common measure used in the litera-

[17]DDD is an international accepted classification system for drug consumption. World Health Organization defines DDD as "the assumed average maintenance dose per day for a drug used for its main indication in adults" (http://www.whocc.no/atcddd/).

ture (results on number of prescriptions and DDDs can be found in the Appendix A). We show results separately for non-chronic condition drugs subject to 40% co-payment for the non-retired, chronic condition drugs subject to 10% co-payment for the non-retired, and chronic condition drugs subject to an out-of pocket payment of 2.64 per prescription. As indicated above, retired individuals pay 0% for all drugs (receive 100% subsidy)[18].

For each individual, prescribed drug consumption measures are aggregated at the quarter level. This not only follows Card *et al.* (2008), but also coincides with the minimum window available for the employment data that we will review below. Moreover, in practice, retirees need a special card to pay zero for the prescription drugs. This card can take anything between 4 and 8 weeks to receive; so many individuals who are 65 years and one month would not yet be paying zero. This is why we will not consider the first three months after 65 in the analysis. The selection of the bandwidth is determined by the availability of data as we only observe individuals up to 67 years old.

The descriptive statistics for key variables of interest of our final dataset are listed in Table 1. The data we use contain 2,019,826 observations on 281,589 individuals. The mean age of our sample is 64.5 and 51% of the observations relate to women. Regarding education level, 15.7% have achieved high school or college diploma. In almost 50% of the observations there is positive consumption. Regarding drug quarterly consumption: average total expenditure is 70.1, average out of pocket expenditure is 2.73 , average number of prescriptions is 5, and average number of DDDs is 121.9.

Figure 1 shows drug total expenditure (actual and fitted) on non-chronic conditions drugs by each age quarter from age 63 to 67. In particular, the dots are the residuals of a regression of the dependent variable (drug total expendi-

[18] 22% of the chronic drugs prescriptions are subject to the 2.64 maximum.

ture) on time dummies (month in which the drug was consumed)[19]. The lines are regression fits, from a linear model that allows for a different first order age polynomial on either side of the cut-off point (65 years of age). Figure 2 (3) shows the same graph but for chronic condition drugs with a pre-retirement co-payment of 10% (less than 10%: 2.64 per prescription).

Figures 1-3 show that drug total expenditure increases linearly with age, and that the slopes are extremely similar on either side of age 65. While there is clear evidence of a discontinuity in non-chronic drug total expenditure at age 65 (Figure 1), it is either much smaller or non-existent for chronic drug expenditure (Figure 2 and Figure 3).

1.3.2 Retirement status

Data on retirement status is obtained using the Active Population Survey (*Encuesta de Población Activa*). This is a quarterly cross-section nationally representative survey, routinely used to estimate the unemployment rate. We use the Catalonian subsample for the 12 quarters that cover our period of analysis (2004-2006). Our key variable is whether the individual is retired or not, as retired individuals do not pay anything for prescription drugs.

The third column of Table 1 lists the descriptive statistics for key variables of the Active Population Survey: our sample contains 7,174 observations, 64.1% of whom are retired. Comparing the second and third column of Table 1, it is clear that the sample of the two datasets (drug consumption dataset and Active Population Survey) are very similar.

As mentioned above, the legal age for retirement, although not mandatory, is 65 for both men and women (earlier retirement is penalized through a de-

[19]We condition on the month of consumption because pharmaceutical consumption might be seasonal and the average age in the sample is not uniformly distributed across the months in the sample.

crease in the drawn benefit, postponement of retirement increases pension payout only for those who had contributed at least 35 years). Figure 4 shows the proportion of retired individuals by each age quarter from 63 to 67. The solid dots are the average proportion of retirees at each quarter of age. The lines are regression fits, from a linear model that allows for a different first order age polynomial on either side of the cut-off point (65 years of age). The discontinuity at age 65 suggests that legal incentives have a powerful effect on the retirement decision.

1.4 Empirical Strategy

A key issue in estimating the price elasticity of prescription drugs is how much of the change in pharmaceutical consumption that happens upon retirement is due to the drop in co-payment rates (from 40% or 10% or less to 0%), and not due to health shocks that trigger retirement. To isolate the effect of co-payment changes, we use a Regression Discontinuity design and exploit the sharp increase in retirement rates that occurs at 65 years, the legal retirement age. The crucial identification assumption is that there are no other discontinuities at age 65 in variables that affect drug consumption except for the discontinuity in the co-payment rate[20][21]. In section VI, we consider possible threats to the basic identification assumption.

Because not all individuals retire at age 65, we use a fuzzy regression discontinuity design (Hahn *et al.*, 2001)[22]. If $E[]$ denotes the expectation operator,

[20]This is similar to Card *et al.* (2008) and (2009) who rely on the only discontinuity at age 65 being in insurance coverage.

[21]In most RD designs, a second condition must be added that individuals cannot completely manipulate the forcing variable. In our case, manipulation is not a possibility because our forcing variable is age. This is reported to the social security system at the beginning of the individual's working life, and it must match the national identity card records. A birth certificate is required when issuing the national identity card.

[22]Early applications of the Regression Discontinuity method included Thistlethwaite and

C denotes a measure of pharmaceutical consumption, R denotes a binary variable that takes value 1 if the individual is retired and 0 otherwise, and a denotes age, then the ratio (1)

$$\frac{\lim_{a\to 65^+} E[C\,|a] - \lim_{a\to 65^-} E[C\,|a]}{\lim_{a\to 65^+} E[R\,|a] - \lim_{a\to 65^-} E[R\,|a]} \quad (1.1)$$

identifies the causal effect of the co-payment changes associated with retirement on pharmaceutical consumption for the compliers (those individuals who retire because they have reached the legal retirement age)[23].

Defining $B_{it} = \mathbf{1}[\mathbf{b} \geq \mathbf{0}]$ as a binary variable that takes value 1 if the individual i is older than 65 years at time t and 0 if younger, ratio (1) can usually be estimated using B_{it} as instrument for R_{it} in the regression below

$$C_{it} = g(a_{it}) + R_{it}\pi + m_t + \epsilon_{it} \quad (1.2)$$

where $g()$ is a smooth polynomial function of a_{it}, m_t denotes month fixed effects, and ϵ_{it} an error term. The estimate of treatment effect, ratio (1), is given by the estimate of the parameter π. However, we cannot estimate equation (1.2) because R_{it} and C_{it} are not available in the same dataset. Consequently, our estimation strategy is based on estimating the numerator and the denominator of (1.1) separately, each with a different dataset. In particular, we use OLS to estimate both:

$$C_{it} = g(a_{it}) + B_{it}\pi_n + m_t + v_{it} \quad (1.3)$$

Campbell (1960), Angrist and Lavy (1999), Black (1999) and Van der Klaauw (2002). Imbens and Lemieux (2008), and Lee and Lemieux (2010) provide up to date surveys on RD methods.

[23] See Hahn *et al.* (2001); Imbens and Angrist (1994).

and

$$R_{it} = g(a_{it}) + B_{it}\pi_d + m_t + u_{it} \tag{1.4}$$

Regressions (1.3) and (1.4) are estimated using the administrative pharmaceutical consumption records from the Catalonian NHS and the Active Population Survey respectively[24]. We exclude from the estimation the quarter that starts with 65 years because, as already explained, the card required to be eligible for the 0% co-payment can take one or two months to be issued. Given the clear linear pattern with constant slope that emerges from Figures 1, 2, 3 and 4, we choose a linear first order polynomial in a_{it} for the function $g()$. The estimate of the treatment effect, ratio (1), is given by the ratio of the estimates of π_n and π_d. In particular, equation (1.5):

$$\widehat{TE} = \frac{\widehat{\pi_n}}{\widehat{\pi_d}}$$

We take into account the following features of the data when estimating the standard errors of $\widehat{\pi_n}$, $\widehat{\pi_d}$ and $\widehat{TE}$. First, the forcing variable, age, is discrete and consequently the regression is prone to specification error which can be taken into account by clustering the standard errors by age (Lee and Card, 2008). Second, the administrative drug consumption record from the Catalonian NHS is longitudinal and there are several observations for the same individual. Consequently, we also cluster the standard errors at the individual level to consider the correlation of errors for the same individual over time. Third, the number of clusters as defined by age is relatively small, 17, and standard statistical formulae for clustered standard errors based on asymptotic theory (cluster-correlated Huber-White estimator) have been shown to provide standard error estimates

[24]Due to data limitations, we use quarter rather than month fixed effects in equation (1.4).

that are too small if the number of clusters (age bins here) is small (Donald and Lang, 2007; Wooldrige, 2004; Bertrand *et al.*, 2004 and Cameron *et al.*, 2008)[25]. We use wild bootstrap-se standard errors as they are conservative according to Cameron *et al.* (2008). Moreover, we use the formulae provided by Miller *et al.* (2009) to take into account the two-way clustering (age in quarters and individuals) when using the administrative drug consumption data from the Catalonian NHS[26].

1.5 Results

1.5.1 Main Results

Table 2 presents estimates of reaching age 65 on the probability of going into retirement ($\widehat{\pi_d}$ in regression 4). As suggested in Figure 4, the probability of going into retirement increases sharply upon reaching age 65. Our results indicate that reaching 65 increases the probability of being retired by 10 percentage points. The impact is very similar across high educated (12 percentage points) and low educated (10 percentage points).

Table 3 presents estimates for the impact of going into retirement at age 65 on drug total expenditure ($\widehat{TE}$)[27]. We find that total quarterly expenditure on non-chronic drugs increases by 15.41. Consistent with Figures 2 and 3, the increase for chronic drugs is much smaller (less than 2) and not statistically significant for those drugs for which out-of-pocket payment is capped at 2.64 per prescription (co-payment $<$10%). Interestingly, the increase is very similar

[25]Cameron *et al.* (2008) indicate 30 as a rule of thumb for when the number of clusters can be considered small, but they indicate that in general it will depend on the level of intra-cluster correlation and the number of observations per cluster.

[26]See Appendix C for more details on the computation of standard errors.

[27]Tables A1 and A2 in Appendix A show the results for the number of drug prescriptions and DDDs respectively.

for the low and high educated.

Table 4 shows the estimates of the arc price-elasticity of drug total expenditure. The price elasticity for non-chronic conditions drugs is -0.20, while it is -0.08 for chronic condition drugs (-0.03 for chronic condition drugs with an out-of-pocket payment capped at 2.64). It is expected that chronic condition drugs are more inelastic as they must be taken regularly due to the nature of the diseases they are prescribed for. Tables A3 and A4 in Appendix A report very similar price elasticities for the quantities of drugs as for expenditure (independently of whether quantities are measured as number of prescriptions or DDDs).

The price elasticity of expenditure is a crucial term in the formula to compute the optimal co-payment (Besley 1988)[28]. The result that chronic conditions drugs are less price elastic point in the direction that co-payments for chronic drugs should be smaller. However, it must be acknowledged that several other factors could reverse this recommendation: larger externalities or health effects of non-chronic drugs, larger financial losses due to non-chronic drugs, and more scope for ex-ante moral hazard in chronic drugs[29].

1.5.2 New or existing drugs

We estimate the increase in the probability of consuming any drug due to retirement at age 65 by estimating (5) but using as dependent variable in equation (1.3) whether or not the individual consumed any drugs in the quarter. The results are reported in Table 5. We find that the proportion of new consumers changes very little, especially that of consumers of drugs for chronic conditions

[28]Elasticities play a crucial role in the determination of optimal benefits in different types of social insurance models (see Chetty and Finkelstein 2012 for a recent review).

[29]Lower co-payment for chronic drugs could decrease the incentives for individuals to invest in healthy lifestyles and hence increase the probability of suffering some chronic diseases (i.e. diabetes).

(0.01 or 0.007).

The estimates of Table 5 are useful to address how much of the increase in the consumption is due to new consumers and how much comes from existing consumers. We obtain this by separating our RD estimate into two effects: first, the increase in total expenditure which is due to new users (which is calculated by multiplying the corresponding increase reported in Table 5 by the estimated total expenditure at age 65.25 for those retired), and second, the increase in total expenditure which is due to existing users.

For non-chronic condition drugs, we find that only 12.4% of the increase in the drug total expenditure is explained by new consumers. For chronic condition drugs for which the 10% co-payment rate applies, we find that only 5.8% of the total increase is due to new users. For those chronic condition drugs where co-payment rate is less than 10%, we find an increase of 10%, but not statistically significant. These findings support the hypothesis that most of the increase in total expenditure is due to existing users, rather than new users.

1.5.3 Appropriate use

In order to learn more about the behavioural response of the change in health insurance coverage, we carry out the analysis distinguishing the drugs according to their appropriateness. For this purpose we apply the "Beers criterion" (Beers et al., 1991) updated by Fick et al. (2003) to our dataset. This is the most predominant explicit classification of the quality of the prescription for the elderly and has been widely applied in the literature (see, for instance, Gallagher et al., 2008; Costa-Font et al., 2010). Their criteria are based on consensus by experts in geriatric care in the US and they define inappropriate medications as those which entail more potential risks than benefits.

Applying this criterion we identify 31 inappropriate active principles in our

sample, which represents 7.45% of all observations. We find that total quarterly expenditure on inappropriate medications increases by 0.174. This is statistically significant at the 10% level[30]. We then analyse how the proportion of new consumers of inappropriate medication changes using the procedure explained in the previous subsection. We find that the proportion of new consumers changes 0.009 which means that only 6.9% of the total increase in the drug total expenditure on inappropriate medications is due to new users. These results are reported in Table 6.

1.5.4 Biased away from zero?

In this section we discuss two possible sources of bias in our estimates: (1) doctor visits could discontinuously increase at age 65 and (2) our dataset only contains information on drugs prescribed by NHS doctors. As we argue below, if these biases were important, they would bias our estimates away from zero. Below, we provide suggestive evidence that these biases are unlikely to be quantitatively important in our case. However, it is important to highlight that our estimates remain informative even if these biases are present, because our elasticity estimates are already reasonably close to zero (especially the chronic drug ones), so our estimates could be interpreted as informative upper bounds (in absolute value)[31].

Total doctor visits (irrespective of whether they are to an NHS or non-NHS

[30]Regarding inappropriate medication, we also find that doses increase by 0.383 (bootstrapped standard error 0.2238) and prescriptions by 0.011 (0.0275).This last standard error is the maximum of the standard errors obtained from one-way clustering along each possible dimension as the resulting variance when implementing the two-way formula was negative.

[31]A different concern would be if the decrease in income following retirement could also decrease pharmaceutical consumption. Income probably changes discontinuously with retirement. However, this does not bias the results. Given that the post-retirement price is zero, the quantity demanded post-retirement would be the same independently of post-retirement income and hence it is irrelevant whether income changes post-retirement. Lending further support to this, we found little heterogeneity according to education group in Table 4.

provider) could increase abruptly post-retirement because the individual faces a lower opportunity cost of time[32]. More doctor visits might translate into more drug prescriptions. In that case, we would be overestimating the change in consumption and thus our elasticity measures would be biased away from zero. We do not believe this to be of first order importance because health concerns are likely to dominate career ones for those close to retirement, so workers would be more inclined to take time off to visit the doctor. Moreover, as we indicated above, the Spanish law is quite generous with permissions to go the doctor.

A second source of bias comes from visits to non-NHS doctors, which are around 13% of total visits for individuals aged 63-67. Individuals who visit a non-NHS doctor and obtain a prescription from him/her can either (1) buy the drugs directly from the pharmacy and pay the full price of the drugs (hence forgoing the public subsidy of 60% or 90% if the individual is not retired and 100% if the individual is retired) or (2) visit an NHS doctor and ask him/her to re-write the prescription issued by the non-NHS doctor on an NHS prescription form which then would be eligible for the public subsidy. One concern is that the proportion of individuals who behave according to (2) increases discontinuously upon retirement at the expense of individuals following (1). This is important because the drugs purchased using prescriptions from non-NHS doctors, those in (1), are not recorded in our dataset. This effect would also bias our elasticity estimates away from zero. We do not think that this is an important issue because we believe that most individuals will follow (2) even pre-retirement, given that the public subsidy on prescription drugs is already quite large (60%, 90% or even more) and the visit to the NHS doctor is free.

[32]It is theoretically possible that doctor visits decrease post-retirement if individuals' health improves (i.e. individuals have more time to allocate to health improving activities). However, it is unlikely that health improves much in the six-month period (64.75 to 65.25) from which we identify the effect.

In both of the cases above, we would be overestimating the change in consumption upon retirement and thus our elasticity measures would be biased away from zero. In this case, we can still interpret our elasticity estimates as upper bounds (in absolute value). Note that our estimates are already reasonably small, so they are quite informative even as upper bounds.

Whether these two possible sources of bias are important or not is an empirical issue. We cannot provide conclusive evidence, but several results of our analysis alleviate concerns about them. First, even for those drugs with the lowest pre-retirement co-payment (less than 10% of the price of the prescription), the last column of Table 3 (as well as Figure 3) showed evidence of no discontinuity in total drug expenditure. Second, one would expect these sources of bias to be more important for the high educated (whose opportunity cost of time is higher while working, and who are more likely to visit a non-NHS doctor), yet we find that the price elasticities are very similar for high and low educated which suggests that doctor visits do not increase discontinuously at 65. Third, according to our results in Table 5, most of the increase in total drug expenditure comes from individuals who were existing users, rather than for those who became new users post-retirement. Hence, it is unlikely that our individuals are starting to visit the NHS doctor upon retirement.

1.6 Conclusion

Estimating the price-elasticity of a single type of health care goods has remained challenging because co-payments for different goods often change simultaneously and hence complementarities or substitutions among health care health care goods might bias findings. In this paper, we estimate the price elasticity of prescription drugs for the elderly by exploiting several unique features

of the Spanish Health System. First, co-payments for prescription drugs fall from 40%, 10% or less to 0% upon retirement, which itself increases discontinuously at 65 years old, the normal retirement age in Spain. Second, co-payments to other health services (medical consultations, outpatient and inpatient treatment) remain constant. Third, there is no deductible or maximum out-of-pocket expenditure (monthly, yearly, etc) which usually complicates the computation of the price elasticities.

We find that the price-elasticity of prescription drugs for non-chronic conditions is -0.20. For chronic conditions prescription drugs, the price elasticity is -0.08 (-0.03) for those whose pre-retirement co-payment is 10% (less than 10%). Our price-elasticity estimates are very similar to those obtained for other types of care and populations. One could interpret our results as upper bound estimates (in absolute value) because of a possible abrupt increase in doctor visits following retirement and because we do not observe drugs purchased using non-NHS doctor prescriptions. However, several pieces of evidence suggest that these are unlikely to be a major source of bias. Even as upper bounds, we consider our elasticity estimates to be quite informative because they are reasonably small.

One limitation is worth highlighting. The design we apply allows us to measure the elasticity on pharmaceutical consumption on a short-term basis only. Whilst this is a limitation, at the same time it ensures that the effects we are measuring are not affected by the consequences that retirement could have on health which may occur over a longer period of time.

These findings have implications for the design of an optimal co-payment scheme for prescriptions for the elderly. They also provide important information to policy makers as they allow for the accurate prediction of the expected budgetary impacts of changes to co-payment rates for prescription drugs.

1.7 References

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1.8 Tables and Figures

Table 1. Descriptive statistics for key variables

	Drug consumption database	Active population survey
Age (mean)	64.5	65
Female	51%	51.60%
High Educated (high school and college)	15.70%	18.70%
Retired		64.10%
Bought any prescribed drugs	49.8%	
Expenditure (euros, mean)	70.1	
Out of pocket expenditure (euros, mean)	2.73	
Defined Daily Doses* (mean)	121.9	
Prescriptions (mean	5	
n (# individuals)	281,589	7,174
N (# observations)	2,019,826	7,174

*Restricted to 1,500 DDD per quarter.

Table 2. Changes in the probability of going into retirement at age 65

All	0.100***
	[0.0084]
Low educated	0.096***
	[0.0126]
High educated	0.123***
	[0.0377]

Note: Each entry shows the estimate of πd (regression 4) for different samples (defined by education). The regression includes age, post-65 dummy and quarter fixed effects. Standard errors (in brackets) are calculated using a wild bootstrap-se by age. *** Denotes significance at the 1% level.

Table 3. Regression Discontinuity Estimates (total drug expenditure in euros)

ALL		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
15.41***	1.93***	1.39***
[2.7393]	[0.3072]	[2.6531]
{40.03}	*{11.48}*	*{19.84}*
LOW EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
15.55***	1.65***	-1.27
[2.7043]	[0.2884]	[3.2470]
{41.97}	*{12.01}*	*{20.34}*
HIGH EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
13.62***	1.32**	3.29
[4.5105]	[0.5545]	[2.3770]
{36.48}	*{10.82}*	*{18.28}*

Note: Each cell shows the estimate of *TE* (equation 5) for a different sample (as defined by type of drug and individual's education).The regression includes age, post-65 dummy and time fixed effects. Standard errors (in square brackets) are calculated applying a wild bootstrap-se procedure accounting for multi-way cluster structure. The estimated mean post-65 total drug expenditure for retired individuals is in curly brackets. *** Denotes significance at the 1% level, ** 5% level.

Table 4. Estimates of arc price-elasticity of total drug expenditure

ALL		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
-0.20***	-0.08***	-0.03
[0.0360]	[0.0141]	[0.0648]
LOW EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
-0.19***	-0.07***	0.03
[0.0310]	[0.0119]	[0.0760]
HIGH EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
-0.20***	-0.06**	-0.09
[0.0678]	[0.0294]	[0.0677]

Note: Each column shows the estimates of the arc price-elasticity, according to the type of drug and individual's education. The measure of drug consumption is indicated in the title of the table. Standard errors (in square brackets) are calculated applying a wild bootstrap-se procedure accounting for multi-way cluster structure. *** Denotes significance at the 1 % level, ** 5 % level

Table 5. Changes in the proportion of consumers

Non-chronic	Chronic (10%)	Chronic (<10%)
0.048***	0.010***	0.007
[0.018]	[0.004]	[0.007]

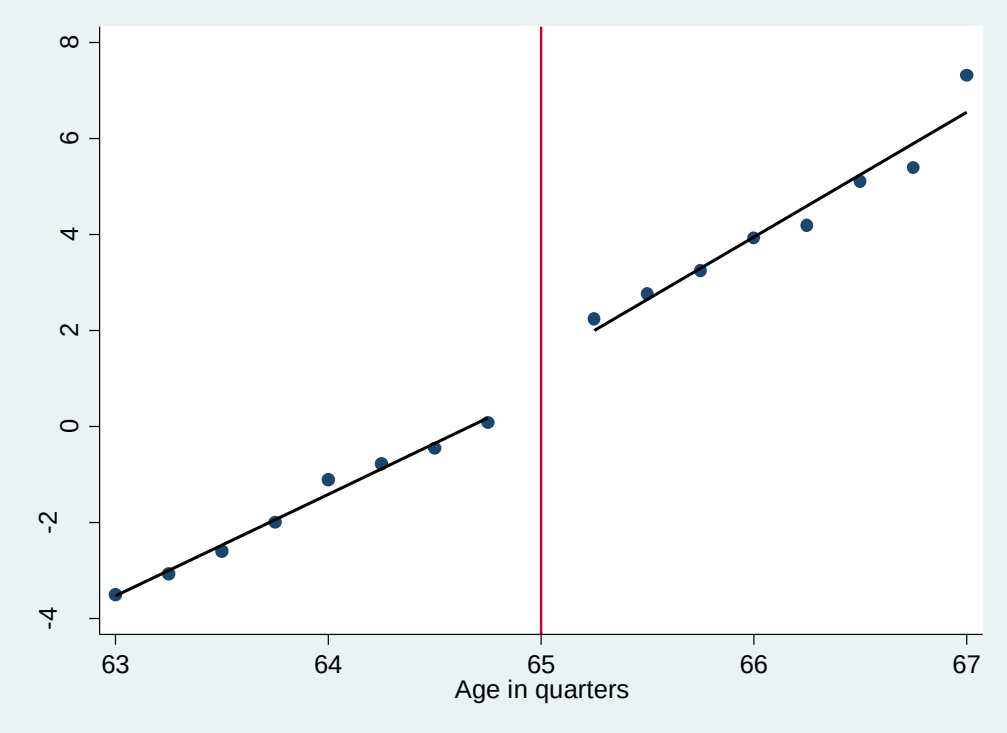
Note: Each column shows coefficients for a different regression, according to the type of drug. Entries are regression discontinuity estimates from models that include age, post-65 dummy and time fixed effects. The dependent variable is a dummy variable indicating whether or not the individual consumed any drug in the quarter. Standard errors (in square brackets) are calculated applying a wild bootstrap-se procedure accounting for multi-way cluster structure. *** Denotes significance at the 1% level.

Table 6. Changes in the inappropriate use

Expenditure	New users
0.17*	0.01***
[0.1031]	[0.002]

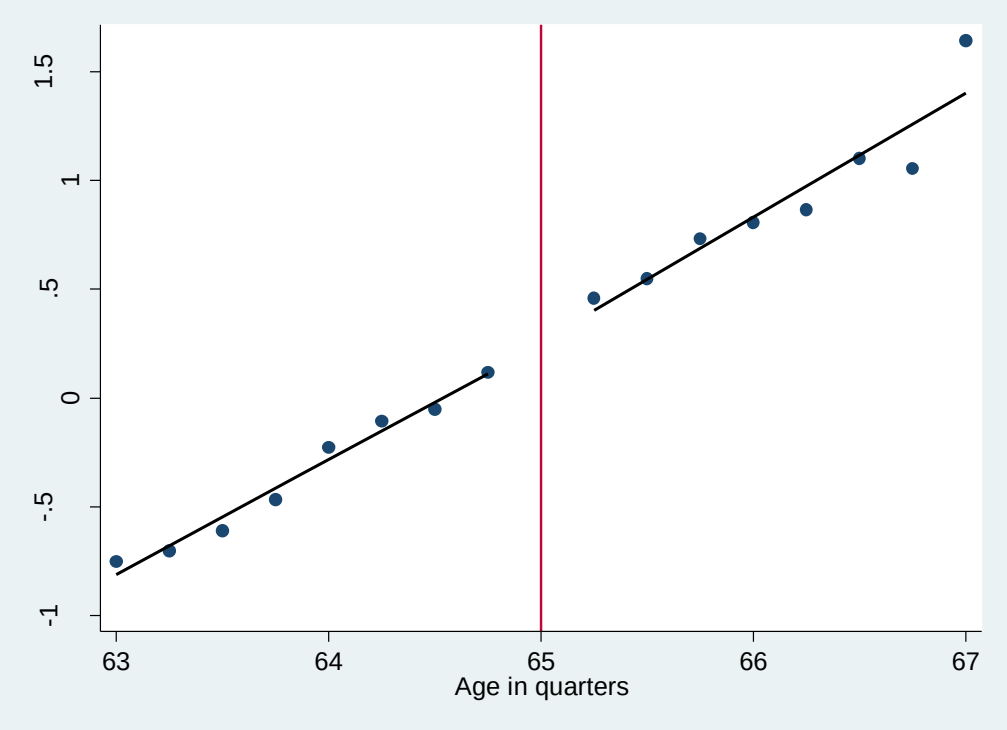
Note: Entries are regression discontinuity estimates from models that include age, post-65 dummy and time fixed effects. In the first column the dependent variable is total drug expenditure on inappropriate medication. In the second column the dependent variable is a dummy variable indicating whether or not the individual consumed any inappropriate drug in the quarter. Standard errors (in square brackets) are calculated applying a wild bootstrap-se procedure accounting for multi-way cluster structure. *** Denotes significance at the 1 % level, * 10 % level.

Figure 1. Total drug expenditure on non-chronic condition drugs by age.



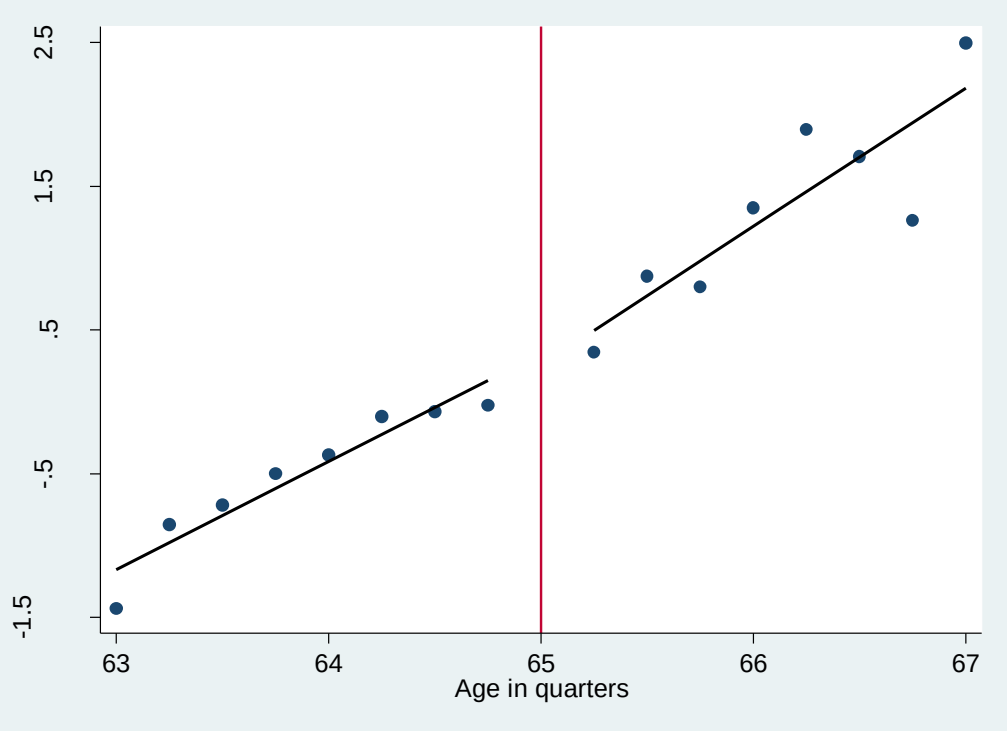
Note: The dots are the average of the residuals of a regression of drug expenditure (euros) on month dummies, i.e. month in which the drug was consumed. The lines are regression fits, from a linear model that allows for a different first order polynomial in age on either side of 65.

Figure 2. Total drug consumption on chronic condition drugs (10% co-payment) by age.



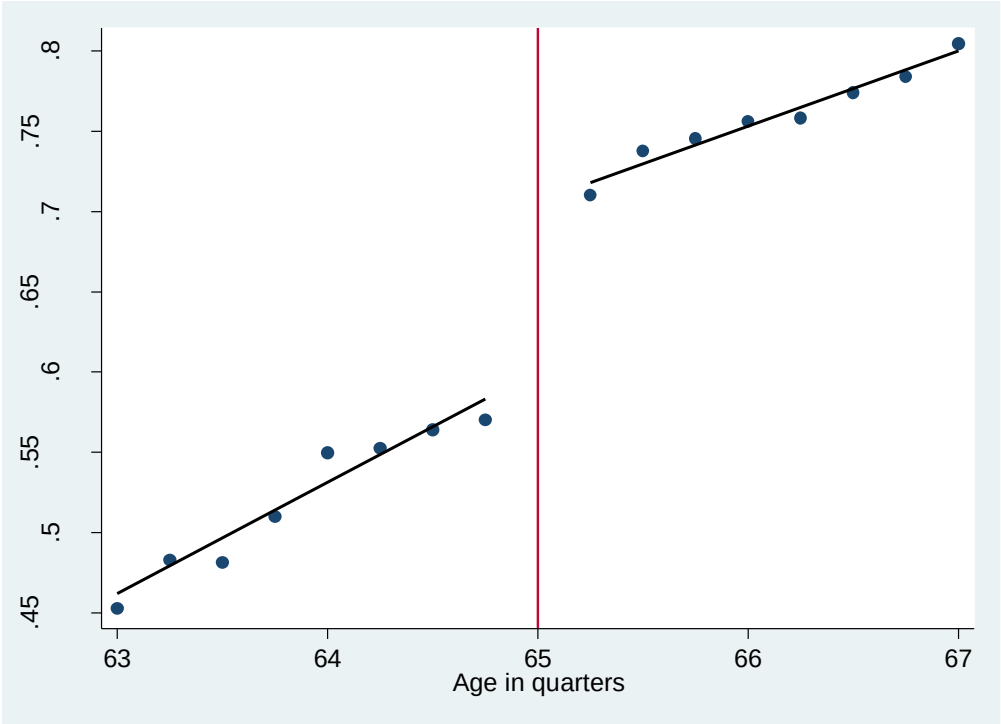
Note: The dots are the average of the residuals of a regression of drug expenditure (euros) on month dummies, i.e. month in which the drug was consumed. The lines are regression fits, from a linear model that allows for a different first order polynomial in age on either side of 65.

Figure 3. Total drug expenditure on chronic condition drugs (< 10% co-payment) by age.



Note: The dots are the average of the residuals of a regression of drug expenditure (euros) on month dummies, i.e. month in which the drug was consumed. The lines are regression fits, from a linear model that allows for a different first order polynomial in age on either side of 65.

Figure 4. Proportion of retirees by age.



Note: The dots are the average proportion of retirees at each quarter of age. The lines are regression fits, from a linear model of retired status on age, a dummy variable that indicating 65 or older, an interaction term between age and dummy variable for being older than 65 and a time variable that indicates the quarter in which the survey was conducted.

1.9 Appendix A: Additional Tables

Table A1. Regression Discontinuity Estimates (number of prescriptions)

ALL		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
1.28***	0.23***	0.04
[0.27]	[0.06]	[0.03]
{3.44}	*{1.32}*	*{0.35}*
LOW EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
1.24***	0.17***	0.02
[0.25]	[0.06]	[0.03]
{3.63}	*{1.36}*	*{0.37}*
HIGH EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
1.25**	0.26**	0.02
[0.56]	[0.14]	[0.04]
{2.86}	*{1.15}*	*{0.29}*

Note: Each cell shows the estimate of *TE* (equation 5) for a different sample (as defined by type of drug and individual's education). The regression includes age, post-65 dummy and time fixed effects. Standard errors (in square brackets) are calculated applying a wild bootstrap-se procedure accounting for multi-way cluster structure. The estimated mean post-65 number of prescriptions for retired individuals is in curly brackets. *** Denotes significance at the 1% level, ** 5% level.

Table A2. Regression Discontinuity Estimates (DDDs)

ALL		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
25.72***	8.78***	1.55
[5.51]	[1.41]	[1.51]
{75.03}	*{44.53}*	*{13.55}*
LOW EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
24.43***	6.68	0.24
[5.05]	[4.61$^{\text{Y}}$]	[1.51]
{78.59}	*{46.72}*	*{14.03}*
HIGH EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
22.62***	11.78***	0.76
[11.05]	[4.25]	[1.37]
{64.79}	*{39.83}*	*{11.04}*

Note: Each cell shows the estimate of *TE* (equation 5) for a different sample (as defined by type of drug and individual's education). The regression includes age, post-65 dummy and time fixed effects. DDDs (Defined Daily Doses) are restricted to 1,500 per quarter. Standard errors (in square brackets) are calculated applying a wild bootstrap-se procedure accounting for multi-way cluster structure. The estimated mean post-65 drug consumption (DDDs) for retired individuals is in curly brackets. *** Denotes significance at the 1% level. $^{\text{Y}}$ denotes the maximum of the standard errors obtained from one-way clustering along each possible dimension as the resulting variance when implementing the two-way formula was negative.

Table A3. Estimates of arc price-elasticity of the number of prescriptions

ALL		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
-0.19***	-0.09***	-0.05
[0.04]	[0.02]	[0.04]
LOW EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
-0.17***	-0.06***	-0.03
[0.04]	[0.02]	[0.03]
HIGH EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
-0.24**	-0.12*	-0.04
[0.11]	[0.07]	[0.06]

Note: Each column shows the estimates of the arc price-elasticity, according to the type of drug and individual's education. The measure of drug consumption is indicated in the title of the table. Standard errors (in square brackets) are calculated applying a wild bootstrap-se procedure accounting for multi-way cluster structure. *** Denotes significance at the 1 percent level, ** 5 % level, * 10 % level.

Table A4. Estimates of arc price-elasticity of drug consumption (DDDs)

ALL		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
-0.18***	-0.10***	-0.05
[0.04]	[0.02]	[0.05]
LOW EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
-0.16***	-0.08***	-0.01
[0.03]	[0.004]	[0.05]
HIGH EDUCATED		
Non-chronic	**Chronic (10%)**	**Chronic (<10%)**
-0.19**	-0.17***	-0.03
[0.09]	[0.06]	[0.06]

Note: Each column shows the estimates of the arc price-elasticity, according to the type of drug and individual's education. The measure of drug consumption is indicated in the title of the table. DDDs (Defined Daily Doses) are restricted to 1,500 per quarter. Standard errors (in square brackets) are calculated applying a wild bootstrap-se procedure accounting for multi-way cluster structure. *** Denotes significance at the 1 % level, ** 5 %level.

1.10 Appendix B

In this Appendix, we provide details on the computation of the elasticities that we report in the paper. We estimate the arc price-elasticity of the demand of pharmaceuticals ($\hat{E}_p$) using the following expression:

$$\hat{E}_p = \frac{\frac{\triangle C}{(C_1+C_2)/2}}{\frac{\triangle P}{(P_1+P_2)/2}}$$

where $\triangle C$ is our $\widehat{TE}$ (the regression discontinuity estimate, see(5)); P_1 is the pre-retirement price, C_1 is the quantity (measured either as total cost, DDDs or number of prescriptions) purchased at P_1, P_2 is the post-retirement price, and C_2 is the quantity purchased at P_2. $\triangle P = P_2 - P_1$. The values of P_1, P_2, and $\triangle P$ follow the table below:

	Non-chronic drugs	Chronic drugs	Chronic drugs (price capped)
P_1	$0.4P$	$0.1P$	2.64
P_2	0	0	0
$\triangle P$	-0.4P	-0.1P	-2.64

As previously indicated, we do not observe who is retired or not in the dataset in which we observe C. Hence, we cannot directly measure either C_1 or C_2. To tackle this, we solve the following system of equations:

$$C^{65-} = R^{65-} * C_2^{65-} + (1 - R^{65-}) * C_1^{65-}$$
$$C^{65+} = R^{65+} * C_2^{65+} + (1 - R^{65+}) * C_1^{65+}$$
$$C_2^{65+} = C_2^{65-} + (2\theta_a)$$

$$C_1^{65+} = C_1^{65-} + (2\theta_a)$$

where C^{65-} and C^{65+} are C at ages 64.75 and 65.25 respectively, R^{65-} and R^{65+} are the proportion of retired individuals at ages 64.75 and 65.25 respectively, C_1^{65-} and C_1^{65+} are the levels of C for non-retired individuals at ages 64.75 and 65.25 respectively, C_2^{65-} and C_2^{65+} are the levels of C for retired individuals at ages 64.75 and 65.25 respectively, and θ_a is the age coefficient in equation (3)[33]. Note that $(C_1^{65-}, C_1^{65+}, C_2^{65-}, C_2^{65+})$ is the vector of unknowns but the other parameters can be either directly estimated from the data $(C^{65-}, C^{65+}, R^{65-}, R^{65+})$ or taken from the estimates of our econometric models (θ_a).

After solving for $(C_1^{65-}, C_1^{65+}, C_2^{65-}, C_2^{65+})$ in the system of equations above, we use

$$C_1 = (1 - R^{65-}) * C_1^{65-} + (1 - R^{65+}) * C_1^{65+}$$
$$C_2 = R^{65-} * C_2^{65-} + R^{65+} * C_2^{65+}$$

to obtain C_1 and C_2, and be able to compute the elasticity using the formulae above.

As we report elasticities for each type of drug, we apply this procedure separately for each type of drug (non-chronic, chronic, chronic but with price capped) and for each quantity indicator (total drug expenditure, DDDs, and number of prescriptions).

[33]Note that we multiply by 2 the age coefficient because we are evaluating the change from 64.75 to 65.25, and not from 64.75 to 65.

1.11 Appendix C

We consider the following features of the data when computing the standard errors of our estimates: (1) the forcing variable, age, is discrete which calls for clustering at the level of age (Lee and Card, 2008), (2) the number of age cluster is relatively small, 17, and hence the standard errors need to be bootstrapped, (3) the drug consumption dataset is longitudinal and hence errors of the same individual are correlated over time which calls for clustering at the individual level. (1) and (3) together imply that we need to correct for two-way clustering. Following Cameron et al. (2011), the variance of TE ? corrected for two-way clustering is:

$$V(\widehat{TE}) = V^A(\widehat{TE}) + V^I(\widehat{TE}) - V^U(\widehat{TE}) \tag{1.5}$$

where V^A is the variance adjusted for clustering by age, V^I is the variance adjusted for clustering by individual, and V^U is the variance assuming independence across observations, that is, without cluster adjustment. We compute V^A, V^I, and V^U, by drawing bootstrap samples at the appropriate cluster level (age, individual, or without cluster adjustment). Because the number of clusters as defined by age is relatively small, we draw the samples using wild bootstrap instead of the more standard pair bootstrap. Wild bootstrap has shown to provide conservative standard errors when the number of clusters is small (Cameron *et al.*, 2008). Note that $\widehat{TE}$ is a ratio $\widehat{TE} = \frac{\widehat{\pi_n}}{\widehat{\pi_d}}$ and its variance across the 1,000 pseudo-bootstrap samples can "explode" if the value of the denominator is very close to zero even in one pseudo-bootstrap sample. To avoid this problem, we use a robust estimator of the standard error of $\widehat{TE}$, based on the

assumption of normality. In particular, we estimate the standard error of $\widehat{TE}$ as:

$$\mathbf{SE}(\widehat{TE}) = \frac{P_{75} - P_{25}}{2 * 0.6745} \tag{1.6}$$

where P_{75} and P_{25} are the 75^{th} and 25^{th} percentiles of $\widehat{TE}$ across the 1,000 pseudo-bootstrap samples[34]. After substracting one to the other, one obtains $\mathbf{SE}(\widehat{TE}) = \frac{P_{75}-P_{25}}{2*0.6745}$. This provides an estimate of the standard error of $\widehat{TE}$ which is robust to values of the denominator very close to zero for some pseudo-bootstrap sample[35].

We obtain similar results when we use the Delta Method, which does not require using (1.6). To use the Delta Method, we need the standard errors of the numerator, $\hat{\pi}_n$, and the denominator, $\hat{\pi}_d$. For the latter, we use wild bootstrap clustering by age to take into account that the number of clusters (when defined by age) in the Active Population Survey is relatively small. The standard error of the numerator is estimated using

$$V(\hat{\pi}_n) = V^A(\hat{\pi}_n) + V^I(\hat{\pi}_n) - V^U(\hat{\pi}_n) \tag{1.7}$$

because we consider clustering at both age (as in the case of the Active Population Survey) and individual level when using the pharmaceutical consumption dataset[36]. We use the standard White-estimator to estimate $V^U(\hat{\pi}_n)$, and the standard cluster adjusted Huber-White estimator to estimate $V^I(\hat{\pi}_n)$ because the number of individual based clusters is large. As the number of age based clusters is relatively small, we use wild bootstrap to estimate $V^A(\hat{\pi}_n)$. Once we have estimated $V^A(\hat{\pi}_n)$, $V^I(\hat{\pi}_n)$ and $V^U(\hat{\pi}_n)$, we can apply (3) and ob-

[34]Under the normality assumption, $\frac{P_{75}-E(TE)}{SE(TE)} = 0.6745$ and $\frac{P_{25}-E(TE)}{SE(TE)} = -0.6745$

[35]The results are not sensitive to the percentiles used. We obtain similar results if we use $\mathbf{SE}(\widehat{TE}) = \frac{P_{97.5}-P_{2.5}}{2*1.96}$.

[36]Unlike the Active Population Survey, the pharmaceutical consumption dataset is a panel and hence clustering at the individual level must be taken into account.

tain an estimate of the standard error of$\hat{\pi}_n$, which is used together with the standard error of $\hat{\pi}_d$ and the Delta Method to obtain the standard error of $\widehat{TE}$.

Chapter 2

Family Types and Intimate-Partner Violence: A Historical Perspective

2.1 Introduction

Worldwide, 30% of all women who have been in a relationship have experienced physical and/or sexual violence by their intimate partner (WHO, 2013). Exposure to this abuse has serious consequences for women's health, fatal injures being the most extreme outcome: as many as 38% of all female murders are perpetrated by their intimate partners -in contrast to 6% of all murdered men (WHO, 2013). Understanding the factors that cause this kind of abuse is very important since it constitutes a major public health problem and a violation of women's human rights.

So far, the economics literature has focused on the short-term determinants of intimate-partner violence (IPV). The objective of this paper is to understand the long-term determinants. Among cultural factors linked to violence against women, the traditional structure of the family is one of the most important. The family is a fundamental institution with a great power in shaping values

and attitutes towards gender. This paper contributes to the analysis of the IPV causes by studying the relationship between IPV and historical family types.

In particular, I focus on the effects of two family types: stem and nuclear. Each of these family types has a distinct residence and inheritance pattern. In stem families, one single kid inherits all and remains at the parental homestead. He brings his spouse and continues the family line. Therefore, two couples from two generations are living together. In nuclear families, however, all children leave the house to start their own independent households. There is equal division of bequest among all children and no intergenerational cohabitation.

My hypothesis is that co-residence with other women (normally the mother in-law), which is a feature of stem families, accentuated the productive role of the wife, increasing her contribution to farming work. Indeed, the presence of an older woman reduces the burden of the household work, freeing up time for farming work (see Sasaki (2002) for the case of Japan). To illustrate this I model the behaviour of a traditional peasant family in the preindustrial period, where all the household members work and live together in the family farm. Violence enters the utility function of the husband directly and positively [1], but also negatively as a loss of wife's productivity. I show how if the wife's productivity loss associated with violence is higher in the farming work than in the domestic work, then the optimal level of violence will decrease when the presence of the mother-in-law increases in the household.

In my main empirical analysis, I use Spanish data for two reasons. First, this country provides IPV measures of the highest quality. To measure IPV, I use a comprehensive survey dataset for 1999-2005 on violence against women

[1]This is consistent with an interpretation of violence as an expressive behaviour that provides direct gratification commonly used when modelling domestic violence. See, for instance, Tauchen et al. (1991), Aizer (2010) or Card and Dahl (2011). Other papers consider violence as an instrument for controlling the victim's behaviour (Bolch and Rao, 2002). Alternative explanations provided in section 3 would be consistent with this second interpretation of violence.

in Spain (n=69,627) where IPV is measured objectively through a set of questions. Second, the stem and nuclear family types are stable and remarkably persistent in Spain. Indeed, historians trace their origins back to the Middle Ages. To measure the family types, I use the 1860 census data and compute the average number of married and widowed women in the household at the province level. I control for an exhaustive set of individual characteristics, and I subsequently include additional controls: (1) contemporaneous (GDP and unemployment, social capital, etc), (2) historical (population density and urbanization rates), and (3) geographical (ruggedness and climate) variables. The results are robust, statistically significant, and show a negative relationship between traditional stem family territories and IPV.

To better understand the causality of this relationship I exploit a unique source of exogenous variation and instrument the family types by using the Christian "Reconquest" of the Iberian Peninsula. The so-called "Reconquest" is a centuries-long period (722-1492) in which several Christian kingdoms took control and repopulated the Iberian Peninsula from the Islamic rulers. There are two important dimensions of this historical event that explain the establishment of the different family types: the political structure and the land tenure structure. On the one hand, western kingdoms had a stronger and more centralized monarchy, with interests in restricting the development of powerful landholding families, served by the introduction of equal allocation of bequest. Meanwhile, in the east, more powerful feudal nobility sought to maintain their feudal holdings intact through indivisible inheritance (a single heir). On the other hand, resettlement in the north, where the Reconquest started, favored small and medium ownership by free peasants. These small and medium holdings needed to be undivided in order to guarantee the family continuity and therefore established indivisible inheritance. I find that IV estimates are consis-

tent with OLS estimates.

During the last century, the importance of the stem family in Spain has been decreasing alongside the full industrialization of the country. Still, this family structure persisted long enough to potentially explain the behaviour in different circumstances and time. My hypothesis is that the internalization and intergenerational transmission of these cultural norms have a role in explaining why we still see lower levels of domestic violence in territories where stem family was socially predominant in the past. To explore further the cultural transmission channel I use data from the *World Values Survey* for Spain. I find that traditional stem family territories exhibit today attitudes towards more gender equality compared to nuclear family territories. However, when examining other values and attitudes (life satisfaction, trust, homosexuality, euthanasia) I don't find any statistically significant difference.

To my knowledge this is the first paper to look at the relationship between historical family types and intimate-partner violence. This paper fits in the literature in three main strands. First, it contributes to the analysis of domestic violence causes. The bulk of this literature looks at how the distribution of bargaining power within the couple affects domestic violence. For instance, they analyze the effect of income (Tauchen, Witte and Long, 1991), services for battered women (Farmer and Tiefenthaler, 1996), divorce (Stevenson and Wolfers, 2006), gender wage gap (Aizer, 2010), unemployment (Anderberg *et al.*, 2013), and cash transfers (Bobonis, González-Brenes and Castro, 2013) on domestic violence. Other papers treat IPV as a signal of dissatisfaction with the marriage (Bolch and Rao, 200) or as an expressive mechanism triggered by an emotional cue (Card and Dahl, 2011). All these papers study the short-term determinants of domestic abuse. Only Pollack (2004) recognizes this important gap in the literature and develops a theoretical model of the intergenerational transmission

of domestic violence. This paper tries to identify and understand the deeper and historical factors that underlie violence against women.

Second, it contributes to the literature on family types. An important part of this literature has focused on the dimension of large kinship groups versus nuclear family and its interaction with cooperation and the provision of goods and safety. In this respect, Greif (2005) highlights the importance of family structure on the emergence of the economic and political corporations in late medieval Europe, and Greif and Tabellini (2012) study two different ways of sustaining cooperation in China and Europe, the clan and the city. Alesina and Giuliano (2013) study the effects of strong or weak family ties on economic behaviour and economic attitudes.

Finally, this paper is also related to the growing literature on culture, institutions and history[2]. In particular, two papers are close to my topic of interest. First, Alesina, Giuliano and Nunn (2013) examine the historical origins of gender roles. They test Boserup's (1970) hypothesis that societies that traditionally practiced plough agriculture where men had an advantage in farming work, exhibit today less equal gender norms. Second, Grosjean (2012) examines the origins of the culture of honor in the US. She shows that historical settlements by Scot or Scot-Irish herders 200 years ago are still associated with homicide today.

The remaining of the paper is organized as follows. Section 2.2 reviews family types and their measurement. Section 2.3 presents the model. Section 2.4 briefly summarizes the historical background, the different family law institutions and the origins of the family types. Section 2.5 documents the data used and the empirical strategy. Section 2.6 reports OLS and IV results. Section 2.7 shows supporting evidence on the effects of the family structure on female par-

[2]See Nunn (2013) for a recent survey on comparative historical economic development.

ticipation in agriculture in pre industrial societies, and violence against women in countries where stem family still persists. Section 2.8 discusses potential transmission mechanisms and shows evidence in favor of the cultural transmission channel. Section 2.9 concludes.

2.2 Family Types

According to the work started by Le Play (1884), there are three basic types of families in all parts of the world and all ages of history. First, the joint or communitarian family, in which all sons remain with their parents and bring their wives to the family house upon reaching adulthood. When the family gets too large it splits apart. Second, in the stem family, only one child stays at the parental homestead, together with his wife and children. He will be the one who inherits the land and the house, thus continuing the family line. The other children that want to marry and start their own households leave the house. Third, the nuclear family, in which all children leave the parental house to establish their own households.

This classification is used, with some variations, by Todd (1990)[3]. To draw a map of family types in Western Europe he uses a combination of recent data and historical monographs. Supported by the use of anthropologic and historical evidence, he suggests that family types in Europe have a stable and long-lasting pattern. He traces back the origins of the different family structures to the medieval time, if not earlier for some regions.

Figure 2.1 shows Duranton et al. (2009) version of Todd's map of family types in Europe. In Spain, only two family structures are found: stem and nu-

[3]Todd classifies families according to two organizing principles: the relationship between parents and children (liberal or authoritarian), and the relationship between siblings (equal or unequal). Combining these two principles he would then characterize four types of families: communitarian, stem, egalitarian nuclear and absolute nuclear.

clear[4]. This is consistent with the anthropological work done in Spain by Lisón Tolosana (1975, 1977). There are two dimensions in which stem and nuclear families differ: co-residence and inheritance patterns. In stem families there is a higher degree of intergenerational cohabitation and the indivisible or impartible inheritance principle (single heir) serves the main purpose of preserving the family heritage. Conversely, in nuclear families, as children leave the house to form their own households, there is no cohabitation of couples and, at least in Spain, there is equal allocation of bequest among children.

2.2.1 Measurement of Family Types in Spain

To measure the social predominance of both family types in Spain, I use 1860 census (as in Mikelarena Peña, 1992). This is the first dataset that allows us to reliably measure household types for the whole country. The indicator chosen to best capture the family structure is the number of married and widowed women in the household. This indicator is preferred to others that only measure household size (number of people or adults per household) and also to others that do not correct for immigration (number of married and widowed people in the house). Moreover, the number of married and widowed women has a correspondence to Laslett classification: a value of 1.075 married and widowed women per household is equal to 25% of complex households. And according to a convention agreed by researchers, if a society reaches this threshold, then we can say that stem family is social predominant (Mikelarena Peña, 1992)[5].

Figure 2.2 shows the family types in Spain in 1860. Although this represents a specific point in time, some authors (Reher, 1996; García González, 2011) show

[4]Outside Europe and Spain, stem families are also found in Japan, Korea, and some parts of Southeast Asia, Hungary and Canada (Goldschmidt and Kunkel, 1971).

[5]Figure 2.7 in the Appendix A shows the core territories where stem family was socially predominant according to this convention.

that these patterns have remained stable at least during the period between the 17^{th} century and the beginning of the 1970's. The social and economic changes performed in Spain during the 20^{th} century (full industrialization, demographical transition, and massive migration to cities) have jeopardized the traditional peasant stem family structure [6].

If we compare our own elaborated map of family types in Spain using 1860 census with Todd's map of family structures in Europe, I only find two small differences in Spain. First, in Galicia, in the northwestern part of the Iberian Peninsula, I find that nuclear families are social predominant at the province level. Second, in the Eastern region known as Valencia, the presence of stem families is relatively high. The latest evidence for both regions confirms my findings (Ardit Lucas, 2008 for Valencia; Pérez García, 2008 for Galicia)[7].

2.3 The Model

In this section I show the main mechanism through which traditional stem families, compared to nuclear families, could lead to lower levels of domestic violence. The context is an agrarian and pre demographic transition economy, in which all family members live together, and consume and produce jointly. Divorce is impossible or prohibitively costly.

In the household that I model, there can be three agents: husband h, wife w, and the mother (normally the mother-in-law) m. m only appears in stem families. Each agent i is endowed with up to one unit of time $t_i \in [0, 1]$. t_i can

[6] Figure 2.8 in the Appendix A shows the family structure using 2001 census. When computing the average number of married and widowed women per household at the province level we find that all figures are remarkably lower, and that the geographical pattern has completely changed.

[7] For the sake of clarity, Figure 2.9 in the Appendix A shows the regional division of Early Modern Spain, and Figure 2.10 in the Appendix shows the provincial map of Spain. The 50 provinces division was first introduced in 1833 and has remained unchanged until present days.

be allocated in farming activity c or domestic activity q. c and q are produced and consumed jointly using the following production technology:

$$c = \omega_h t_h + \omega_w(v) t_w + \omega_m t_m$$

$$q = \gamma_h(1 - t_h) + \gamma_w(v)(1 - t_w) + \gamma_m(1 - t_m)$$

where ω_i and γ_i represent the productivity in the farming activity and domestic activity respectively. Both $\omega_w(v)$ and $\gamma_w(v)$ are a negative function of violence:

$$\frac{d\omega_w(v)}{dv} < 0 \, , \frac{d\gamma_w(v)}{dv} < 0$$

I assume the following pattern regarding the comparative advantage: the husband is better than the wife in farming work relative to domestic work, and the wife is better than the mother-in-law in farming work relative to domestic work:

$$\frac{\omega_h}{\gamma_h} \geq \frac{\omega_w(v)}{\gamma_w(v)} \geq \frac{\omega_m}{\gamma_m}$$

I assume that the husband spends all his time on the fields ($t_h = 1$), and that the mother spends all her time at the house ($t_m = 0$).

I also assume a male dominant decision making and that the husband preferences are represented by a quasi-linear Cobb-Douglas utility function $U_h = c^{\alpha} q^{1-\alpha} + v$. Violence enters the utility function positively and directly[8], but also negatively and indirectly as wife's productivity loss. The husband chooses t_w

[8]This is consistent with an interpretation of violence as an expressive behaviour that provides direct gratification commonly used in economics when modelling domestic violence. See, for instance, Tauchen et al. (1991), Aizer (2010) or Card and Dahl (2011). Other papers consider violence as an instrument for controlling the victim's behaviour (Bolch and Rao, 2002). Alternative explanations provided at the end of this section would be consistent with this second interpretation of violence.

and v to solve:

$$\max_{\{t_w, v\}} \; (w_h + \omega_w(v)t_w)^{\alpha}(\gamma_w(v)(1-t_w) + \gamma_m)^{1-\alpha} + v$$

The main idea is that, due to the comparative advantage, the presence of the mother-in-law reduces the burden of the domestic activity on the wife. In stem families, therefore, wives contribution to farming work will be greater. This is shown in the solution for t_w from the first order condition:

$$t_w^* = \alpha + \alpha\frac{\gamma_m}{\gamma_w(v)} + (\alpha - 1)\frac{\omega_h}{\omega_w(v)}$$

I then do comparative statics to determine how the optimal violence v^* responds to changes in γ_m [9]. I find that, assuming that the utility function is a concave function of the violence (i.e. $f_{vv} < 0$), if the productivity loss of the wife due to violence is higher in the farming activity than in the household activity[10], then the optimal level of violence v^* will decrease when the presence of the mother-in-law in the household increases:

$$\frac{\partial v^*}{\partial \gamma_m} < 0 \text{ if } \frac{\frac{d\omega_w(v)}{dv}}{\omega_w(v)} < \frac{\frac{d\gamma_w(v)}{dv}}{\gamma_w(v)}$$

To sum up, the model is based on the hypothesis that co-residence with the mother in law, a feature of stem families, allows for a more productive role of

[9] More details regarding the first-order conditions and the comparative statics can be found at the Appendix B

[10] In the fields the wife not only needs more physical strenght that can be jeopardized by extreme violence, but also work complementarities and cooperation between husband and wife can be dampered as a consequence of lower levels of violence

the younger wife. Indeed, the presence of an older woman in the household reduces the burden of household work, freeing up time for the farming work. I assume that there is no divorce and that the husband is taking all decisions. Violence provides direct gratification to the husband, but it also has a cost since it reduces wife's productivity. The model shows that if the wife's productivity loss associated with violence is higher (in absolute terms) in the farming activity than in the household activity, then the optimal level of violence will decrease when the presence of the mother-in-law increases in the household.

The results of this model are also consistent with other potential explanations. For instance, with a model based on the moral hazard literature, where violence is used as a monitoring device. Since in stem families the wife is going to be more monitored both in the farm by the husband and in the house by the mother, we would also expect to see lower levels of violence compared to nuclear families. Also, if we considered a negative effect of witnesses on violence, we would again expect less violence in stem families as there are more people living in the same house.

Although in the empirical part I provide evidence that the main mechanism described by the model is important, I cannot rule out that the other potential explanations might also play a role in explaining the relationship between family types and domestic violence.

2.4 Historical Background

2.4.1 The Christian *Reconquest*

In 711 AD the Moslem Africans crossed the strait and entered the Iberian Peninsula. After seven years of battling against the Visigoths they dominated the majority of the territory and established their authority over Al-Andalus (Is-

lamic Iberia). Muslim expansion towards Europe came up against the Franks in 732 at the battle of Tours in France. As a consequence, Charlemagne established the Spanish March, a buffer zone in north-eastern Spain (broadly between the Pyrenees and the Ebro river) to protect his empire against Islamic attacks from Al-Andalus.

At the same time, in north-western Spain where many of the ousted Gothic nobles had taken refuge, the Christian Kingdom of Asturias was consolidating. Their first significant victory against the Muslims was in Covadonga stronghold in 722. This event determines the beginning of the so-called Christian "Reconquest". The repopulation and dominance of Iberia by the Christian kingdoms lasted more than seven centuries and finished in 1492 with the fall of Granada. Its slow pace and the different circumstances that originated the Christian kingdoms of the west and the east are important features in understanding the structure of the subsequent states.

In the east, distant central power allowed the Counts from the Spanish March to gain their independence from the Frankish Empire. They started their conquest of territories under the Muslim control towards the south. Still, the feudal system that Charlemagne had brought persisted for some time. Indeed, this feudal superstructure would be at the origin of the traditional "pactismo", at least in Catalonia (Sobrequés i Callicó, 1982). With this term historians refer to the principle of reaching agreements between the king and the parliament (first represented only by noblemen and clergy, and later also by townsmen), which limited the royal power. From 1137 and until 1707, eastern territories formed the Crown of Aragon. It had a highly decentralized system, both geographically –it was a confederation of states- and politically –each state preserved its own institutions, laws and privileges.

Meanwhile, in the west, Christian kingdoms were also expanding their ter-

ritories towards the south. In 1230 all these states unite into the Crown of Castile[11]. As opposed to the Crown of Aragon, in Castile there was a single king that fought to maintain and centralize the power and to establish homogeneous institutions and laws. With the marriage of Isabella of Castile and Ferdinand of Aragon, also known as the Catholic Monarchs, in 1469, both Crowns were united, although each of them preserved their own institutions[12]. The Catholic Monarchs completed the Christian Reconquest of the Iberian Peninsula and led Spain to the beginning of the modern era. Figure 2.3 shows the political development of Medieval Iberia between 910 and 1492.

2.4.2 Family Law Institutions

The emergence of several independent states at the beginning of the Christian Reconquest, along with other determinants, brought about a great variety of civil legal sytems (Castán Tobeñas, 1988). The Crown of Castile had its own unified civil law system, also known as "common law" [13]. In the Crown of Aragon, however, the situation was different. Each of its regions (Aragon, Catalonia, Balearic Islands, and Valencia) had its own distinct civil law. Also, Navarre and some territories in the Basque Country had their own legal systems. All these territories are known as "foral" law territories.

These *foral* laws are characterized by the respect for the autonomy on one's own matters and by a strong family organization. Indeed, most of the *foral* law is devoted to family institutions. They all have in common the age-old existence of a *house*; namely a stable peasant family together with the farm that

[11] In the very west of the Iberian Peninsula, the Kingdom of Portugal became independent in 1139.

[12] In between both Crowns of Aragon and Castile, the smaller Kingdom of Navarre sought to expand its territories towards the northern side of the Pyrenees. Its peninsular territories were conquered by the Crown of Castile in 1512 and they also preserved their own institutions.

[13] In this paper "common law" is not used in the sense of case law or precedent but only to refer to the Castilian legal system. "Civil law" is used as non-criminal law.

supports their living[14]. To assure family and future generations' survival the farm needed to be undivided. Their family and inheritance legal systems' rationale was thus to guarantee the conservation and continuity of the family heritage. This is shown in specific institutions that were distinct from the ones established in the rest of Spain, where Castilian law was in force. In this sense, one of the most paradigmatic family institutions of the *foral* regions is the single heir/heiress as opposed to the equal division of bequest between offspring that was promoted under common law.

Regarding the inheritance system, in Castile it was mandatory to leave 4/5 of the bequest to descendants: 2/3 should be equally allocated and 1/3 could be given to the preferred descendant. The testator could give 1/5 of his bequest to anyone but to the descendant that was already favoured. Only since 1505, the 1/5 could be added up 1/3, commonly known as "mejora de tercio y quinto" [15]. The Crown of Aragon had a distinct inheritance law. As shown in Figure 2.4, already in the 13^{th} century freedom of testation was instituted in all its territories, plus in some Basque regions and Navarre. Therefore, impartible inheritance by which a single heir/heiress could inherite all was allowed. It came up as a noble claim but later it was extended to all citizens.

Apart from inheritance, other traditional *foral* institutions were also devoted to the preservation and continuity of the house and the family. In this respect, widows in foral territories held life interest in the property so that the farm could smoothly continue its activity after the death of one of the household heads. Wives were also granted more rights in some of the foral territories

[14]The *house* was named differently in each region, according to its language, although it had the same meaning everywhere. It was called *baserria* (or *etxea*) in Basque Country; *torre* in Aragon; *can*, *mas* or *masia* in Catalonia; *barraca* in Valencia, etc. (Lisón Tolosana, 1972)

[15]According to these rules, a testator with 4 kids could leave at most 40% of his goods to one of his kids before 1505, and 60% after. An exception to this rule was the "mayorazgo", an institution that arose in the 14^{th} century as a privilege that the king granted to some noble families to maintain their patrimony together.

compared to the common law as, for instance, they had greater management of marital goods and could appoint the heir/heiress[16].

2.4.3 The Origins of Family Types

Clearly, there is a close connection between inheritance practices and family structure, impartible inheritance being a key determinant of the stem family. When asked about the origins of these practices, anthropologists and historians have stated several hypothesis [17]. One of the most well-established is the one by Goldschmidt and Kunkel (1971). They examine the variation in family structure of different peasant communities and find three patterns of family associated with particular inheritance rules [18]. They also find that the peasant family structure is linked to the legislation and the needs of the superior power structure. In this sense, they underscore the historical relationship between impartible inheritance and strong, independent feudal nobility. On the contrary, highly centralized authorities would institute divisible or partible inheritance in order to restrict the development of powerful landholding families [19].

This hypothesis has been applied to the Spanish case by Terradas (1984). He links the origins of impartible inheritance to the feudalized system established in the Spanish March by the Franks. Nobility would use this institution to guar-

[16]Moret y Prendesgast and Silvela (1863) compare family institutions in Castile and in the *foral* territories (Aragon, Balearic Islands, Catalonia, Navarre and some regions of the Basque Country). They find that widows held life interest in the property in Aragon, Navarre and Catalonia, this last one only until 1351. From that year onwards, even though it was not a legal right, it was still a common institution for widows in some regions of Catalonia and Balearic Islands. In Navarre and Basque Country wives had greater management of marital goods jointly owned in the community property. Riaza and García Gallo (1934) also find that in some regions of the Crown of Castile where stem family was also found (Asturias, Leon and Galicia), widows held life interest in property and wives could appoint the heir/heiress.

[17]See Barrera González (1990) and Mikelarena Peña (1992) for an excellent review.

[18]These are: (1) patrilocal stem with patrilineal impartible inheritance, (2) patrilocal joint with patrilineal partible, and (3) nuclear with bilateral inheritance.

[19]As illustrative examples, they cite on the one hand, feudalized Japan and western Europe, and imperial and centralized China and Russia on the other.

antee the preservation of their landholdings and to consolidate their regional authority. Impartible inheritance would then be progressively transmitted to peasants. On the one hand, this system would link a family to a piece of land, ensuring the feudal lord the collection of regular rents. And at the same time it would release the manpower needed for the repopulation in the Reconquest context.

With this hypothesis we are able to explain the emergence of the stem family in the territories that in the 13^{th} century had allowed impartible inheritance: the Crown of Aragon (i.e., Aragon, Balearic Islands, Catalonia and Valencia), Navarre and Basque Country (Figure 2.4). As already explained, in these territories political power was more decentralized as opposed to what happened in the Crown of Castile, where the monarchs sought to centralize power. Still, the prevalence of the stem family in the north of the Crown of Castile, where the law established partible inheritance, remains unexplained.

My hypothesis for explaining the low level of law enforcement and the adoption of stem family structures in these territories is based on the underlying land tenure structure. At the beginning of the Reconquest, the initial Kingdom of Asturias and Leon (later part of the Crown of Castile) started the colonization on deserted lands by free peasants (Sánchez Albornoz, 1978). The repopulation formula at that time was the "presura", i.e., the propriety of the land was granted directly by the king to the first that ploughed it, with the condition that they remained there. All these factors contributed to the emergence of small and medium landholdings in this region owned by free and independent families, and best preserved by impartible inheritance.

As the Reconquest moved forward, towards the South of the Iberian Peninsula, state structure developed and so did the resettlement policy. Clergy and nobility participation was rewarded with vast extensions of land. Some authors

claim this was the origin of the large estates or latifundia in the south of Spain (Carrión, 1975) and, furthermore, that the fundamental regional contrasts on land tenure structure that were set during the Reconquest have persisted over time (Malefakis, 1970). Landless peasants and day labourers typically hired at these large plots would be less concerned with inheritance rules.

2.5 Data and Empirical Strategy

Intimate-partner violence (IPV) data comes from three cross-sectional surveys on violence against women in Spain -"macroencuesta sobre la violencia contra la mujer en Espana". These surveys were conducted by phone in 1999, 2002 and 2005 (sample sizes 20552, 20652 and 28423, respectively) and contain a broad and representative sample of adult women ($\geq$ 18 years old) living in Spain (n=69,627) and different IPV measures: self-reported and objective. In this paper I use the so-called objective measure since self-reported measures tend to underestimate domestic violence. This type of survey data represents the gold standard to estimate the prevalence of any form of inter-personal violence (WHO, 2013). Direct questions about specific acts of violence over a period of time tend to disclosure more information than generic questions about "domestic violence" or "abuse".

When being introduced to the interview, women were told that they were doing a survey about the situation of women in the household (regarding their health, housework, children, etc.). Later on, they were asked about domestic violence. In particular, women needed to indicate whether they had encountered any of 26 situations which are related to domestic violence. These 26 situations are specifically designed to detect violence against women; 13 of them are considered as as an indicator of domestic violence because they describe

more serious situations. They encompass six different types of violence against women: physical, sexual, psychological, economic, structural, and spiritual violence. Table 2.1 shows these 13 situations. I then construct an IPV indicator variable that takes the value 1 if the woman answers "often" or "sometimes" to at least one of these 13 questions, and 0 otherwise. Figure 2.5 shows the resulting map of intimate-partner violence in the Spanish provinces during the period 1999-2005.

These surveys also include information at the individual level on the woman's and partner's level of education, woman's job status, household's reference person, marital status, children, number of people in the household, and religious beliefs.

To study the relationship between contemporaneous IPV and the 1860 province level family types, I also control for province characteristics that might be correlated with violence against women and with family types. First, I control for a set of contemporaneous variables that capture the level of economic developement at the province level, both formal (through GDP per capita and unemployment rate) and informal (through a measure of social capital). I also add religion (whether the woman is a Catholic or not) and number of people in the household. Second, I include historical variables to control for the level of economic development in the past, namely population density and urbanization rates at 1787 and 1860, also at the province level. Finally, I add geographical variables that could affect labour productivity in the farm (a ruggedness index and climate variables, such as temperature, range of temperature, rain and frost) in order to control for land quality and climate. Data sources are listed in Table 2.2.

Using all these data I then run the following regression to study the relationship between IPV and the different family types:

$$IPV_{i,p,y} = \alpha + \beta Stem_p + \gamma \boldsymbol{X}_{i,p,y} + \delta \boldsymbol{Z}_{p,y} + \theta_y Year_y + \epsilon_{i,p,y} \tag{2.1}$$

where $IPV_{i,p,y}$ is a binary variable that indicates if the woman i from province p on survey year y is receiving violence from her intimate-partner, $Stem_p$ is the average number of married and widowed women per household in province p based on 1860 census, $\boldsymbol{X}_{i,p,y}$ is a vector of control variables at the individual level, $\boldsymbol{Z}_{p,y}$ comprises regional controls at the province level, $Year_y$ are survey-year fixed effects and $\epsilon_{i,p,y}$ is the error term.

However, OLS estimates might be biased away from zero if societies that were initially more pro-women were also more likely to establish a stem family structure. On the contrary, if more advanced societies were more prone to adopt nuclear family structure and to have more gender-equal role attitudes at the same time, then the OLS might be biased towards zero. To address this important concern, I do not only control for observable characteristics (contemporaneous and historical economic development, determinants of farm labour productivity) but I also use an instrumental variable strategy.

Indeed, to better understand the causality of this relationship I exploit a historical source of exogenous variation, unique in the history of Europe. I instrument the family types by using the Christian Reconquest of the Iberian Peninsula. There are two important dimensions of the Christian Reconquest that are key to explain the emergence of the different family types: the political process and the land tenure structure.

On the one hand, regarding the political process, western kingdoms within the Iberian Peninsula had interests in restricting the development of a powerful landholding family. This was best served by instituting equal allocation of be-

quest, that led to nuclear family structures. Meantime, in the east, power was more decentralized, and feudal nobility sought to maintain the holdings intact through indivisible inheritance (which led to stem family structures).

To quantify the political process instrument I use the map of provinces that already in the 13^{th} century had freedom of testation, which allowed indivisible inheritance. I construct an indicator variable at the province level that takes the value 1 if the province had freedom of testation by the 13^{th} century and 0 otherwise[20].

On the other hand, regarding the land tenure structure, I find that resettlement in the north, where the Reconquest started, favoured small and medium ownership by free and independent peasants. These small and medium holdings needed to be undivided in order to guarantee the family continuity and therefore established indivisible inheritance which led to the emergence of stem families in the north of the Iberian Peninsula. As the Reconquest moved forward, towards the south, state structure developed, and clergy and nobility participation in the Reconquest was rewarded with vast extensions of land. These large states would typically hire day labourers and landless peasants who were less concerned about inheritance rules and thus established equal allocation of bequest and nuclear family structures.

To quantify the land tenure structure instrument, I use the stages of the Reconquest as a proxy. Based on the map of the Spanish reconquest by Lomax (1978) shown in Figure 2.6, I assign to each province a date from a set of 7 categories, based on the time each province was reconquered: 914, 1080, 1130, 1210, 1250, 1480 and 1492.

I use a two-stage least-square (2SLS) to estimate (1). In the first stage, I

[20]There were 13 provinces with freedom of testation by the 13^{th} century: Alicante, Balearic Islands, Barcelona, Castellon, Girona, Huesca, Lleida, Navarre, Tarragona, Teruel, Valencia, Vizcaya and Zaragoza

estimate the effect of the political process and the land tenure structure on becoming a stem family province:

$$Stem_{i,p,y} = \alpha + \sum_{j=1}^{J} \lambda_j Stage_p + \sigma Polit_p + \boldsymbol{\gamma} \boldsymbol{X}_{i,p,y} + \boldsymbol{\delta} \boldsymbol{Z}_{p,y} + \theta_y Year_y + u_{i,p,y} \quad (2.2)$$

where $Stage_p$ is the date in which each province was resettled (from seven categories) and $Polit_p$ is an indicator variable that takes value 1 if the province had freedom of testation by the 13^{th} century. The different stages of the Reconquest enter the regression as dummy variables, and since I omit the initial stage category category I end up with 7 excluded instruments (6 λ_j and 1 σ coefficients).

2.6 Results

2.6.1 OLS Results

Table 2.3 reports the OLS estimates of regression (1). The results show that living in provinces where stem family was more socially predominant in 1860 is associated with less contemporaneous intimate-partner violence. In particular, an increase in one in the average number of married and widowed women in the household per province in 1860 is associated with a decrease of around 5 percentage points in the current intimate-partner violence prevalence. This effect persists after controlling for contemporaneous, historical and geographical variables. It remains stable through the different specifications and statistically significant[21].

[21] Table 2.11 in the Appendix A show the results when using different definitions of IPV: physical and sexual violence on the one hand, and psychological, economic, spiritual, and structural violence on the other hand. Both set of results are consistent with the baseline measure of IPV.

There are other factors that could potentialy be correlated with traditional family structure and violence against women. Even though the lack of reliable data prevents us from controlling for these factors in the regressions, historical evidence suggests that these are not correlated neither with the family structure nor with IPV. The first one is the existence of matriarchal societies in ancient times. The Greek geographer Strabo, in his *Geography* (by 20 BC) finds in Cantabria what some have interpreted as a matriarchal society [22]. More recently, Todd (1990), based on the work done by Portuguese and Spanish ethnographers, finds also evidence of matriarchal traces in the southwest of the Iberian Peninsula.

Second, pastoral societies could be more gender equal since women had a comparative advantage in livestock farming, as showed by Voigtländer and Voth (2012). Together with agriculture, herding (especially sheep herding) was an important activity in medieval Spain, favoured by the lack of manpower and the abundance of land. Even though the lack of data, there is evidence of ancient tradition of transhumance herding, which was regulated in 1273 in the Crown of Castile. The seasonal movements took place between the northern mountains (Cantabric mountains and Pyrenees) and the southern steppes (Extremadura and New Castile), whereas in the east and south (the Mediterranean coast and Andalucia) agriculture was the main activity (Vicens Vives, 1959).

I address concerns about potential omitted variable bias by using a measure of unobservable selection. Following Altonji, Elder, and Taber (2005) I look at

[22]For instance, he describes Cantabrian women as "these women till the soil, and when they have given birth to a child they put their husbands to bed instead of going to bed themselves and minister to them; and while at work in the fields, oftentimes, they turn aside to some brook, give birth to a child, and bathe and swaddle it." (Strabo, Geography, III, 4, 18). Also: "it is the custom among the Cantabrians for the husbands to give dowries to their wives, for the daughters to be left as heirs, and the brothers to be married off by their sisters. The custom involves, in fact, a sort of woman-rule — but this is not at all a mark of civilisation." (Strabo, Geography, III, 4, 18). Although he refers to the Cantabrians, some historians extend these practices to other pre-Roman societies of in the northwest of the Iberian Peninsula.

the coefficient movements as control variables are added. I compare the coefficients of the specifications with contemporaneous, historical and geographical controls ($\hat{\beta}_{controls}$) to my baseline regression (model (1), ($\hat{\beta}_{baseline}$)) and compute the ratio ($\hat{\beta}_{controls}$)/($\hat{\beta}_{baseline}$-$\hat{\beta}_{controls}$). Under the assumption that selection on observables is proportional to selection on unobservables, this ratio tells us how much stronger the effect of omitted variable would have to be, relative to observables, to explain away the effect observed between historical family types and intimate-partner violence. When comparing the baseline model to the model with contemporaneous variables, I find that the effect of selection on unobservables would have to be at least 3.86 times higher. The estimated effect obtained when comparing the baseline model to the model with historical and contemporaneous variables is very similar (3.90). In the case of the fully controlled model, when all contemporaneous, historical and geographical variables are included, I find that the effect of omitted variable bias would have to be 8.4 times higher to completely explain away the relationship found between family structure and intimate-partner violence.

2.6.2 IV Results

Tables 2.4 and 2.5 show the IV estimates, which confirm the OLS estimates. Table 2.4 reports the first-stage results of regression (2). The results show how the more political decentralization has a positive effect on becoming a stem family province, and how further stages of the Reconquest are negatively correlated with finding stem family structure. The instruments are a powerful predictor of the family types, as reflected the F statistics for all specifications.

Regarding the second-stage and consistently with the OLS estimates, I find a negative and statistically significant effect of the historical stem family on IPV (Table 2.5): increasing in one the average number of married and widowed

women in the household in 1860 would decrease in around 6-7 percentage points the prevalence of intimate-partner violence in the last decade in Spain. The magnitudes are slightly higher than in the OLS estimates.

To further test the validity of the instruments I follow Angrist and Pischke (2009) and I estimate the just-identified model using a single instrument. The results for the just-identified model with my preferred instrument (political process) are reported in Tables 2.12 (first-stage) and 2.13 (second-stage) in the Appendix A. The coefficients are negative and statistically significant, and the magnitude is greater in absolute terms (around 10-11 percentage points). When I use only the repopulation stages instrument the results show again a negative relationship between stem family and IPV although of a lower magnitude (4-5 percentage points) and not statistically significant. Tables 2.14 (first-stage) and 2.15 (second-stage) in the Appendix A report these last results.

The validity of the IV results rests on the assumption that the Reconquest affects intimate-partner violence today only through its impact on family types. The primary concern with this strategy would be that the different political institutions and land tenure structure could be correlated with different levels of development that at the same time could affect violence against women. To address this concern I control in my regressions by historical and contemporaneous measures of economic development, plus by a measure of social capital -only contemporaneous- as a control for informal development.

A related issue would be the potential long-term impact of the expulsion of converted Muslims (or Moriscos) after the Christian Reconquest. Chaney (2008) analyzes the long-term effects of the expulsion of the 1609 expulsion of Moriscos from the Kingdom of Valencia. He finds evidence suggesting that the persistence of extractive institutions in pre-industrial economies dampened the

development of the non-agricultural sector [23]. The expulsion of the Moriscos also affected other areas of Spain, although to a much lesser extent [24], and recent studies suggest that economic effects were concentrated in the Kingdom of Valencia (Álvarez-Nogal and Prados de la Escosura, 2007). To address this concern I run my regressions without Valencia region and find similar results.

Other potential concern would be related with the effect of the Reconquest on other kinds of inter-personal violence and conflict. In this respect, one might argue that land inequality could have fostered social unrest in large estates areas. From the second half of the 19th century, uprisings claiming land rights were frequent among Andalusian day labourers. This movement systematized into an anarchist ideology. This ideology, however, was not exclusive of landless peasants in the south of Spain and was also embraced by industrial labourers in Barcelona and spread throughout the Mediterranean coast [25].

2.7 Additional Evidence

In this section I show supporting evidence for the relationships and mechanisms claimed in the paper. First, using the *Ethnographic Atlas* dataset I look at the effect of impartible inheritance on female participation in agriculture in pre industrial societies. Second, I explore the concurrent relationship between stem family and intimate-partner violence by looking at Philippines, a country where stem family still persists and where the *Demographic Health Survey*

[23] Chaney and Hornbeck (2013) investigate the economic dynamics of the 1609 expulsion of Moriscos from the Kingdom of Valencia. They suggest that the Malthusian convergence was delayed due to the persistence of extractive institutions. By limiting labour income, these institutions discouraged migration to former-Morisco areas and slowed demographic responses to labor scarcity.

[24] Spain expelled a total of approximately 300,000 Moriscos. 110,000 were living in the Kingdom of Valencia, and the rest were scattered all through the rest of Spain (LaPeyre, 1959).

[25] Figure 2.11 in the Appendix A shows the Spanish regions with traditional anarchist ideology.

provides us with data on violence against women.

2.7.1 Evidence from the *Ethnographic Atlas*

In the model presented, wives in stem families contributed more to farming work, and through this channel they received less violence. To test this I use the *Ethnographic Atlas* dataset by Murdoch, that contains information for 1,265 ethnographic groups prior to their industrialization. This dataset contains information on female participation in agriculture relative to men, and on the inheritance distribution of real property (land), along with other socioeconomic indicators. In order to look at the effect of family structure on female participation in farming I run the following regression:

$$y_e = \alpha + \beta Impartible_e + \gamma \boldsymbol{X}_e + u_e \tag{2.3}$$

where the dependent variable y_e measures traditional female participation in agriculture relative to men in ethnicity e. The variable takes on integer values between 1 and 5 and is increasing in female participation: (1) males only, (2) males appreciably more, (3) equal participation, (4) female appreciably more, and (5) females only [26]. "Impartible" is an indicator variable that equals 1 if the inheritance distribution for real property (land) goes exclusively or predominantly to one adjudged to best qualified, to the last born, or to the first born. X_e is a vector of control variables at the ethnicity group level that includes: dependency on animal husbandry, an index of settlement density as a measure of economic development, and an index of political complexity (measured by

[26] Following Alesina, Giuliano and Nunn (2013), I group the two categories 'differentiated but equal participation' and 'equal participation, not marked differentiation' into 'equal participation'.

the levels of jurisdictional hierarchies in the society). In Model (2), following Alesina, Giuliano and Nunn (2013) I add "traditional plough use", an indicator variable that equals 1 if the plough was traditionally used in pre industrial agriculture.

Table 2.6 shows the results. I find a positive effect of impartible inheritance on greater female participation in agriculture for pre industrial ethnicities. The results are robust to the inclusion of the traditional plough use in the regression.

2.7.2 Evidence from the *Demographic and Health Survey* Dataset

I explore further the relationship between stem family and intimate-partner violence when both are observed at the same time. To do this I look at Philippines, a country where stem family is said to exist (Fauve-Chamoux and Ochiai, 2009) and has information on domestic violence. I take the *Demographic and Health Survey* (DHS) dataset for Philippines which contains a module on domestic violence. The questions of this specific module are addressed to women between 15-49 years-old and specifically designed to measure IPV.

First, I analyze whether co-residence with other women affects the pattern of female work. To study this dimension I focus on the distinction between women working at home and women working outside the home [27]. I construct a binary variable that takes the value 1 if the woman has a job outside her home and 0 otherwise, and then estimate the following equation:

$$y_{i,r} = \alpha + \beta Coresidence_{i,r} + \gamma \mathbf{X}_{i,r} + \phi_r z_r + e_{i,r} \tag{2.4}$$

where $y_{i,r}$ takes value 1 if woman i that lives in region r is working out-

[27] In the sample, 43% of women do not work, 14% work at home, and 43% work outside the home.

side the home. In all the specifications I control for individual and household characteristics $X_{i,r}$ such as the number of household members and the number of children $\leq$ 5 living in the household. I also control for woman's age and whether she lives if a urban and rural environmnent and I include region fixed effects ($\phi_r z_r$). The key covariate of interest is the co-residence with other women between 15-49 living in the household ($Coresidence_{i,r}$). There are 17 regions and I cluster the standard errors by regions. Standard statistical formulae for clustered standard errors based on asymptotic theory (cluster-correlated Huber-White estimator) have been shown to provide standard error estimates that are too small if the number of clusters (regions here) is small. I therefore use wild bootstrap-se standard errors with weights assigned at the region level as they are conservative according to Cameron *et al.* (2008)[28].

Table 2.7 shows the results. I find that co-residence with other women has a positive effect on female labor force participation outside the home. The coefficients are robust to the inclusion of additional covariates, such as woman's marital status, educational level of the woman and her partner, and ethnicity fixed effects, and indicate that one more women between 15-49 living in the house is associated with an increase in the probability of working outside the home of 2-3 percentage points.

Second, I analyze the effect of co-residence with other women on IPV. I take the whole sample and construct a binary variable that takes the value 1 if the woman has ever experienced any kind of violence (physical, sexual, emotional, and economic) from her intimate-partner and 0 otherwise, and estimate a similar regression on the effects of co-residence with other women on IPV. As shown in Table 2.8, I find a negative relationship between female co-residence and do-

[28]They indicate 30 as a rule of thumb for when the number of clusters can be considered small, but they indicate that in general it will depend on the level of intra-cluster correlation and the number of observations per cluster.

mestic violence. The coefficents remain remarkably stable when I add religion and ethnicity fixed effects and show that an additional women aged 15-49 in the household is associated with a decrease in the probability of experiencing intimate-partner violence of 2 percentage points.

2.8 Transmission channels

Different reasons may explain the persistence of this distinct culture of violence against women within Spain. In this section I explore the potential transmission channels. On the one hand, the institutional environment could have reinforced or offset the internal beliefs about gender roles. In this sense, stem or nuclear family regions could have established different labor market institutions, laws, or policies that interacted with culture. On the other hand, it might just be purely cultural transmission. Cultural traits are sticky and slow-moving and there is evidence of a high degree of intergenerational correlation of domestic violence (Pollak, 2004), and of the important role of intra-family transmission of gender-role attitudes (Thornton, Alwin and Camburn, 1983). Moreover, Fernández, Fogli and Olivetti (2004) stressed the role of family attitudes and their intergenerational transmission in transforming women's role in the economy. They show that having a working mother influences man's preferences for a working wife or directly makes him a better partner for a working woman, and that the growing presence of this kind of man accounts for the increase in female labor force participation over time.

Even though I cannot rule out completely the institutional channel, the evidence that I am presenting is consistent with the cultural transmission channel. First, I am looking at within country variation, which means that all regions are facing the same external environment in terms of the laws, policies and mar-

kets that are determined by the central authority. Indeed, since the beginning of the Modern Era until the 1980's the tendency in Spanish history has been, with some exceptions, to unify regional institutions and policies and centralize the power. Only some regions managed to maintain their own institutions. Still, family structure and internal beliefs persisted in territories with very different degrees of institutional persistence. This allows us to apply a natural experiment approach. Basque Country and Navarre kept their own institutions almost throughout history; Aragon, Catalonia and Balearic Island lost their legislative body in the 18th century, but kept their own laws; Valencia lost both its legislative body and laws in the 18th century [29]; finally, some regions at the north of the former Crown of Castile (Asturias, Cantabria) never had their own formal institutions but maintained a stem family structure and exhibit today less intimate-partner violence.

2.8.1 Evidence from the *World Values Survey*

I explore attitudes towards women and other values in contemporary Spanish society and find evidence in support of the cultural transmission channel. With this purpose, I use the Spanish sample for period 1990-2007 of the *World Values Survey*. This survey contains, apart from demographic characteristics, information about values and attitudes towards women. The degree of gender equality is measured through the agreement or disagreement with 4 statements[30]: (1) "When jobs are scarce, men should have more right to a job than women"; (2) "On the whole, men make better political leaders than women do";

[29]The Nueva Planta decrees were signed by Phillip V between 1707 and 1716 after winning the War of the Spanish Succession. They suppressed the political and administrative institutions of the regions that were part of the Crown of Aragon. Eventually, Aragon, Catalonia and Balearic Island were allowed to keep their civil law. Basque Country and Navarre were not affected since they supported Phillip V.

[30]The first two are taken from Alesina, Giuliano and Nunn (2013).

(3) "Both the husband and wife should contribute to household income"; and (4) "Having a job is the best way for a woman to be an independent person".

I generate a binary variable for each of these statements, that takes the value 1 when the answers indicate beliefs towards greater equality and 0 otherwise [31]. To examine the effect of a traditional stem family structure on contemporary attitudes towards gender, I estimate the following equation:

$$y_{i,r} = \alpha + \beta Stem_r + \boldsymbol{\gamma} \boldsymbol{X}_{i,r} + \delta z_r + e_{i,r} \tag{2.5}$$

where $y_{i,r}$ takes value 1 if individual i that lives in region r has beliefs for greater gender equality. $Stem_r$ measures the average number or widowed and married women in the household based on 1860 census and aggregated at the region level (Autonomous Communities). $X_{i,r}$ includes control variable at the individual level: sex, age, marital status fixed effects, and educational level fixed effects. z_r measures the GDP per capita at the region level measured in the same year as the dependent variable. The information on beliefs is at the region level and I cluster the standard errors by region. Since there are only 16 regions[32] I report wild bootstrap-se standard errors with weights assigned at the region level[33].

Table 2.9 reports the results: individuals that live in a region where stem family was socially predominant in 1860 have contemporaneous beliefs towards geater gender equality.

I then do a similar exercise but instead of looking at attitudes towards gen-

[31] For statement (1), I omit the 'don't know' and 'neither' categories. For statements (2-4), I aggregate the 'agree strongly ' with the 'agree' answer, and the 'strongly disagree' with the 'disagree' answer.

[32] There are 17 Autonomous Communities but information on family structure is missing for the Canary Islands.

[33] See footnote 28 and comments on regression (2.4).

der I look at attitudes towards other things: life satisfaction, trust, homosexuality and euthanasia. Similarly, I construct indicator variables for the following questions: (1) "All things considered, how satisfied are you with your life as a whole these days?" (1 indicates satisfied, 0 disatisfied); (2) "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" (1 indicates most people can be trusted, 0 otherwise); (3) "Do you think homosexuality can always be justified, never be justified, or something in between?" (1 indicates justifiable, 0 otherwise); and (4) "Do you think euthanasia can always be justified, never be justified, or something in between?" (1 indicates justifiable, 0 otherwise) [34]. I run the same regression used above when looking at gender equality measures. Table 2.10 report the results. I find no statistically significant differences in stem family territories in these attitudes when compared to nuclear family territories.

2.9 Conclusion

Family is a fundamental institution that affects all spheres in the society. Its importance in shaping values and attitudes is unquestionable. In this paper I analyze the effect of the family structure on the culture of violence against women. I look at the relationship between intimate-partner violence in Spain and traditional family types (stem and nuclear). My hypothesis is that different family types shaped a distinct gender attitude and that this has had a long-term and persistent impact that explains violence against women today.

The results show that territories where stem family was socially predominant in the past exhibit today a lower prevalence of intimate-partner violence. The underlying mechanism that I claim is based on the greater female participa-

[34] In all 4 cases the responses vary in a 1-10 scale. Following what I did when looking at attitudes towards gender, I aggregate 1-5 and 6-10 answers.

tion in agriculture found in stem families. Co-residence with the mother-in-law reduced the burden of household work and accentuated the productive role of the wife. To illustrate this I model a traditional peasant family in the pre industrial period and show how the presence of the mother-in-law in the family could decrease the optimal level of violence against the wife.

In my regressions I combine past and present data. To address potential endogeneity concerns I control for an exhaustive set of observable contemporaneous, historical, and geographical characteristics. I also use a unique event in the history of Europe, the Christian "Reconquest" of the Iberian Peninsula, as an instrument for the family types. There are two dimensions of the "Reconquest" (722-1492) that explain the emergence of the two family types: the political structure and the land tenure structure. Both OLS and IV estimates show a negative relationship between stem family predominance and violence against women.

Additional datasets provide supporting evidence for the channels and relationships that I claim in this paper. First, ethnographic data shows that impartible inheritance, which is a feature of stem families, is positively associated with greater female contribution to agriculture in pre industrial societies. Second, in Philippines, a country where stem family is still predominant, I find that co-residence with other women is linked to an increase in the probability of working outside the home, and to a reduction in the probability of being abused by the intimate-partner.

Even though during the last century the importance of the stem family has decreased, it persisted remarkably long enough (evidence suggests from the Middle Ages until the 1970's) to potentially explain current behaviour. In the last section I show evidence that is consistent with the thesis that attitudes that arose from the family structure and their intergenerational transmission have a

role in explaining violence against women today. In this resepcte, survey data from the *World Values Survey* for Spain shows that historical stem family territories exhibit today not only less intimate-partner violence but also more equal gender roles. However, no statistically significant difference is found with regard to other values and attitudes.

This study contributes to the understanding of the deeper and historical factors that underlie violence against women. It provides evidence on how a historical event affected the family structure and how this in turn had a long-term impact on interpersonal relations.

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2.11 Tables and Figures

Table 2.1: Definition of intimate-partner violence in the survey

At the moment, how often someone from your home or your intimate-partner has...?
He doesn't allow you to see your family, friends or neighbors.
He takes the money you make or doesn't give you enough money to sustain you.
He insults or threatens you.
He decides the things you can or cannot do.
He insists in having sexual relationships even though he knows you don't want to.
He doesn't take into account your needs (he leaves you the worst part of the food, the house, etc.).
He scares you.
When he is angry, he shoves or beats you.
He says that you are not capable of doing anything on your own/without him.
He says that all things you do are wrong, that you're clumsy.
He ridicules or doesn't value your beliefs (religious, political, organizational).
He doesn't appreciate your work.
In front of your children, he says things to make you look bad.

Table 2.2: Data sources

Variables	Source
GDP per capita, population and unemployment	National Institute for Statistics
Population density in 1787 and 1860	Census
Urbanization rates at 1787 and 1860	*Estadísticas Históricas de España siglos XIX y XX*, by Carreras and Tafunell (2006)
Social capital	Pérez García et al. (2008)
Ruggednes	Goerlich Gisbert and Cantarino Martí (2010)
Climate variables	Province average for the whole century computed using Goerlich Gisbert (2012)

Table 2.3: OLS results

	(1)	(2)	(3)	(4)
	Intimate-partner violence			
Mean of dependent variable	0.085			
Stem family	-0.0575***	-0.0457**	-0.0458***	-0.0514***
	(0.0192)	(0.0195)	(0.0168)	(0.0188)
Contemporaneous controls		yes	yes	yes
Historical controls			yes	yes
Geographical controls				yes
Observations	60743	60743	60743	60743
R^2	0.040	0.041	0.041	0.041

Notes: Stem family defined as the average number of married and widowed women in the household at the province level in 1860. Model (1) includes age, children, woman's and partner's level of education, woman's job status, household's reference person, marital status, habitat size and year when survey was conducted. Model (2) adds contemporaneous controls (GDP per capita, unemployment rate, and social capital at the province level; religion; number of people in the household). Model (3) adds historical controls (population density at 1787, 1860, and survey year; urbanization rates at 1787 and 1860. All at the province level). Model (4) adds geographical controls (ruggedness index and climate variables -temperature, range of temperature, rain, and frost-. All at the province level).
Standard errors in parentheses computed applying a cluster structure by province.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.4: First-stage 2SLS results

	(1)	(2)	(3)
		Stem family	
Mean of dependent variable		1.02	
Political decentralization	0.0884***	0.111***	0.114***
	(0.0265)	(0.0336)	(0.0222)
Reconquest stage 1080	-0.0591***	-0.0235	-0.0516***
	(0.0170)	(0.0242)	(0.0184)
Reconquest stage 1130	-0.0871***	-0.107***	-0.122***
	(0.0184)	(0.0375)	(0.0278)
Reconquest stage 1210	-0.0871***	-0.105***	-0.147***
	(0.0224)	(0.0376)	(0.0320)
Reconquest stage 1250	-0.0596***	-0.0638*	-0.107**
	(0.0204)	(0.0325)	(0.0406)
Reconquest stage 1480	-0.105***	-0.0915*	-0.0387
	(0.0346)	(0.0497)	(0.0645)
Reconquest stage 1492	-0.0127	-0.0125	-0.0688*
	(0.0176)	(0.0239)	(0.0373)
Contemporaneous controls	yes	yes	yes
Historical controls		yes	yes
Geographical controls			yes
F-stat	11.22	12.36	15.46
Observations	60743	60743	60743

Omitted category: Initial Reconquest stage at 914.

Notes: All models include age, children, woman's and partner's level of education, woman's job status, household's reference person, marital status, habitat size and year when survey was conducted. Model (2) adds contemporaneous controls. Model (3) adds historical controls. Model (4) adds geographical controls.

Standard errors in parentheses computed applying a cluster structure by province.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.5: Second-stage 2SLS results

	(2)	(3)	(4)
	Intimate-partner violence		
Mean of dependent variable		0.085	
Stem family	-0.0677**	-0.0630**	-0.0667***
	(0.0299)	(0.0305)	(0.0247)
Contemporaneous controls	yes	yes	yes
Historical controls		yes	yes
Geographical controls			yes
Observations	60743	60743	60743
R^2	0.041	0.041	0.041

It uses the time in which the province was resettled and a dummy variable indicating if the province had freedom of testation as instruments for having a different family structure.

Notes: All models include age, children, woman's and partner's level of education, woman's job status, household's reference person, marital status, habitat size and year when survey was conducted. Model (2) adds contemporaneous controls. Model (3) adds historical controls. Model (4) adds geographical controls.

Standard errors in parentheses computed applying a cluster structure by province.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.6: OLS results from Ethnographic Atlas

	(1)	(2)
	Female participation in agriculture	
Mean of dependent variable		2.8
Impartible inheritance	0.598***	0.443***
	(0.113)	(0.117)
Traditional plough use		-0.748***
		(0.163)
Observations	326	326
R^2	0.134	0.190

Notes: The unit of observation is an ethnic group from the Ethnographic Atlas. The dependent variable measures traditional female participation in agriculture relative to men in the pre-industrial period. The variable takes on integer values between 1 and 5 and is increasing in female participation. "Impartible inheritance" is an indicator variable that equals 1 of the inheritance distribution for real property (land) goes exclusively or predominantly to one adjudged to best qualified, to the last born or the first born. Control variables include: dependency on animal husbandry, an index of settlement density, and an index of political development. "Traditional plough use" is an indicator variable that equals 1 if the plough was traditionally used in pre-industrial agriculture.

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.7: OLS results from DHS for Philippines. Working away from home

	(1)	(2)	(3)
	Working away from home		
Mean of dependent variable	0.75	0.73	0.73
Co-residence with other women	0.0217**	0.0274**	0.0271**
	(0.0095)	(0.0124)	(0.0128)
Education and Marital status		yes	yes
Ethnicity fixed effects			yes
Observations	5226	4256	4256
R^2	0.025	0.040	0.051

Notes: The unit of observation is a woman between 15-49 living inPhilippines in 2010 from DHS. The dependent variable is an indicator variable that takes the value 1 if the woman work away from home, and 0 if she works at home. "Co-residence with other women" is a variable that measures the number of other women between 15-49 years old living with the interviewed women. Control variables include: number of household members, number of children ≤ 5 living in the household, woman's age, if she lives in a urban or rural environment, and region fixed effects. Model (2) adds woman's marital status and educational level of the woman and her partner. Model (3) adds ethnicity fixed effects (23 ethnic groups). In the whole sample, 43% of women do not work, 14% work at home, and 43% work outside the home.
Wild bootstrapped standard errors with weights assigned to the regional level (17 clusters) in brackets.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.8: OLS results from DHS for Philippines. Intimate-partner violence

	(1)	(2)	(3)
	Intimate-partner violence		
Mean of dependent variable		0.16	
Co-residence with other women	-0.0244**	-0.0245**	-0.0245**
	(0.0101)	(0.0101)	(0.0103)
Religion		yes	yes
Ethnicity			yes
Observations	7030	7030	7030
R^2	0.052	0.052	0.058

Notes: The unit of observation is a woman between 15-49 living inPhilippines in 2010 from DHS. The dependent variable measures the level of intimate-partner violence, physical, sexual, emotional, and economic. The variable is an indicator variable that equals 1 if the woman has experienced violence (ever) and in the 12 months preceding the survey. "Co-residence with other women" is a variable that measures the number of other women between 15-49 years old living with the interviewed women. It ranges from 0 to 8 and the mean value is 1.3. Control variables include: number of household members, number of children ≤ 5 living in the household, woman's age, woman's marital status, educational level of the woman and her partner, if she lives in a urban or rural environment, and region fixed effects. Model (2) adds religion (value that takes value 1 if the women is catholic -76%-) and model (3) adds ethnicity fixed effects (23 ethnic groups).

Wild bootstrapped standard errors with weights assigned to the regional level (17 clusters) in brackets.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.9: OLS results from WVS for Spain. Attitudes towards gender

	(1)	(2)	(3)	(4)
	Jobs scarce	Men better political	Contribute household	Job independent
Mean of dependent var.	0.76	0.78	0.91	0.80
Stem family	0.008	0.196*	0.238**	0.678***
	(0.276)	(0.103)	(0.118)	(0.125)
Observations	2853	3082	2118	1299
R^2	0.098	0.053	0.026	0.037

Notes: The unit of observation is the individual, aged 18+ living in Spain between 1990 and 2007. The dependent variables are indicator variables and value 1 refers to beliefs for greater gender equality. (1) "When jobs are scarce, men should have more right to a job than women"; (2) "On the whole, men make better political leaders than women do"; (3) "Both the husband and wife should contribute to household income"; and (4) "Having a job is the best way for a woman to be an independent person". "Stem family" measures the average number of widowed and married women at the household based on 1860 and aggregated at the region (Autonomous Community) level. Control variables include: sex, age, marital status fixed effects, job status fixed effects, educational level fixed effects, and GDP per capita at the region level measured in the same year as the dependent variable. Model (4) does not include educational level fixed effects since the dependent variable is only defined for year 1990 and education information is missing that year.

Wild bootstrapped standard errors with weights assigned tat the Autonomous Community level (16 clusters) in brackets.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.10: OLS results from WVS for Spain. Attitudes towards other things

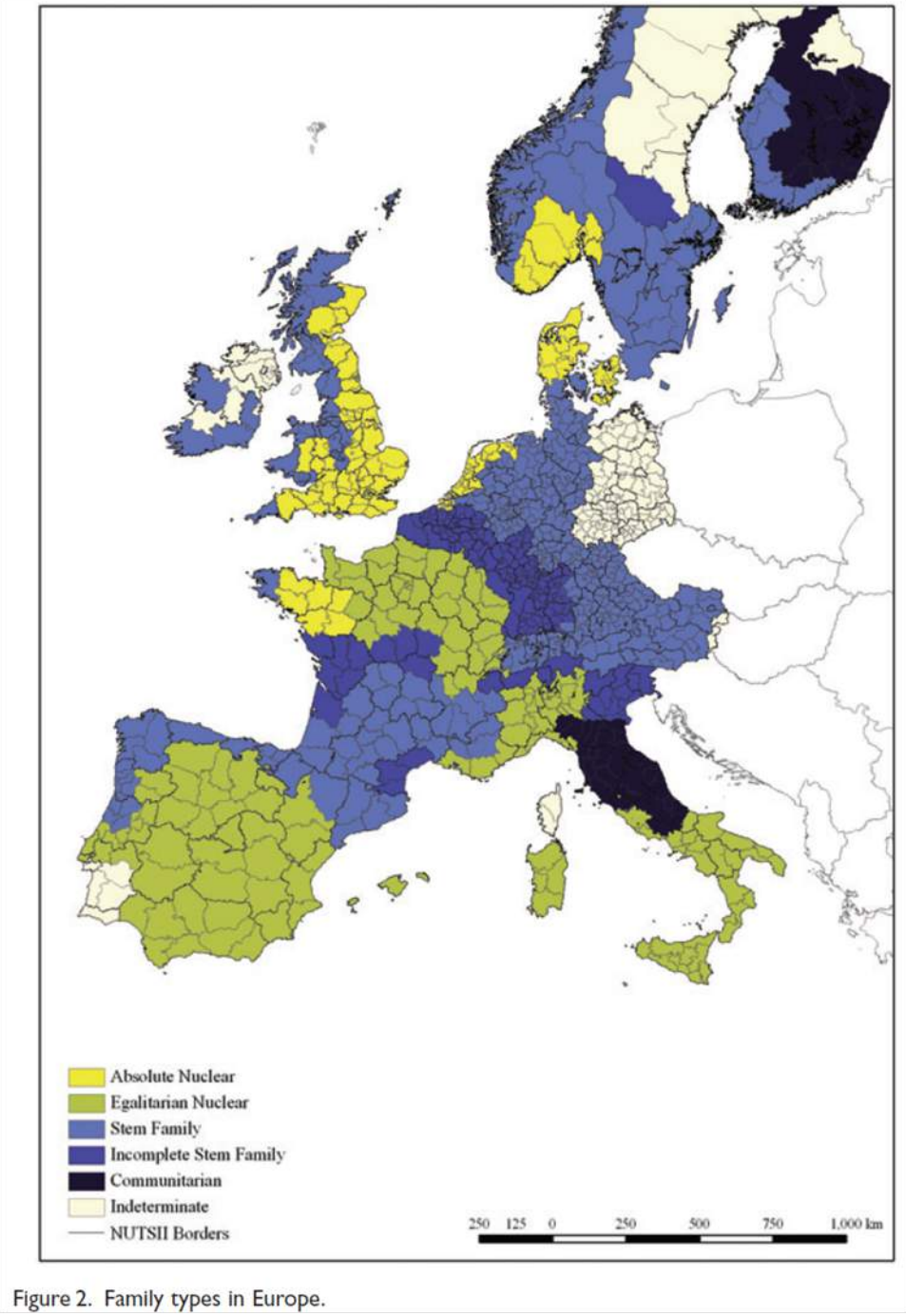
	(1)	(2)	(3)	(4)
	Life satisfaction	Trust	Homosex.	Euthanasia
Mean of dependent var.	0.80	0.27	0.54	0.43
Stem family	-0.081	0.264	-0.225	0.327
	(0.115)	(0.260)	(0.308)	(0.223)
Observations	3286	3204	3112	3025
R^2	0.075	0.013	0.124	0.084

Notes: The unit of observation is the individual, aged 18+ living in Spain between 1990 and 2007. The dependent variables are indicator variables for the following questions: (1) "All things considered, how satisfied are you with your life as a whole these days?" (1 indicates satisfied, 0 disatisfied); (2) "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" (1 indicates most people can be trusted, 0 otherwise); (3) "Do you think homosexuality can always be justified, never be justified, or something in between?" (1 indicates justifiable, 0 otherwise); and (4) "Do you think euthanasia can always be justified, never be justified, or something in between?" (1 indicates justifiable, 0 otherwise). "Stem family" measures the average number of widowed and married women at the household based on 1860 and aggregated at the region (Autonomous Community) level. Control variables include: sex, age, marital status fixed effects, job status fixed effects, educational level fixed effects, and GDP per capita at the region level measured in the same year as the dependent variable.

Wild bootstrapped standard errors with weights assigned tat the Autonomous Community level (16 clusters) in brackets.

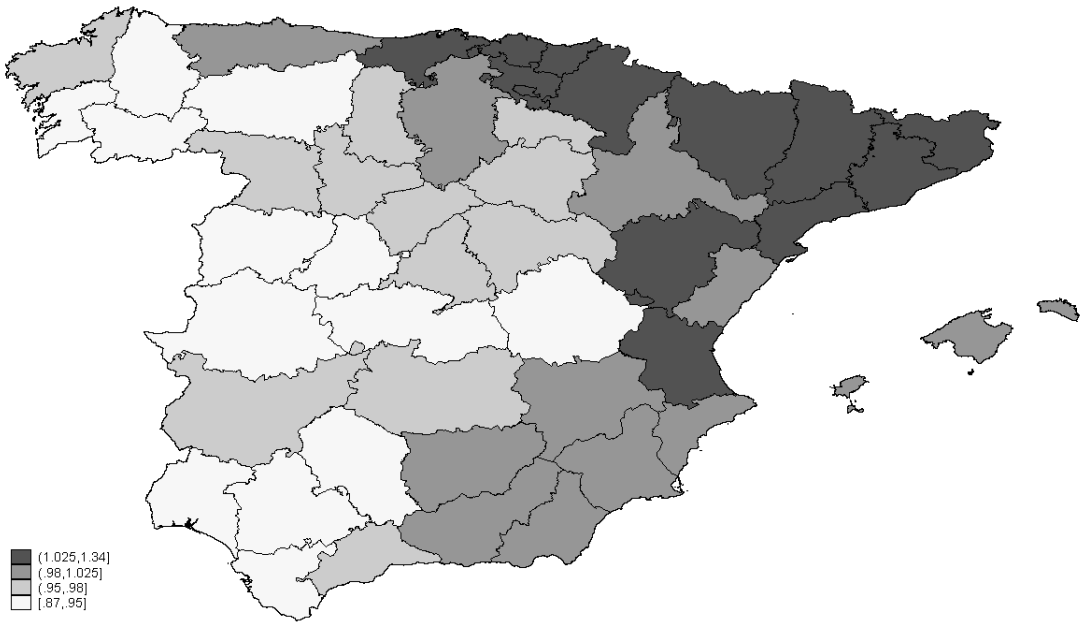
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 2.1: Family types in Western Europe



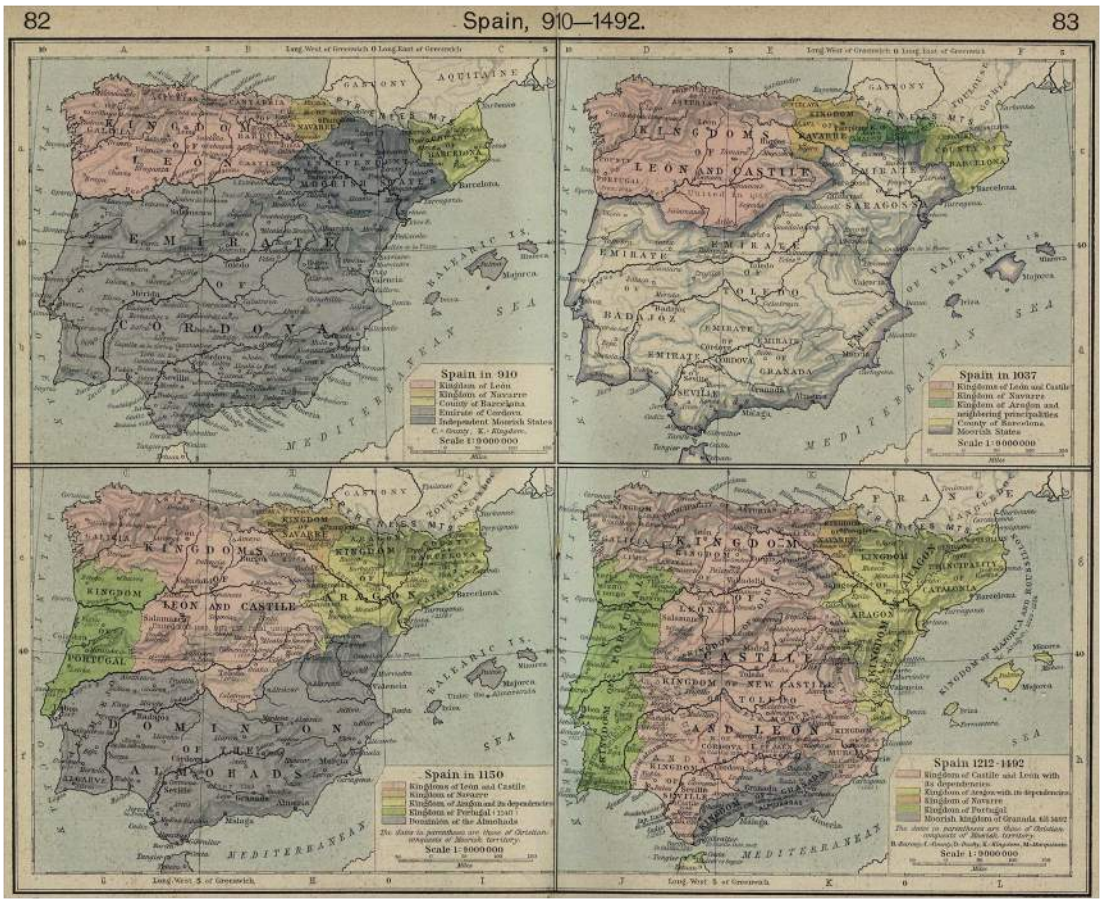
Source: Duranton, Rodríguez-Pose and Sandall (2008). Based on Todd's (1990) map.

Figure 2.2: Family types in Spain in 1860



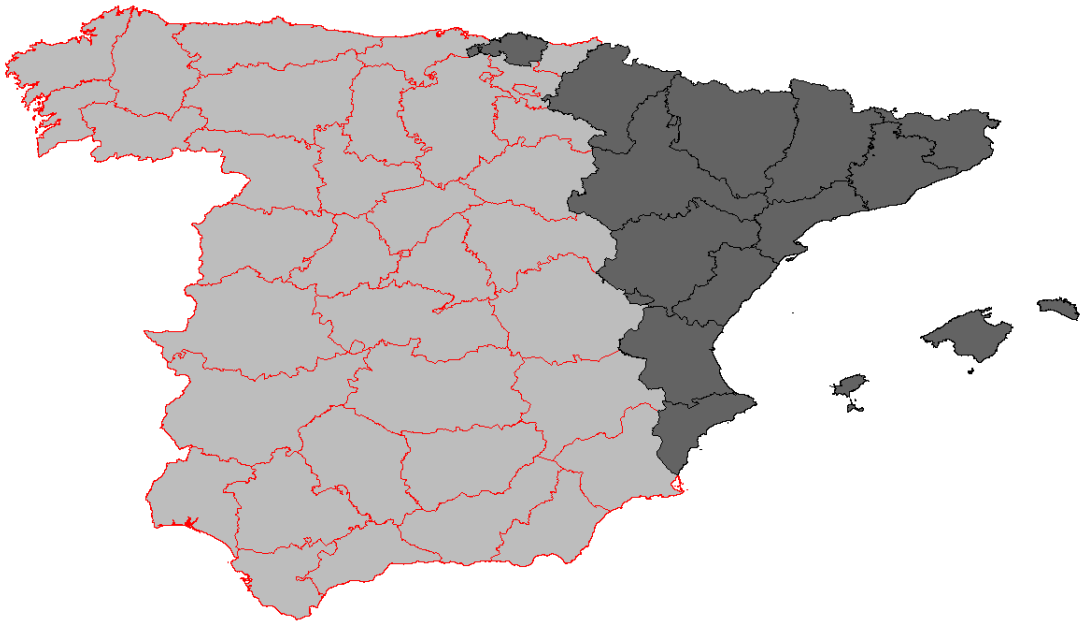
Source: Own elaboration using 1860 census.

Figure 2.3: Spanish regions during Middle Ages



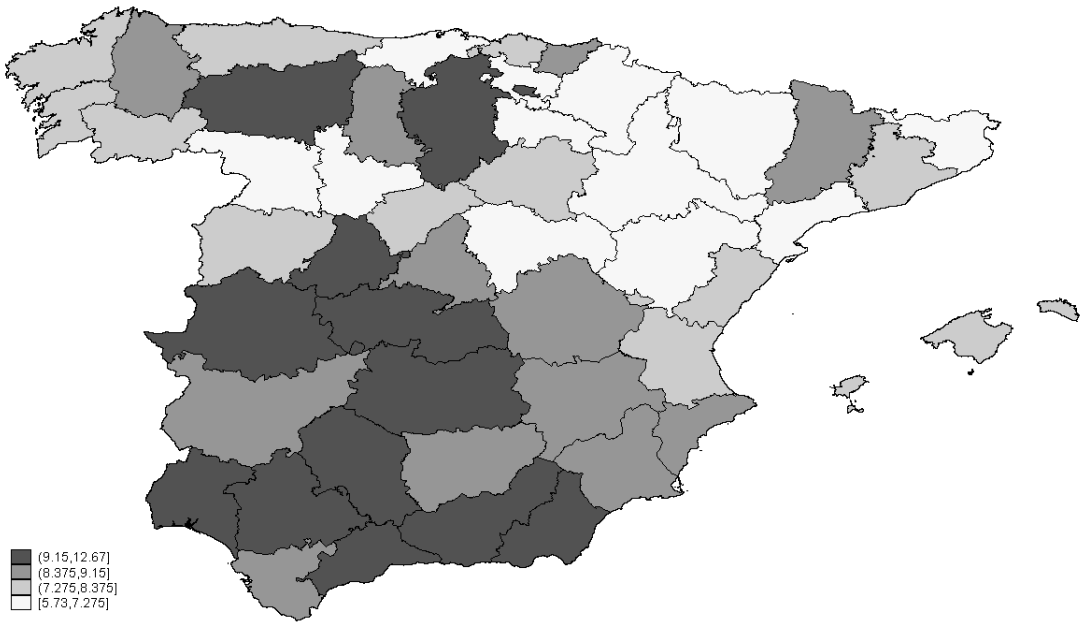
Source: Historical Atlas by William R. Shepherd (1923)

Figure 2.4: Spanish territories with freedom of testation in 13^{th} century



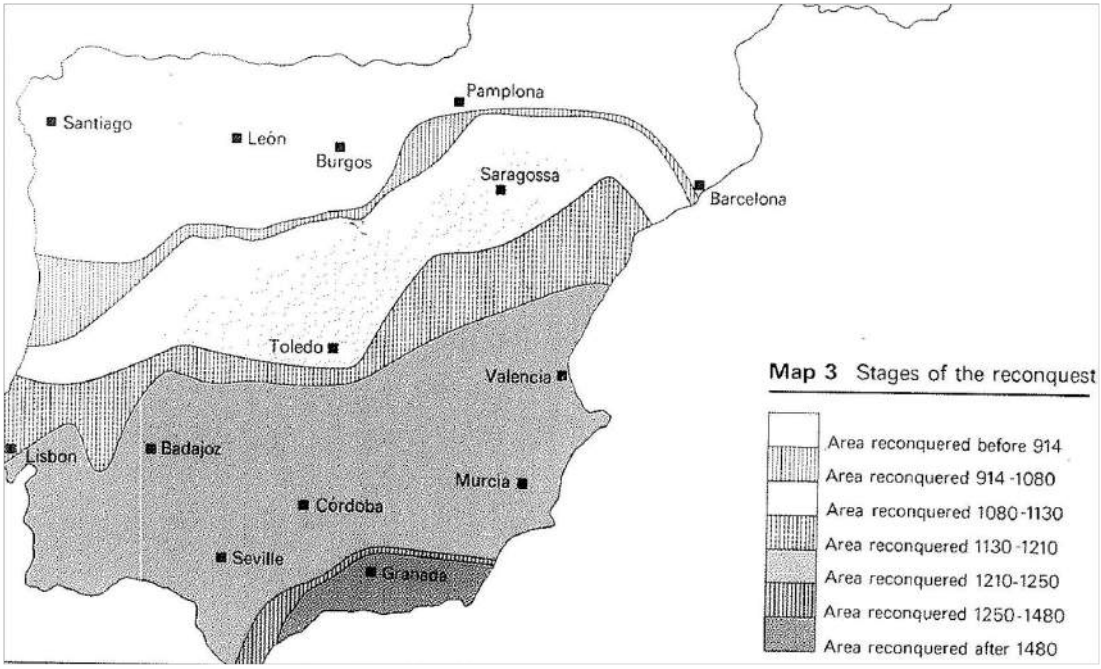
Source: Own elaboration. Based on Chacón and Bestard (2011)

Figure 2.5: IPV within Spain, 1999-2011



Source: Own elaboration from the Spanish surveys on violence against women.

Figure 2.6: Stages of the Reconquest



Source: Derek W. Lomax (1978)

2.12 Appendix A: Additional Tables and Figures

Table 2.11: OLS results with different IPV measures

	(1)	(2)	(3)	(4)
	Physical and sexual violence			
Mean of dependent var.	0.032			
Stem family	-0.0333***	-0.0282***	-0.0212*	-0.0275**
	(0.0105)	(0.00896)	(0.0114)	(0.0122)
Observations	60743	60743	60743	60743
R^2	0.019	0.019	0.019	0.019
	(1)	(2)	(3)	(4)
	Psychological, economic, spiritual, and structural			
Mean of dependent var.	0.069			
Stem family	-0.0428**	-0.0344*	-0.0442***	-0.0444***
	(0.0166)	(0.0174)	(0.0126)	(0.0123)
Observations	60743	60743	60743	60743
R^2	0.032	0.032	0.032	0.032

Notes: Stem family defined as the average number of married and widowed women in the household at the province level in 1860. Model (1) includes age, children, woman's and partner's level of education, woman's job status, household's reference person, marital status, habitat size and year when survey was conducted. Model (2) adds contemporaneous controls (GDP per capita, unemployment rate, and social capital at the province level; religion; number of people in the household). Model (3) adds historical controls (population density at 1787, 1860, and survey year; urbanization rates at 1787 and 1860. All at the province level). Model (4) adds geographical controls (ruggedness index and climate variables -temperature, range of temperature, rain, and frost-. All at the province level).

Standard errors in parentheses computed applying a cluster structure by province.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.12: First-stage 2SLS results. Just-identified model. Political decentralization instrument only

	(2)	(3)	(4)
		Stem family	
Mean of dependent variable		1.02	
Political decentralization	0.108***	0.0896**	0.112***
	(0.0343)	(0.0336)	(0.0267)
Contemporaneous controls	yes	yes	yes
Historical controls		yes	yes
Geographical controls			yes
F-stat	9.87	7.11	17.67
Observations	60743	60743	60743

Notes: All models include age, children, woman's and partner's level of education, woman's job status, household's reference person, marital status, habitat size and year when survey was conducted. Model (2) adds contemporaneous controls. Model (3) adds historical controls. Model (4) adds geographical controls.

Standard errors in parentheses computed applying a cluster structure by province.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.13: Second-stage 2SLS results. Just-identified model. Political decentralization instrument only

	(2)	(3)	(4)
		Intimate-partner violence	
Mean of dependent variable		0.085	
Stem family	-0.108**	-0.114**	-0.115***
	(0.0461)	(0.0547)	(0.0386)
Contemporaneous controls	yes	yes	yes
Historical controls		yes	yes
Geographical controls			yes
Observations	60743	60743	60743
R^2	0.041	0.041	0.041

It uses a dummy variable indicating if the province had freedom of testation as instruments as an instrument for having a different family structure.

Notes: All models include age, children, woman's and partner's level of education, woman's job status, household's reference person, marital status, habitat size and year when survey was conducted. Model (2) adds contemporaneous controls. Model (3) adds historical controls. Model (4) adds geographical controls.

Standard errors in parentheses computed applying a cluster structure by province.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.14: First-stage 2SLS results. Only with Reconquest stages (7 categories)

	(2)	(3)	(4)
		Stem family	
Mean of dependent variable		1.02	
Reconquest stage 1080	-0.118***	-0.0716***	-0.108***
	(0.0187)	(0.0172)	(0.0306)
Reconquest stage 1130	-0.124***	-0.0799**	-0.0922**
	(0.0313)	(0.0384)	(0.0394)
Reconquest stage 1210	-0.0699***	-0.0406	-0.107**
	(0.0215)	(0.0333)	(0.0468)
Reconquest stage 1250	-0.0527**	0.0147	-0.0191
	(0.0227)	(0.0362)	(0.0446)
Reconquest stage 1480	-0.0860**	0.0411	0.172*
	(0.0381)	(0.0738)	(0.100)
Reconquest stage 1492	-0.0335	-0.00909	-0.0691
	(0.0280)	(0.0305)	(0.0454)
Contemporaneous controls	yes	yes	yes
Historical controls		yes	yes
Geographical controls			yes
F-stat	12.99	9.38	5.85
Observations	60743	60743	60743

Omitted category: Initial Reconquest stage at 914.

Notes: All models include age, children, woman's and partner's level of education, woman's job status, household's reference person, marital status, habitat size and year when survey was conducted. Model (2) adds contemporaneous controls. Model (3) adds historical controls. Model (4) adds geographical controls.

Standard errors in parentheses computed applying a cluster structure by province.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.15: Second-stage 2SLS results. Only with Reconquest stages (7 categories)

	(2)	(3)	(4)
	Intimate-partner violence		
Mean of dependent variable		0.085	
Stem family	-0.0458	-0.00895	-0.0346
	(0.0390)	(0.0614)	(0.0400)
Contemporaneous controls	yes	yes	yes
Historical controls		yes	yes
Geographical controls			yes
Observations	60743	60743	60743
R^2	0.041	0.041	0.041

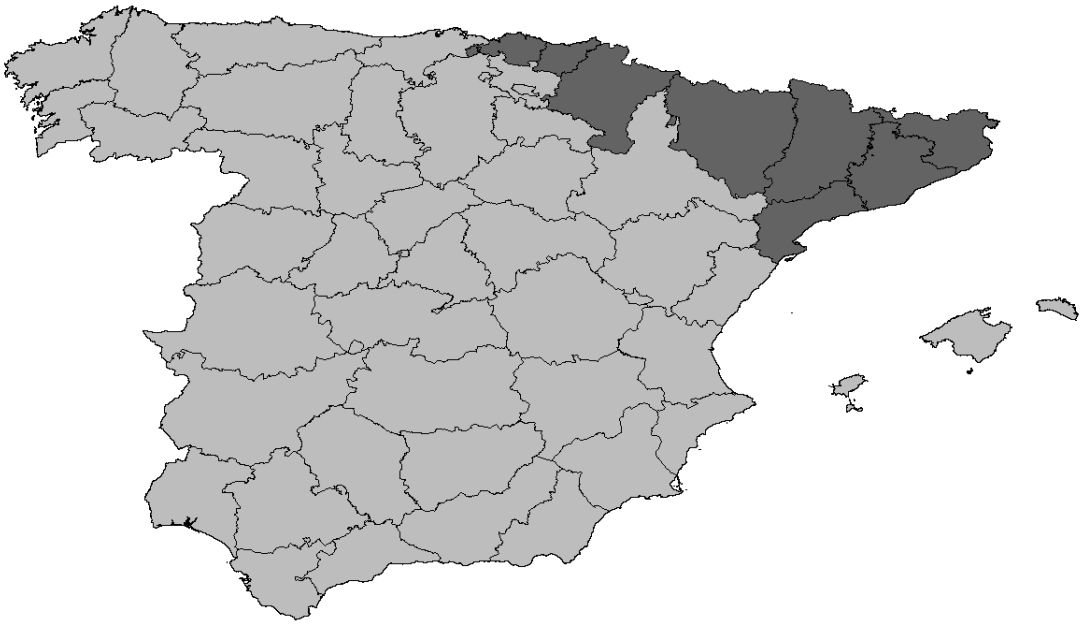
It uses the time in which the province was resettled as instruments for having a different family structure.

Notes: All models include age, children, woman's and partner's level of education, woman's job status, household's reference person, marital status, habitat size and year when survey was conducted. Model (2) adds contemporaneous controls. Model (3) adds historical controls. Model (4) adds geographical controls.

Standard errors in parentheses computed applying a cluster structure by province.

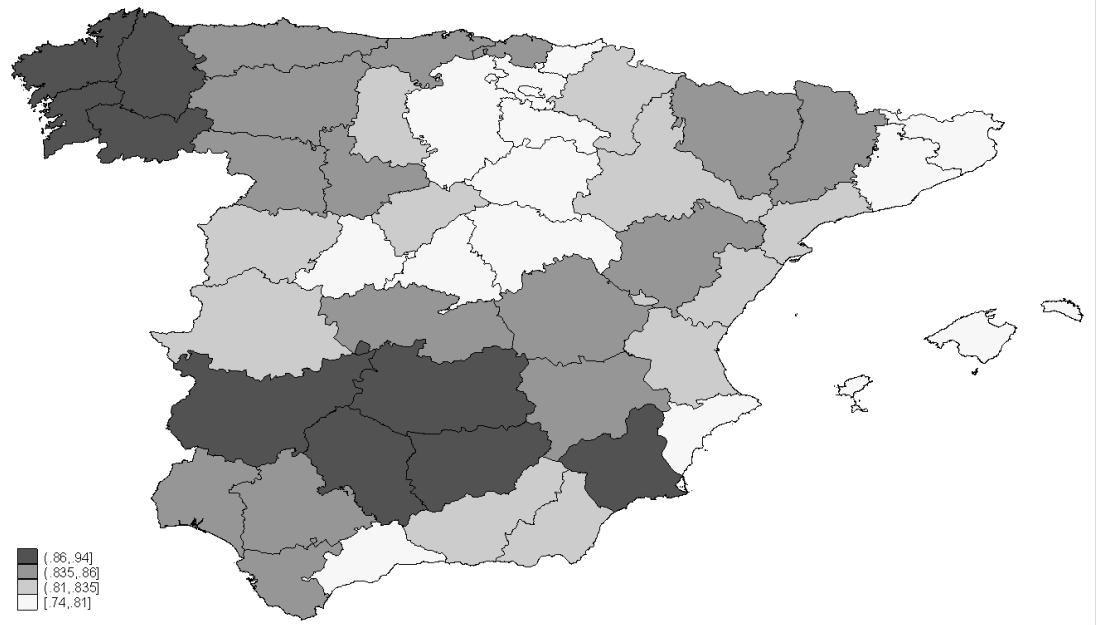
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 2.7: Stem family in Spain, 1860



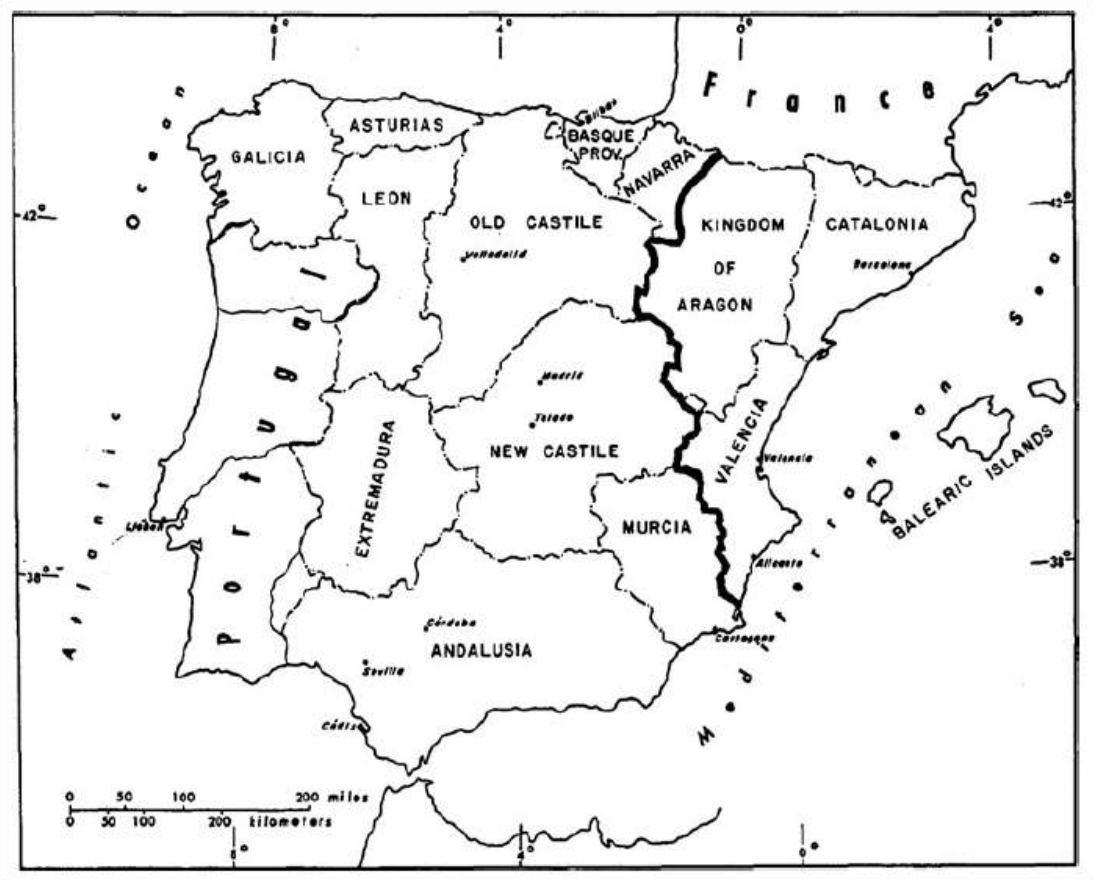
Source: Own elaboration using 1860 census. Provinces where the average number of widowed and married women in the household is ≥ 1.075.

Figure 2.8: Family structure nowadays



Source: Own elaboration using 2001 census. Number of widowed and married women in the household.

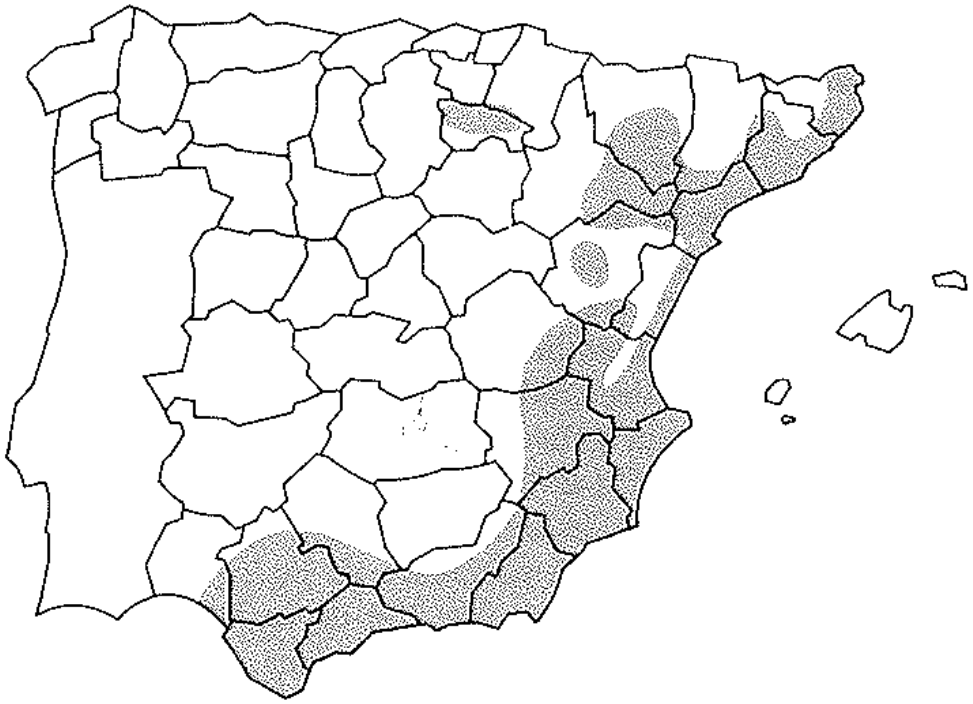
Figure 2.9: Spanish regions in Early Modern Era



Source: Álvarez-Nogal and Prados de la Escosura, 2007

Figure 2.10: Provincial map of Spain

Figure 2.11: Traditional anarchist areas



Source: Todd (1990).

2.13 Appendix B: Theoretical model

The husband chooses t_w and v to solve:

$$\max_{\{t_w, v\}} (w_h + \omega_w(v)t_w)^{\alpha}(\gamma_w(v)(1 - t_w) + \gamma_m)^{1-\alpha} + v$$

The first-order conditions of this maximization problem are:

$$\frac{\partial U_h}{\partial v} \tag{2.6}$$

$$\frac{\partial U_h}{\partial t_w} \Rightarrow t_w^* = \alpha + \alpha\frac{\gamma_m}{\gamma_w(v)} + (\alpha - 1)\frac{\omega_h}{\omega_w(v)} \tag{2.7}$$

If we substitute t_w^* in c and q we obtain:

$$c = \alpha\left(\omega_w(v) + \omega_h + \frac{\omega_w(v)}{\gamma_w(v)}\gamma_m\right)$$

$$q = (1 - \alpha)\frac{\gamma_w(v)}{\omega_w(v)}\left(\omega_w(v) + \omega_h + \frac{\omega_w(v)}{\gamma_w(v)}\gamma_m\right)$$

We want to determine how v^* responds to changes in γ_m. We know that v^* has to satisfy the first-order condition:

$$\frac{\partial U_h(v(\gamma_m), t_w(\gamma_m), \gamma_m)}{\partial v} = 0 \tag{2.8}$$

Since we have an explicit solution for t_w^*, we plug it in (3), and then we differentiate this expression with respect to γ_m:

$$f_{vv}\frac{\partial v^*}{\partial \gamma_m} + f_{vt}\frac{\partial t^*}{\partial \gamma_m} + f_{v\gamma} = 0$$

We isolate the effect of γ_m on the optimal violence v^*:

$$\frac{\partial v^*}{\partial \gamma_m} = -\frac{(f_{vt}\frac{\partial t^*}{\partial \gamma_m} + f_{v\gamma})}{f_{vv}}$$

Assuming $f_{vv} < 0$, then the sign of $\frac{\partial v^*}{\partial \gamma_m}$ will be equal to the sign of $(f_{vt}\frac{\partial t^*}{\partial \gamma_m} + f_{v\gamma})$.

The expression $(f_{vt}\frac{\partial t^*}{\partial \gamma_m} + f_{v\gamma})$ is the cross-partial second derivate of the first-order condition (1) with respect to γ_m after substituting t_w by t_w^* from (2). To see this, we first write the first-order condition for v in terms of c, q and t_w^*:

$$\frac{\partial U_h}{\partial v} = \alpha \left(\frac{c}{q}\right)^{\alpha-1} \frac{d\omega_w(v)}{dv} t_w^* + (1-\alpha)\left(\frac{c}{q}\right)^{\alpha} \frac{d\gamma_w(v)}{dv}(1-t_w^*) + 1$$

We then take the second cross-partial derivative with respect to γ_m:

$$\frac{\partial^2 U_h}{\partial v \partial \gamma_m} = \alpha \left(\frac{c}{q}\right)^{\alpha-1} \frac{d\omega_w(v)}{dv} \alpha \frac{1}{\gamma_w(v)} + (1-\alpha)\left(\frac{c}{q}\right)^{\alpha} \frac{d\gamma_w(v)}{dv}(-\alpha)\frac{1}{\gamma_w(v)}$$

Simplifying this expression, we find that for it to be negative we need:

$$\alpha \left(\frac{c}{q}\right)^{\alpha-1} \frac{d\omega_w(v)}{dv} - (1-\alpha)\left(\frac{c}{q}\right)^{\alpha} \frac{d\gamma_w(v)}{dv} < 0$$

$$\frac{\frac{d\omega_w(v)}{dv}}{\frac{d\gamma_w(v)}{dv}} < \frac{(1-\alpha)}{\alpha}\left(\frac{c}{q}\right)$$

Recall that $\left(\frac{c}{q}\right)$ evaluated at t_w^* is equal to $\frac{\alpha}{(1-\alpha)}\frac{\omega_w(v)}{\gamma_w(v)}$.

$$\frac{\frac{d\omega_w(v)}{dv}}{\frac{d\gamma_w(v)}{dv}} < \frac{\omega_w(v)}{\gamma_w(v)}$$

$$\frac{\frac{d\omega_w(v)}{dv}}{\omega_w(v)} < \frac{\frac{d\gamma_w(v)}{dv}}{\gamma_w(v)}$$

Therefore, when the productivity loss of the wife due to violence is greater in absolute terms than the loss of productivity in the house, we will find that $\frac{\partial v^*}{\partial \gamma_m} < 0$.

Chapter 3

Unemployment and Intimate-Partner Violence

3.1 Introduction

Despite the general perception that domestic violence increases with recessions, the evidence is inconclusive. This paper contributes to this literature by analysing the relationship between intimate-partner violence (IPV) and unemployment using individual IPV data of the highest quality for Spain. It also contributes by including gender identity in the analysis: I look at how male and female unemployment have a different impact on IPV depending on the gender identity, which is determined by the historical family types that prevailed in each region.

In the last years, a growing body of research has looked at the relationship between unemployment and domestic violence. Some studies find near zero effects of *total* unemployment on domestic violence (Aizer, 2010; Iyengar, 2009), while other (Van der Berg and Tertilt, 2012) find positive effects. Regarding potential mechanisms, these latter positive effects of total unemployment on

IPV could be explained by the aggressive behaviour triggered by an economic downturn [1], or by the difficulty of "bad matches" to split apart during a recession (Stevenson and Wolfers, 2006). Similarly, a model of exposure reduction would also predict a decrease in domestic violence after a decrease in unemployment since partners would then spend less time together (Dugan, Nagin, Rosenfeld, 1999).

When looking at *relative* male and female unemployment, Anderberg *et al.* (2013) find effects going in opposite directions. They show that an increase in male unemployment decreases the incidence of IPV, while an increase in female unemployment increases IPV. These findings are consistent with a household bargaining model: a decrease in female unemployment, relative to male unemployment, improves women's bargaining power. This would in turn decrease the IPV incidence by making women's outside option better (Aizer, 2010; Anderberg *et al.* 2013).

Conversely, a model of "male blacklash" predicts that a decrease in female unemployment might *increase* IPV because men would feel their traditional gender role threatened (Macmillan and Gartner, 1999). In line with this theoretical framework, Angelucci (2008) studies the determinants of domestic violence and alcohol abuse using experimental data for the evaluation of *Oportunidades*[2]. She finds that while small transfers reduce domestic violence by alleviating poverty, large income transfers (all transfers are only given to women) increase the aggresive behaviour of husbands with traditional views of gender roles. This is supported by the widespread belief in elegible villages that the man should provide for his family (Maldonado *et al.*, 2005).

Consistently with this, in this study I find heterogenous impacts of female

[1] Card and Dahl (2011) look at the link between emotional cues and domestic violence

[2] Oportunidades is Mexico's flagship welfare program, that transfers grants to poor households conditional on school attendance and health checks. Importantly, cash transfers are handed only to women.

and male unemployment on IPV, in accordance with the underlying gender identity. My hypothesis is that the social predominance of different family types (nuclear and stem) throughout history has shaped different gender identities across the Spanish regions [3]. Some provinces have a more traditional gender roles than others, and the gender identity will determine the impact that unemployment has on IPV.

On the one hand, in territories where stem family prevailed, the presence of the mother-in-law in the household freed up time for the younger wife to contribute more to the productive activity (i.e., farming). As a consequence, during centuries, in these regions both husbands and wives were considered providers and co-workers in the fields. This worked towards forming a more equal gender identity, that has been transmitted over time. On the other hand, in territories with nuclear family tradition, the family structure did not allow women to work outside the home and therefore there was a clear division of roles between husbands and wives. Men used to be the main breadwinners and female activities were restricted to the household environment. This originated a more traditional gender identity in these regions.

The distinct gender identities will determine which will be the impact of unemployment on domestic violence. In nuclear family territories, a decrease in female unemployment, relative to men, will increase domestic violence, since men will feel their traditional breadwinner role at risk and react against this feeling with violence. This effect will not be found in stem family regions, where both men and women where expected to contribute more equally to the household income. To test this I include the interaction of unemployment with the historical family types in my regression. My empirical findings are consistent with this hypothesis.

[3]More information about the characteristics of the different family types, their origins and history in Spain, can be found in Chapter 2

The relationship between employment, gender identity and couple relations has also been explored by Macmillan and Gartner (1999). According to these authors, when female unemployment decreases relative to male unemployment, this "challenges the culturally prescribed norm of male dominance and female dependence. Where a man lacks this sign of dominance, violence may be a means of reinstating his authority over his wife" (p. 949). They find that the effect of a woman's employment on her risk of spousal violence is conditioned by the employment status of her partner. They interpret spousal violence as a mechanism to dominate and control women in marital relationships.

The instrumental nature of violence, as means for controlling wives' behaviour or for redistributing resources, is one of the justifications of IPV found hitherto in the literature. For instance, Bolch and Rao (2002) model violence as a means for extracting transfers from the wife's family in the Indian rural context. The second interpretation of domestic violence most commonly used in the economics literature treates violence as an expressive behaviour that provides direct gratification (see, for instance, Tauchen *et al.*, 1991; Aizer, 2010; or Card and Dahl, 2011).

I propose a third reason for domestic violence, which introduces a social dimension. Men not only abuse their partners simply because this provides them with gratification or to obtain something in exchange. In my model, men use violence against women as way to restore their wounded masculinity. The male and female role models are defined at the social level. To my knowledge, this is the first paper to propose an alternative explanation of IPV.

It is an application of the identity model proposed by Akerlof and Kranton (2000). They include an identity parameter in the individual utility function. This identity parameter contains the ideals or norms that the individual would want to comply since a deviation from these norms would decrease his utility.

In my model, the identity parameter is the gender role, and the social categories that define how is the ideal men and woman are derived from historical family types.

In territories with nuclear family tradition, masculinity has been associated with being the main provider. Therefore, in these provinces, for a man, the fact that female employment improves relative to male employment may be view as an insult which, if left unanswered, impugns his masculinity. To allay the feelings of being less "man", he may act to affirm his masculinity and abuse his female partner. This is not necessarily the case in provinces where stem family was socially predominant in the past since both men and women were contributing to the household income.

The remaining of the paper is organized as follows. Section 3.2 documents the data used, both for measuring IPV and unemployment, and presents some figures and descriptive statistics. Section 3.3 reports the empirical strategy and the results. First in subsection 3.3.1 I look at the impact of total unemployment, and male and female unemployment on domestic violence. Second, I analyse the heterogenous effects, depending of the family type heritage in subsection 3.3.2. I also look at the contemporaneous and lagged effects of unemployment on IPV. Subsection 3.3.3 conducts some collinearity checks, since the variables of interest, male and female unemployment, are highly correlated. In the last subsection of results, I analyse the diverse impacts of unemployment on different types of IPV: physical and sexual violence, non-physical or sexual violence, and economic violence. Section 3.4 concludes.

3.2 Data and Descriptive Statistics

3.2.1 Intimate-Partner Violence Data

Intimate-partner violence (IPV) data come from four cross-sectional surveys on Violence Against Women in Spain -"macroencuesta sobre la violencia contra la mujer en Espana". These surveys were conducted by phone in 1999, 2002 and 2005 (sample sizes 20552, 20652 and 28423, respectively) and in person in 2011 (sample size 7898). They contain a broad and representative sample of adult women ($\geq$ 18 years old) living in Spain (n=77525) and different IPV measures: self-reported and objective. I use the so-called objective measure since self-reported measures tend to underestimate domestic violence. This type of survey data represents the gold standard to estimate the prevalence of any form of inter-personal violence (WHO, 2013). Direct questions about specific acts of violence over a period of time tend to disclosure more information than generic questions about "domestic violence" or "abuse".

In the survey women face 26 situations specifically design to detect violence against them; 13 of these questions are considered as as an indicator of domestic violence because they describe more serious situations. These measures encompass not only physical and sexual violence but also psychological, economic, structural and spiritual violence [4]. To compute the incidence of IPV, I construct an indicator variable that takes the value 1 if the woman answers "often" or "sometimes" to at least one of these 13 questions, and 0 otherwise.

These surveys also include individual level information on sociodemographic characteristics. These are presented, together with the IPV associated to some sociodemographic groups in Table 3.1. During 1999-2011, on average 8.7% of all adult women living in Spain experienced IPV. The risk of abuse increases with

[4]More information about these data can be found in Section 5 of the previous chapter

age, except for the women older than 65. The existence of children is also associated with higher domestic violence. Education is negatively correlated with violence: the higher the educational achievement -both of the woman and her partner- the less violence the woman is likely to suffer. Regarding the marital status, married women are on average more exposed to violence. The (smaller) incidence of IPV among divorced, single and widowed women shows that IPV can also come from ex-partners and boyfriends. When the woman is the main earner of the household, her reported violence is much lower that the overall mean.

3.2.2 Unemployment Data

Information on unemployment come from the *Active Population Survey* ("Encuesta de Población Activa"), routinely used to estimate the unemployment rates. It is a cross-sectional survey conducted quarterly by the National Institute of Statistics for Spain. For each of the four editions of the Violence-Against Women Survey I compute the contemporaneous (same quarter) and the lagged (previous quarter) unemployment rate. The period of analysis thus covers from 1999 to 2011. I use data for 8 quarters: the first and second quarter of 1999 (n=166766 and n=165147, respectively), the fourth quarter of 2001 and first quarter of 2002 (n=146194 and n=147309, respectively), the fourth quarter of 2005 and the first quarter of 2006 (n=127476 and n=131136, respectively) and the fourth quarter of 2010 and the first quarter of 2011 (n=144208 and n=144578, respectively). The total sample size is 1172824. I compute the unemployment rate for each age group, gender and province.

Table 3.2 presents the descriptive statistics for unemployment rates, by year, gender and age groups. Total unemployment rate in Spain during 1999-2011 has been 14%, higher for women (18%) than for men (12%). Before the eco-

nomic recession unemployment rate presented a downward trend, from 16% in 1999 to 9% in 2006, and then increased to 20-21% in 2011. Younger cohorts experienced a higher unemployment rate (28%) than older population.

Figure 3.1 shows the evolution of the unemployment rate, from 1999 to 2011, by gender and age groups. Even though female unemployment has been always higher than male, in the last years the gap has narrowed. In 2011 female and male unemployment rates were very similar and male unemployment was even higher than female for the 16-24 year olds. This reflects that the recession has had a stronger impact in male than in female unemployment.

Figure 3.2 plots the different unemployment rates in each province, showing a high dispersion that increases with average unemployment. Figure 3.3 presents the female and male unemployment rates over time together with the IPV rate. Similar to the behaviour of the unemployment rate, IPV shows a gentle downward trend from 1999 to 2005 and then a change of slope until 2011.

3.3 Empirical Strategy and Results

Even though in an initial analysis I use the total unemployment rate, I focus on the effects of female and male unemployment on IPV. Following Anderberg *et al.* (2013), I use the unemployment rates as an indicator of the labour market conditions and the potential unemployment. In all my regressions, I relate each woman's incidence of IPV to the unemployment rates of her peers (both males and females, in her age group and in her province[5]). This way we are focusing on the *perceived* risk of unemployment rather than on actual individual measures of unemployment that might just reflect reverse causality, especially for women.

[5]There are three age groups: 16-24, 25-44, 45-65; and 50 provinces.

Since the dependent variable is a binary indicator of IPV, I estimate probit models and report in all tables the average marginal effects.

3.3.1 Baseline Specification

To study the relationship between IPV and unemployment I estimate the following equation:

$$\begin{aligned} IPV_{i,g,p,y} = \alpha + \beta^f Unemp^f_{g,p,y} + \beta^m Unemp^m_{g,p,y} \\ + \boldsymbol{\gamma} \boldsymbol{X}_{i,g,p,y} + \lambda_p Provin_p + \theta_y Year_y + \epsilon_{i,g,p,y} \end{aligned} \tag{3.1}$$

where $IPV_{i,g,p,y}$ is a binary variable that indicates if the woman i in age group g from province p on survey year y is receiving violence from her intimate-partner; $Unemp^f_{g,p,y}$ is the female unemployment rate for each age group, province and year, $X_{i,g,p,y}$ is a vector of control variables at the individual level, $Provin_p$ and $Year_y$ are province and survey-year fixed effects, respectively, and $\epsilon_{i,g,p,y}$ is the error term[6].

Table 3.3 reports the average marginal effects of total unemployment rate and of male and female unemployment. Total own-age unemployment has near zero effects on IPV. It only becomes significant when we look at male and female unemployment separately. Male unemployment has a small and positive impact on IPV: an increase in 1 percentage point (p.p.) in own-age male unemployment is associated with an increase in 0.07 p.p. in IPV or 0.8% of the sample mean. The effect of own age female unemployment is of similar magnitude but opposite sign: if own-age female unemployment increases 1 percentage point, IPV goes down by 0.05 p.p. aproximately (or 6% of the sample mean). The results are robust to the inclusion of additional sociodemographic control variables (columns (2) and (4)).

[6]In all regressions, standard errors are computing using a cluster structure at the province level.

3.3.2 Heterogenous Impacts

I then move to study the heterogenous impact of unemployment on domestic violence based on the underlying gender identity. My hypothesis is that the social predominance of different family types (nuclear and stem) throughout history has shaped different gender identities across the Spanish regions. The gender identity would influence the impact that unemployment has on IPV. In territories where stem family prevailed, the presence of the mother-in-law in the household allowed for a more productive role of the younger wife. This contributed to shape a cultural norm in which husbands and wives were both providers. In territories where nuclear family prevailed, however, notions of masculinity were linked to being the main breadwinner and female activities were restricted to the household environment.

To test this I add to equation (3.1) an interaction term between the unemployment rate and the historical family type, measured by the average number of married and widowed women in the household at the province level from 1860 census[7]. I also add an interaction term between the survey years and the historical family types to allow for historical family types specific time trends [8].

Results are shown in Table 3.4. We first focus on Panel A that shows the contemporaneous effects of unemployment, i.e. the unemployment observed in the same quarter as the survey was conducted. I find no significant effect of male unemployment on IPV and a large and statistically significant negative impact of female unemployment on IPV. Indeed, a 1 percentage point increase in own-age female unemployment is associated with a 0.6 percentage point decrease in IPV or 7% of the sample mean. When looking at the interaction with

[7]More information about the historical family type variable can be found in Chapter 2. This variable only changes at the province level.

[8]These results are very similar to the ones obtained with a fully interacted model, where all covariates -except province fixed effects- are interacted with the historical family types

historical family types we find that this negative effect of female unemployment on domestic violence vanishes for stem family territories. The more stem family was socially predominant in the past the more the effect is offset.

These effects are stable to the inclusion of additional sociodemographic control variables. Panel B shows the results when using the unemployment in the previous quarter to the quarter when the IPV survey was conducted. We find that the effect of lagged unemployment is very similiar to the contemporaneous impact, suggesting that unemployment has both an immediate and a delayed effect on IPV[9].

3.3.3 Collinearity Checks

Multicollinearity issues arise since female and male unemployment are highly correlated (ρ = 0.82). To check the stability of the parameter estimates I run two different models: (1) with the linear own-age unemployment gender gap (i.e., female-male unemployment), and (2) with the ratio between own-age male and female unemployment (i.e., male/female unemployment). Both models additionally include the own-age general unemployment rate as a covariate.

Both set of results are consistent with previous findings, which suggests that multicollinearity is not a concern in this setting. Table 3.5 shows these results. We find that own-age general unemployment has a negative impact on domestic violence, and that this negative impact is offset in provinces where stem family was socially predominant in the past. Panel A shows that an increase in the own-age female-male unemployment linear gap (e.g., caused by an increase in female unemployment or by a decrease in male unemployment) is associated with a decrease in IPV. In line with these findings, estimates in Panel B report

[9]Van der Berg and Tertilt (2012) found that one quarter lagged unemployment had the strongest impact

a positive effect of an increase in the male/female unemployment rate (e.g. because male unemployment increases or female unemployment decreases) on IPV[10].

3.3.4 Analysis by Different Types of Violence

I now turn to analyse the impact of unemployment on different types of violence. With this purpose I construct three measures of IPV: (i) physical and sexual violence; (ii) psychological, economic, structural and spiritual violence (what is categorized as non-physical and sexual violence); and (iii) economic and structural violence only (a subset of the previous category). I then run equation (3.1) using as a the outcome variable this three indicators.

The economic violence indicator captures the unequal access to shared resources. In the survey this is measured by the following statement: "He takes the money you make or doesn't give you enough money to sustain you.". Structural violence is strictly related to economic abuse and encompasses barriers to basic rights and potential options. The survey corresponding statements are: (a) "He decides the things you can or cannot do." (b) "He doesn't take into account your needs (he leaves you the worst part of the food, the house, etc.)."

Results are shown in Table 3.6. Interestingly, I find only statistically significant effects of unemployment for the less extreme violence[11]. Estimates for physical and sexual violence are not statistically significant. Estimates for non physical or sexual violence are larger in magnitude than in the model with the overall IPV rate. Moreover, the positive effect of male unemployment on IPV becomes statistically significant when analysing non-physical or sexual violence. The highest impact is found when looking only at economic and struc-

[10] Van der Berg and Tertilt (2012) also find a positive effect of the male/female unemployment rate with aggregate time series data.

[11] Anderberg *et al.* (2013) find very similar effects for physical and non-physical abuse.

tural violence.

Regarding psychological, economic, structural and spiritual violence, results in Panel B show that an increase in 1 percentage point in own-age male unemployment is associated with an increase of 0.6 p.p. in violence, or 8% of the sample mean. On the contrary, an increase in 1 p.p. in own-age female unemployment is associated with a decrease of 0.8-0.9 p.p. in this type of abuse, or 11% of the sample mean. Again, this positive (negative) effect of male (female) unemployment is offset in provinces where stem family was socially predominant in the past.

Finally, when examining only economic and structural violence, I find that both male and female unemployment are equally statistically significant, and again of opposite signs. Panel C shows that an increase in 1 p.p. in own-age ale unemployment is associated with an increase of 0.4-0.5 p.p. in this kind of abuse, or 17% of the sample mean. Converserly, an increase in 1 p.p. in own-age female unemployment is associated with an decrease of 0.5 p.p. in the IPV (again, 17% of the sample mean). The offsetting effect of belonging to a province where stem familly prevailed in the past has a similar magnitude and is statistically significant.

The fact that the highest impact of unemployment is found when examining economic and structural abuse is consistent with the identity model proposed to explain IPV. In my model, men react violently to the threat that an increase in female employment is causing on their masculinity. Employment is an indicator to access to economic resources, so to reinstate their authority men may exert control in access to resources, potential options and basic rights.

3.4 Conclusion

In this paper I have explored the relationship between unemployment and IPV, introducing a new approach. I find heterogenous impacts of female and male unemployment depending on the gender identity, which is determined by the historical family types that prevailed in each province in the past. Territories with nuclear family custom have developed a more traditional gender roles (masculinity is associated with being the main provider), whereas in regions where stem family was socially predominant we find nowadays more equal gender roles (both partners contribute to household income)[12].

The results show that a decrease in female unemployment, relative to male unemployment, is associated with an increase in IPV, only for individuals living in provinces with traditional gender roles. This effect is offset for individuals living in provinces with more equal gender roles. My hypothesis is that men perceive the improvement in female employment as an insult that calls into question his masculinity, and abuse their partners to alleviate these feelings. This explanation is new to the economics literature of domestic violence, and it is an adaptation to the identity model proposed by Akerlof and Kranton (2000).

My findings are robust to the inclusion of additional socio-demographic variables and similar when looking at the contemporaneous and lagged effects of unemployment. The effects are higher when looking only at non-physical and sexual violence, particularly when looking only at economic and structural abuse, related to access to resources and basic rights.

[12]The origins of these different gender identities are explained in Chapter 2.

3.5 References

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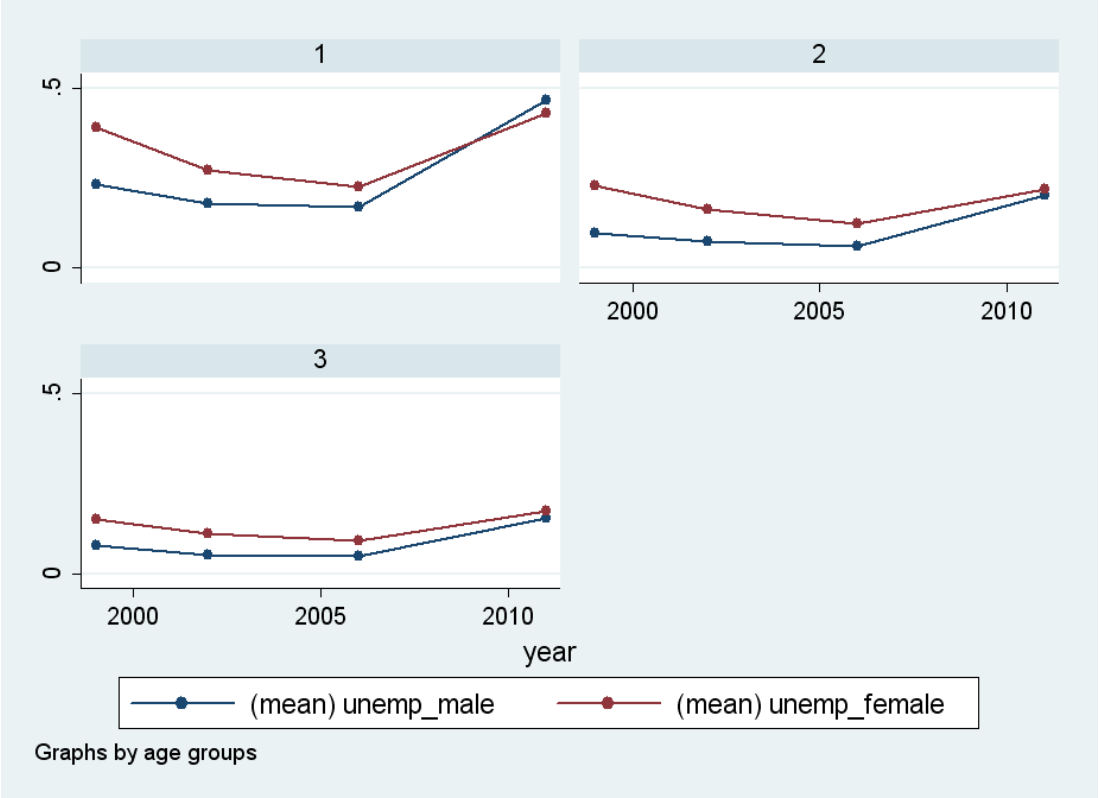
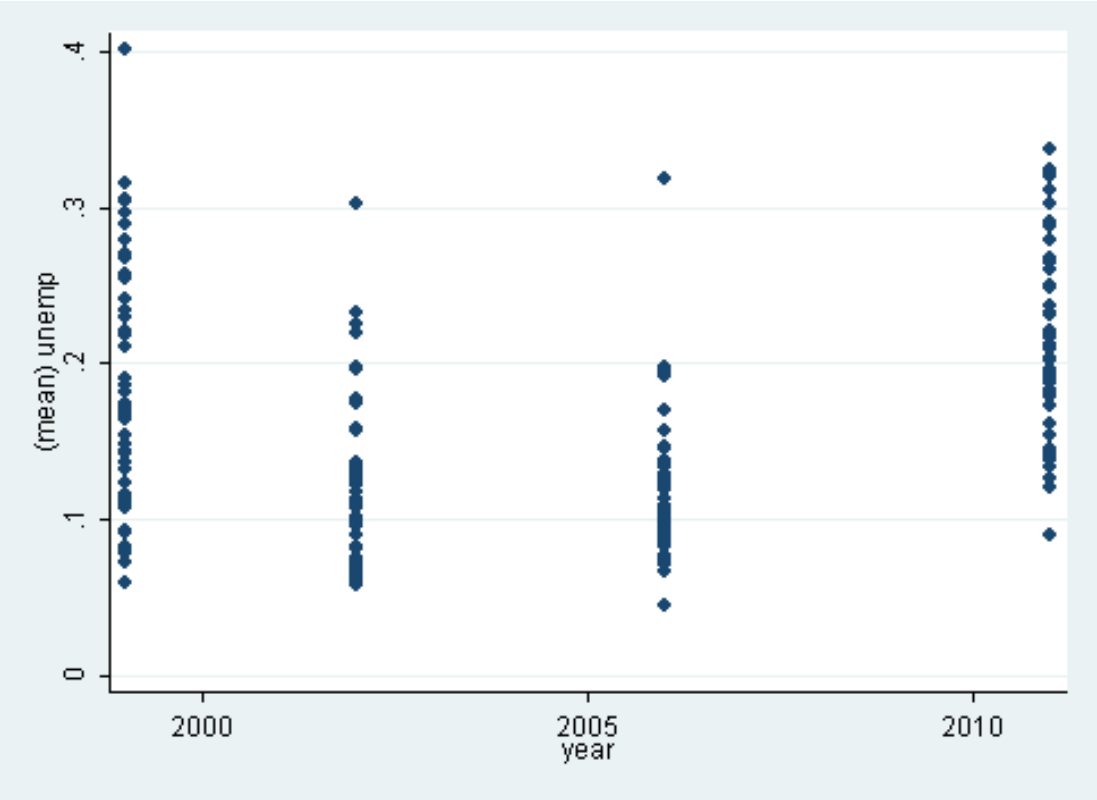
3.6 Tables and Figures

Figure 3.1: Evolution of the unemployment rate, 1999-2011



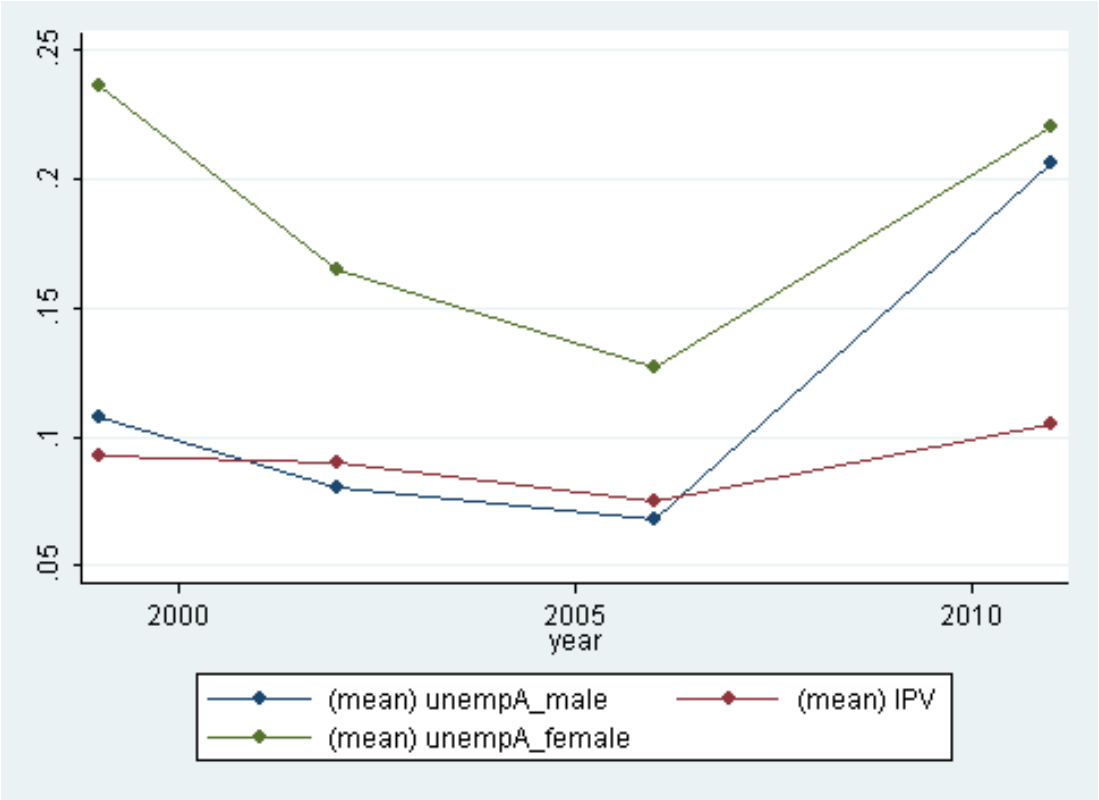
Source: Own elaboration using the Active Population Survey data.

Figure 3.2: Variation in unemployment at the province level, 1999-2011



Source: Own elaboration using the Active Population Survey data.

Figure 3.3: IPV and unemployment in Spain, 1999-2011



Source: Own elaboration using the Active Population Survey and the Violence Against Women Survey data.

Table 3.1: Sociodemographic characteristics and IPV incidence in Spain, 1999-2011

Variables	**Percentage**	**Mean IPV**
Average IPV rate		0.087
Age 18-24	19.6	0.040
Age 25-44	36	0.097
Age 45-64	22.6	0.121
Age $\geq$ 65	21.8	0.076
Children	71.5	0.107
Woman's education $\leq$Primary	38.6	0.106
Woman's education = Secondary	43.9	0.082
Woman's education $\geq$College	17.5	0.053
Partner's education $\leq$Primary	35.4	0.149
Partner's education = Secondary	46.2	0.096
Partner's education $\geq$College	18.4	0.074
Marital status - Single	23.9	0.035
Marital status - Married	61.2	0.122
Marital status - Sep./Divorced	3.9	0.080
Marital status - Widow	11	0.007
Woman main earner	23	0.046

Notes: Own elaboration using the Violence Against Women Surveys.

Table 3.2: Descriptive statistics of unemployment in Spain, 1999-2011

Variables	**Mean**	**Std. Dev.**
Total unemployment	0.144	0.351
Unemployment 1999q1	0.168	0.374
Unemployment 1999q2	0.154	0.361
Unemployment 2001q4	0.106	0.308
Unemployment 2002q1	0.116	0.320
Unemployment 2005q4	0.087	0.282
Unemployment 2006q1	0.091	0.287
Unemployment 2010q4	0.203	0.402
Unemployment 2011q1	0.213	0.409
Female unemployment	0.181	0.385
Male unemployment	0.118	0.322
Age 16-24 unemployment	0.279	0.448
Age 25-44 unemployment	0.140	0.347
Age 45-64 unemployment	0.102	0.303

Notes: Own elaboration using the Active Population Survey. The table provides mean and standard deviation computed using survey weights.

Table 3.3: Impact of Unemployment on IPV. Baseline Specification

	(1)	(2)	(3)	(4)
Mean of dependent variable			0.09	
Unemployment	-0.00284	0.000462		
	(0.0354)	(0.0333)		
Male unemployment			0.0686*	0.0683*
			(0.0410)	(0.0388)
Female Unemployment			-0.0512*	-0.0471*
			(0.0273)	(0.0250)
Year and province fixed effects	Yes	Yes	Yes	Yes
Additional demographic controls	No	Yes	Yes	Yes
Observations	59629	59629	59629	59629

Notes: Standard errors clustered by province in parentheses. The coefficients reported are marginal effects from a probit model. All models inlcude dummies for age, children and level of education as control variables. Additional demographic controls include dummies for the level of education of the partner, whether the woman is catholic or not, and marital status.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.4: Impact of Unemployment on IPV. Contemporaneous and lagged effects

	(1)	(2)
Mean of dependent variable	0.09	
Panel A. Contemporaneous effects (unemployment in same quarter)		
Male unemployment	0.269	0.275
	(0.263)	(0.251)
Female unemployment	-0.603**	-0.571**
	(0.271)	(0.251)
Male unemployment*Stem family	-0.224	-0.228
	(0.242)	(0.233)
Female unemployment*Stem family	0.557**	0.530**
	(0.265)	(0.246)
Panel B. Lagged effects (unemployment in previous quarter)		
Male unemployment	0.326	0.269
	(0.288)	(0.281)
Female unemployment	-0.659**	-0.574**
	(0.291)	(0.272)
Male unemployment*Stem family	-0.318	-0.260
	(0.275)	(0.270)
Female unemployment*Stem family	0.675**	0.589**
	(0.304)	(0.284)
Observations	56535	56535
Year and province fixed effects	Yes	Yes
Historical family specific linear time trends	Yes	Yes
Additional demographic controls	No	Yes

Notes: Standard errors clustered by province in parentheses. The coefficients reported are marginal effects from a probit model. All models inlcude dummies for age, children and level of education as control variables. Additional demographic controls include dummies for the level of education of the partner, whether the woman is catholic or not and marital status. Stem family defined as the average number of married and widowed women in the household at the province level in 1860.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.5: Impact of Unemployment on IPV by Historical Family Types. Collinearity checks

	(1)	(2)
Panel A. Female-Male Unemployment		
Unemployment	-0.334**	-0.299**
	(0.157)	(0.148)
Unemployment*Stem family	0.332**	0.303**
	(0.153)	(0.147)
F-M Unemployment	-0.456*	-0.438*
	(0.254)	(0.239)
F-M Unemployment*Stem family	0.411*	0.395*
	(0.243)	(0.229)
Observations	56535	56535
Panel B. Male/Female Unemployment		
Unemployment	-0.538***	-0.504***
	(0.193)	(0.179)
Unemployment*Stem family	0.522***	0.495***
	(0.191)	(0.179)
M/F Unemployment	0.125**	0.123**
	(0.0616)	(0.0569)
M/F Unemployment*Stem family	-0.114**	-0.114**
	(0.0573)	(0.0529)
Observations	56477	56477
Year and province fixed effects	Yes	Yes
Historical family specific linear time trends	Yes	Yes
Additional demographic controls	No	Yes

Notes: Standard errors clustered by province in parentheses. The coefficients reported are marginal effects from a probit model. All models inlcude dummies for age, children and level of education as control variables. Additional demographic controls include dummies for the level of education of the partner, whether the woman is catholic or not and marital status. Stem family defined as the average number of married and widowed women in the household at the province level in 1860.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.6: Impact of Unemployment on different types of abuse

	(1)	(2)
Panel A. Physical and Sexual Violence		
Mean of dependent variable		0.033
Male Unemployment	-0.159	-0.150
	(0.162)	(0.151)
Female Unemployment	-0.102	-0.0815
	(0.158)	(0.141)
Male Unemployment*Stem family	0.176	0.167
	(0.149)	(0.140)
Female Unemployment*Stem family	0.0791	0.0626
	(0.154)	(0.137)
Panel B. Psychological, economic, structural and spiritual violence		
Mean of dependent variable		0.072
Male Unemployment	0.607**	0.581**
	(0.296)	(0.282)
Female Unemployment	-0.856***	-0.797***
	(0.258)	(0.236)
Male Unemployment*Stem family	-0.576**	-0.547**
	(0.288)	(0.276)
Female Unemployment*Stem family	0.827***	0.771***
	(0.260)	(0.237)
Panel C. Economic and structural violence		
Mean of dependent variable		0.027
Male Unemployment	0.466***	0.443***
	(0.138)	(0.131)
Female Unemployment	-0.511***	-0.463***
	(0.138)	(0.127)
Male Unemployment*Stem family	-0.443***	-0.420***
	(0.137)	(0.130)
Female Unemployment*Stem family	0.491***	0.444***
	(0.138)	(0.127)
Observations	56535	56535
Year and province fixed effects	Yes	Yes
Historical family specific linear time trends	Yes	Yes
Additional demographic controls	No	Yes

Notes: Standard errors clustered by province in parentheses. The coefficients reported are marginal effects from a probit model. All models inlcude dummies for age, children and level of education as control variables. Additional demographic controls include dummies for the level of education of the partner, whether the woman is catholic or not and marital status. Stem family defined as the average number of married and widowed women in the household at the province level in 1860.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Conclusion

In this doctoral dissertation I have applied economics and microeconometric techniques to the analysis of health and violence against women.

In the first chapter, we estimate the price-elasticity of prescription drugs for the elderly. We find that the price-elasticity of prescription drugs is -0.20 for non-chronic condition drugs, and -0.08 or -0.03 for chronic condition drugs. We also find a small increase in the expenditure of medically inappropriate drugs due to the decrease in co-payment. These findings have implications for the design of an optimal co-payment scheme for prescriptions drugs for the elderly. They also provide important information to policy makers as they allow for the accurate prediction of the expected budgetary impacts of changes to co-payment rates for prescription drugs.

In the second chapter, I investigate the historical origins of violence against women, by looking at the relationship between intimate-partner violence (IPV) and historical family types (stem vs. nuclear families). I find that territories where stem family was socially predominant in the past show nowadays a lower IPV rate. This study contributes to the understanding of the deeper and historical factors that underlie violence against women. It provides evidence on how a historical event affected the family structure and how this in turn had a long term impact on interpersonal relations.

In the third chapter, I analyse the impact of unemployment on domestic vi-

olence. I find heterogeneous impacts depending on the gender identity, which is determined by the historical family types that prevailed in each province in the past. The results show that a decrease in female unemployment, relative to male unemployment, is associated with an increase in IPV, only for individuals living in provinces with traditional gender roles (nuclear family regions). This effect is offset for individuals living in provinces with more equal gender roles (stem family regions). My hypothesis is that men perceive the improvement in female employment as an insult that calls into question his masculinity, and abuse their partners to alleviate these feelings.