

Essays on Household and Public Finance

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Als meus pares i al meu germà

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Abstract

Households are central actors in the economy. First, studying the complex and heterogeneous nature of household financial decisions is key to better understanding the impact of different public policies or regulations in a world of imperfect markets. Second, partly as a consequence of recent developments in behavioral economics, economic research has developed a more profound appreciation of the role of economic expectations in shaping household financial behavior and their implications for the propagation of macroeconomic shocks. The first chapter of this thesis exploits rich household survey data from the Spanish Survey of Household Finances to examine how inheritance and gift taxes affect wealth mobility in Spain. The second chapter uses the same survey data to understand how marital property regimes influence household financial investment. The last chapter analyses the effects of regional income shocks on household economic sentiment and durable purchases and highlights the role of optimism as a propagation mechanism of regional demand shocks.

The first chapter, ” *The effects of inheritance and gift taxation on upward wealth mobility at the bottom: Lessons from Spain* ” studies the impact of inheritance and gift (IG) taxation on intragenerational wealth mobility. To do so, I exploit rich variation in tax rates across Spanish regions resulting from the decentralization of this tax to regional governments. Using household panel data from the Spanish Survey of Household Finances, I document that higher inheritance taxes significantly and persistently reduce heirs’ wealth mobility at the lower part of the net wealth distribution. These wealth mobility responses to higher taxes are explained by less wealthy heirs decreasing their financial wealth and increasing their personal credit debt. Liquidity constraints and restricted access to financial instruments help rationalize the rise in personal credit debt at the time of the tax payment. Illiquidity of inheritances helps explain the lasting negative effects of taxes on bottom-wealth mobility, as delays in selling inherited real estate amplify the negative effects of taxes on personal credit debt and financial wealth of bottom-wealth heirs.

The second chapter, ” *When wives command: Household portfolio choices and marital property regime* ”, coauthored with Lidia Cruces and Susana Párraga, studies the link between married couples’ portfolio choices and property division rules. Using household data from the Spanish Survey of Household Finances, we exploit the regional variation in default marital property regimes in Spain to estimate the causal

effect of property division rules on household financial investment. We find that separate-property couples hold riskier financial portfolios than community-property ones when wives are the most knowledgeable about household finances. To rationalize this gap in risky asset holdings, we develop a financial portfolio choice model where wives make savings decisions and couples differ in their property division rule. Compared to separate property, divorce risk encourages higher precautionary savings in the form of safe assets for community-property spouses due to higher dissolution costs of marital savings. This translates into separate-property spouses saving less and allocating a larger portfolio share to risky assets. Lower income levels and higher income risk for women reinforce this mechanism, contributing to explaining the property regime gap in risky financial investment between couples.

The third chapter, "*The sentimental propagation of lottery winnings: Evidence from the Spanish Christmas Lottery*", coauthored with Morteza Ghomi and Evi Pappa, exploits the Spanish Christmas lottery and consumer confidence survey data to investigate the impact of highly geographically clustered lottery winnings on consumer sentiment and durable consumption. We show that, albeit not receiving wins, consumers in winning provinces report substantially more optimistic beliefs about the economic conditions in Spain than consumers in other regions. We argue that this variation in beliefs is orthogonal to changes in regional fundamentals and find that the surge in sentiment affects durable consumption spending intentions. Young, less educated, low-income, and unemployed individuals react stronger to the sentiment shock. At the aggregate level, lottery wins induce significant demand effects, reducing unemployment and increasing job creation and CPI prices.

Contents

1	The effects of inheritance and gift taxation on upward wealth mobility at the bottom: Lessons from Spain	1
1.1	Introduction	1
1.2	Institutional Setting	6
1.2.1	Regional Inheritance and Gift Tax Credits and Deductions . .	7
1.2.2	Inheritance and Gift Tax Calculator	9
1.3	Household Data	12
1.3.1	Sample Selection	15
1.4	Empirical Analysis	16
1.4.1	Identification Strategy	16
1.4.2	Empirical Specification	17
1.5	Results	17
1.5.1	Wealth Mobility	17
1.5.2	Household Wealth and Debt	20
1.5.3	Understanding the Effects of Inheritance Taxes on Bottom-Wealth Mobility	23
1.6	Robustness	26
1.6.1	Inherited Debt	26
1.6.2	Age Profile of Heirs	27
1.6.3	Cash Transfers as Inheritances	27
1.6.4	Rejected Inheritances	27
1.6.5	Alternative Specifications	28
1.6.6	Other Confounding Factors	28
1.7	Conclusion	29
A1	Appendix A to Chapter 1	30
A1.1	Inheritance and Gift Tax in Navarre and Basque Country . . .	30
A1.2	Constructing Regional Average Effective Tax Rates	31
B1	Appendix B to Chapter 1	39
B1.1	Additional Figures and Tables	39
C1	Appendix C to Chapter 1	46
C1.1	Summary Statistics	46
D1	Appendix D to Chapter 1	48
D1.1	Additional Results	48
E1	Appendix E to Chapter 1	51

E1.1	Robustness	51
F1	Appendix F to Chapter 1	55
F1.1	Tax Reforms for Other Groups of Heirs and Donees	55
2	When wives command: household portfolio choices and marital property regime	63
2.1	Introduction	63
2.2	Institutional Background	67
2.3	Data	69
2.4	Instrumental Variable Strategy	71
2.4.1	Robustness Checks	74
2.5	Theoretical Framework	75
2.5.1	Preferences	75
2.5.2	Asset return	75
2.5.3	Income profiles	76
2.5.4	Divorce and marital property regime	76
2.5.5	Timing	76
2.5.6	Recursive Formulation	76
2.6	Calibration	77
2.6.1	First step: Parameter values selected without solving the model	78
2.6.2	Second step: Parameter values selected by solving the model .	80
2.7	Model Results	81
2.7.1	Targeted Moment	81
2.7.2	Untargeted Moments	81
2.8	Explaining the Property Regime Gap in Risky Investment	82
2.9	Further Results	85
2.9.1	Disentangling the role of the dissolution cost and the asset division rules	85
2.9.2	Model validation	87
2.10	Conclusion	88
A2	Appendix to Chapter 2	90
A2.1	Institutional background	90
A2.2	Household Data	91
A2.3	Empirical Results	94
A2.4	Model Calibration and Theoretical Results	96
3	The sentimental propagation of lottery winnings: Evidence from the Spanish Christmas Lottery	99
3.1	Introduction	99
3.2	Data	103
3.2.1	Spanish Christmas Lottery	103
3.2.2	Sentiment and Consumption Data	105
3.2.3	Macroeconomic Data	107

3.3	Effects of Lottery Wins on Sentiment	107
3.3.1	Effects of Lottery Wins on Regional Sentiment	107
3.3.2	Effects of Lottery Wins on Individual Sentiment	111
3.4	Lottery wins, Consumer Sentiment and Durable Consumption	113
3.4.1	Effects of Lottery Wins on Durable Consumption	113
3.4.2	The Joint Response of Sentiment and Consumption	116
3.4.3	Lottery Wins and Economic Fundamentals	118
3.4.4	Heterogeneous Effects	124
3.4.5	Sentimental Effects of Lottery Wins in Expansions vs Reces- sion Periods	126
3.5	Regional Macroeconomic Effects of Lottery Wins	127
3.6	Robustness Exercises	133
3.7	Conclusions	135
A3	Appendix to Chapter 3	136
A3.1	Correlation between Consumer Sentiment and Lottery Expen- diture	136
A3.2	Number of times each province won the Spanish Christmas lottery 2005-2019	136
A3.3	Consumer Sentiment and Durable Consumption Data	138
A3.4	Macroeconomic variables	144
B3	Appendix B to Chapter 3	146
B3.1	Individual-level Regressions	146
C3	Appendix C to Chapter 3	151
C3.1	Province-level Regressions	151
D3	Appendix D to Chapter 3	161
D3.1	News About Fundamentals	161
E3	Appendix E to Chapter 3	163
E3.1	Spanish Christmas Lottery as a Redistribution Mechanism	163
F3	Appendix F to Chapter 3	168
F3.1	Extending the Spanish Lottery Data: El Niño Lottery	168
G3	Appendix G to Chapter 3	178
G3.1	Robustness	178

List of Figures

1.1	Number of Inheritance and Gift Tax Reforms 2002-2019 - Group (ii)	9
1.2	Regional Differences in Inheritance Tax Quota - Group (ii)	11
1.3	Average Effective Inheritance and Gift Tax Rate - Group (ii)	12
1.4	Absolute and Relative Size of the Tax Base by Wealth Percentile	15
1.5	Effect of Inheritance and Gift Taxes on Bottom-Wealth Mobility	19
1.6	Effect of Inheritance and Gift Taxes on Middle-Wealth Mobility	19
1.7	Effect of Inheritance and Gift Taxes on Top-Wealth Mobility	20
1.8	Effect of Inheritance Taxes on Household Wealth and Debt	22
1.9	Effects of Selling Inherited Housing on Personal Credit Debt	24
1.10	Effects of Tax-induced Restrictions To Sell Inherited Dwellings on Household Wealth and Debt	26
B1.1	Number of Inheritance and Gift Tax Reforms by Year - Group (ii)	39
B1.2	Regional Inheritance Tax Reforms by Type - Group (ii)	39
B1.3	Regional Gift Tax Reforms by Type - Group (ii)	40
B1.4	Average Effective Inheritance Tax Rate across Regions - Group (ii)	41
B1.5	Average Effective Gift Tax Rate across Regions - Group (ii)	42
B1.6	Regional Heterogeneity in Tax-induced Time Restrictions to Sell The Inherited Main Dwelling	43
C1.1	Asset Composition of Bequests Along the Wealth Distribution	47
D1.1	Effect of Inheritance Taxes on Bottom-wealth Households' Financial Wealth and Other Non-mortgage debt	50
E1.1	Cash transfers as Inheritances	52
E1.2	Effects of Inheritance Taxes on Wealth mobility - Alternative definition of treatment	53
E1.3	Effect of Inheritance Taxes on Household Wealth and Debt - Alternative definition of treatment	54
E1.4	Correlation between Average Effective Inheritance Tax Rate and Rejected Inheritances Rate	55
F1.1	Regional Inheritance and Gift Tax Reforms - Group (i)	55
F1.2	Regional Inheritance Tax Reforms - Group (iii)-(iv)	56
F1.3	Regional Inheritance Tax Reforms by Type - Group (i)	56
F1.4	Regional Gift Tax Reforms by Type - Group (i)	57
F1.5	Regional Inheritance Tax Reforms by Type - Group (iii)	57
F1.6	Regional Tax Reforms by Type - Group (iii)	58

F1.7 Number of Inheritance and Gift Tax Reforms by Year - Group (i) . . .	59
F1.8 Number of Inheritance Tax Reforms by Year - Group (iii) and (iv) . . .	59
2.1 Default Marital Property Regimes in Spain	68
2.2 Property Regime Gap in Participation in Risky Assets: Model vs. Data	81
2.3 Property Regime Gap in Risky Assets Shares and Total Savings: Model vs Data	82
2.4 Property Regime Gap in Risky Investment: Baseline vs Counterfac- tual 1	83
2.5 Property Regime Gap in Risky Investment: Baseline vs Counterfac- tual 2	84
2.6 Property Regime Gap in Risky Investment: Baseline vs Counterfac- tual 3	85
2.7 Model Validation	88
A2.1 Prenuptial Contracts	90
A2.2 Marriages and Divorces in Spanish Regions by Default Regime	90
A2.3 Married Couples under Separate Property in Community-Property Regions	93
A2.4 Gap in Savings-to-income Ratio - Baseline vs Counterfactual 1 . . .	97
A2.5 Gap in Savings-to-income Ratio - Baseline vs Counterfactual 2 . . .	97
A2.6 Gap in Savings-to-income Ratio - Baseline vs Counterfactual 3 . . .	98
A2.7 Model Validation - Property Regime Gaps for Male-headed Households	98
3.1 Effect of Christmas Lottery Prizes on the Index of Current Economic Condition and the Index of Consumer Expectation	109
3.2 Dynamic effects of Christmas Lottery on consumer sentiment	113
3.3 Effects of Christmas Lottery on realized and intended household durable consumption	114
3.4 Effects of Christmas Lottery on realized household durable consump- tion by item	116
3.5 Effects of Christmas Lottery prizes on the Harmonised Business Con- fidence Index - Seven provinces	120
3.6 Effects of Christmas Lottery prizes on disaggregated consumer senti- ment indices	121
3.7 Heterogeneous effects of Christmas Lottery on intended household durable consumption	126
3.8 Effect of Christmas Lottery prizes on the unemployment rate and CPI	128
3.9 Effect of Christmas Lottery prizes on labor market tightness and labor contracts to participation ratio	129
3.10 Effect of Christmas Lottery prizes on rental prices and the number of mortgages	130
3.11 Effects of Christmas Lottery prizes on the relative number of Google searches for restaurants and retail sales	131

3.12 Effect of the Index of Consumer Expectation Instrumented by Lottery Rewards on the Provincial Unemployment Rate and CPI	132
B3.1 Effects of Christmas Lottery on realized and intended household durable consumption	147
C3.1 Effect of Christmas Lottery Prizes on the Index of Current Economic Condition and the Index of Consumer Expectation	152
C3.2 Effect of Christmas Lottery prizes on the unemployment rate and CPI	153
C3.3 Effects of Christmas Lottery Prizes (net of lottery expenditures) on Unemployment Rate and CPI	155
C3.4 Effect of Christmas Lottery Prizes (net of lottery expenditures) on Index of Current Economic Condition and Index of Consumer Expectation	156
C3.5 Effects of Christmas Lottery Prizes on Relative Unemployment Rate and Relative CPI	157
C3.6 Effect of Christmas Lottery Prizes on Log of Total Unemployment . .	157
C3.7 Effects of Christmas Lottery Prizes on the Growth Rate of Unemployment Rate, CPI, and Consumer Sentiment Indices	158
C3.8 Effects of Christmas Lottery Prizes on Unemployment Rate, CPI, and the Sentiment Indices - Alternative Detrending	159
C3.9 Effects of Christmas Lottery Prizes on Unemployment Rate and CPI - Sub-sample 2011-2020	159
C3.10 Effects of Christmas Lottery Prizes on Labor Contracts by Contract Duration	160
D3.1 Effect of Christmas Lottery Prizes on the Index of Current Economic Condition and the Index of Consumer Expectation- Seven provinces .	162
E3.1 Effects of Christmas Lottery Prizes on the Unemployment Rate, CPI and Consumer Sentiment Indices in High vs Low-GDP per capita Provinces	164
E3.2 Effects of Christmas Lottery Prizes Unemployment rate, CPI and Consumer Sentiment Indices - Redistribution	165
E3.3 Effects of Christmas Lottery on Household Durable Consumption - High-Income vs Low-Income Provinces	167
F3.1 Effect of Christmas Lottery and El Niño Prizes on Regional Consumer Sentiment Indices	171
F3.2 Effects of Christmas and El Niño Lottery on Household Durable Consumption	176
F3.3 Effects of Christmas Lottery and El Niño Lottery Prizes on Unemployment Rate and CPI	177
G3.1 Effect of Christmas Lottery Prizes on the Unemployment Rate and CPI- Spillover Effects	178
G3.2 Effects of Christmas Lottery Prizes on Unemployment Rate, CPI and Consumer Sentiment Indices - Aggregating data in quarters	179

G3.3 Effects of Christmas Lottery Prizes on Unemployment Rate, CPI and Consumer Sentiment Indices - Dummy Variable	180
G3.4 Effects of Christmas Lottery Prizes on Unemployment Rate, CPI and Consumer Sentiment Indices - Outliers	181
G3.5 Effects of Christmas Lottery on Household Durable Consumption - Dropping Outliers	182
G3.6 Effect of Total Christmas Lottery Prizes on Regional Consumer Sen- timent Indices	183
G3.7 Weighted Average of Unit-by-unit Local Projection Estimates	184

List of Tables

1.1	Summary Statistics Inheritance and Gift Receipts	14
A1.1	Tax reforms and data sources	30
A1.2	Reduction in the scaling factor - Regions	32
A1.3	Reduction in the scaling factor and Implicit Tax Credit - Groups (i) and (ii)	32
A1.4	Tax Credit for Ascendants and Descendants - Catalonia 2014	33
A1.5	Taxpayers weights, heirs group (ii) - Catalonia 2014	33
A1.6	Tax Credits and Deductions for Heirs - Group (ii)	35
A1.7	Tax Credits and Deductions for Heirs - Group (ii)	36
A1.8	Tax Credits and Deductions for donees - Group (i) and (ii)	37
A1.9	Tax Credits and Deductions for donees - Group (i) and (ii)	38
B1.1	Average Variation in Inheritance and Gift Tax - Group (ii)	43
B1.2	Regional Inheritance and Gift Taxation and Macroeconomic Aggregates	44
B1.3	Regional Inheritance and Gift Taxation and Regional Public Finances	44
B1.4	Regional Inheritance and Gift Taxation and Political Orientation . .	44
B1.5	Regional Macroeconomic Aggregates and Political Orientation	45
C1.1	Household Summary Statistics at the time of the Inheritance or Gift .	46
C1.2	Share of Inheritance and Gifts by Net Wealth Percentiles	46
D1.1	Event-study Estimates of Inheritance Taxes on Wealth Mobility . . .	48
D1.2	Event-study Estimates of Inheritance Taxes on Household Wealth and Debt - Households below 40th percentile before the tax payment . . .	49
E1.1	Inheritance Taxes and Debt Holdings of Old Households	51
E1.2	Age profile of heirs	51
F1.1	Tax Deductions and Credits for Heirs - Group (i)	60
F1.2	Tax Deductions and Credits for Heirs - Group (i)	61
F1.3	Tax Reforms for Heirs - Group (iii) and (iv)	62
2.1	Household Summary Statistics	71
2.2	First-stage Regressions	73
2.3	Instrumental Variables Estimates	74
2.4	Parameters calibrated without and by solving the model.	78
2.5	Disentangling the role of dissolution costs vs asset allocation rule . .	86
2.6	Parameters when the husband is the household head	87
A2.1	Household Summary Statistics - Wife is household head	91
A2.2	Household Summary Statistics - Husband is the household head . . .	92

A2.3 Robustness Checks - Participation in risky financial assets	94
A2.4 Robustness Checks - Portfolio share in risky asset classes	95
A2.5 Empirical Gaps	95
A2.6 Husband savings calibration	96
A2.7 Wife savings calibration	96
A2.8 Estimation results - Stochastic Income Process	96
A2.9 Counterfactual - Divorce risk	97
3.1 Summary Statistics - Christmas Lottery data at the province level . .	105
3.2 F-statistics of the first-stage regression of Christmas Lottery prizes on consumer confidence. Sample 2011M11-2020M1	110
3.3 Survey evidence on the effects of Spanish Christmas Lottery on con- sumer sentiment	112
3.4 Survey evidence on the effects of Spanish Christmas Lottery on con- sumer sentiment and future consumption	117
3.5 Survey evidence on the effects of Spanish Christmas Lottery on house- holds' current ability to pay bills	119
3.6 First-stage F-statistics for the null hypothesis that the lottery awards have no explanatory power for consumer confidence.	122
3.7 Survey evidence of the effects of Christmas Lottery prizes in provinces with active nationalist movements	123
3.8 Effects of consumer sentiment on recent and intended durable pur- chases - 2SLS estimates	124
3.9 Survey evidence on the effects of the Spanish Christmas Lottery on consumer sentiment: high vs low unemployment rate periods	127
A3.1 Testing for Endogeneity of the Lottery Expenditures	136
A3.2 Number of times each province was awarded with any of the Spanish Christmas Lottery main prizes between May 2005 - Jan 2020.	137
A3.3 Percentage of answers by question and individual characteristics . . .	139
A3.4 Percentage of answers by question and individual characteristics . . .	140
A3.5 Percentage of answers by question and individual characteristics . . .	141
A3.6 Representativeness of Provincial ICC and ICE - Consumer sentiment indices at the province level have been constructed using monthly information between November 2011 and January 2020 for 50 Spanish provinces.	143
A3.7 Summary Statistics - Macroeconomic data at the province and na- tional level for the period May 2005- Jan 2020	144
A3.8 Summary Statistics - Macroeconomic data for Asturias, Cantabria, Islas Baleares, Madrid, Murcia, Navarra, and La Rioja for the period May 2005- Jan 2020	144
B3.1 Survey evidence on the effects of Spanish Christmas Lottery on con- sumer sentiment - Total lottery prizes	146

B3.2 Heterogeneous effects of Spanish Christmas Lottery on consumer sentiment - future household income	148
B3.3 Heterogeneous effects of Spanish Christmas Lottery on consumer sentiment - future employment prospects	149
B3.4 Heterogeneous effects of Spanish Christmas Lottery on consumer sentiment - future Spanish economy	150
C3.1 Wald Test Statistics Results	154
E3.1 Survey evidence on the effects of Spanish Christmas Lottery on consumer sentiment in provinces with different living standards	166
F3.1 Summary Statistics - El Niño Lottery data at the province level. Top prizes and expenditures per capita are computed using data from May 2005 - Jan 2020. Top prizes (% of GDP) are computed using data from 2005 to 2018	169
F3.2 Survey evidence on the effects of Spanish Christmas Lottery and El Niño Lottery on consumer sentiment	172
F3.3 Heterogeneous effects of Spanish Christmas Lottery and El Niño Lottery on consumer sentiment - future household income	173
F3.4 Heterogeneous effects of Spanish Christmas Lottery and El Niño Lottery on consumer sentiment - future employment prospects	174
F3.5 Heterogeneous effects of Spanish Christmas Lottery and El Niño Lottery on consumer sentiment - future Spanish economy	175
G3.1 Survey evidence on the effects of Spanish Christmas Lottery on consumer sentiment - Dropping Outliers	182

Chapter 1

The effects of inheritance and gift taxation on upward wealth mobility at the bottom: Lessons from Spain

1.1 Introduction

At the heart of the ongoing debate on the sharp rise in wealth inequality is the use of inheritance and inter-vivos gift (IG, hereafter) taxation as one of the main available policy tools to redistribute wealth and guarantee equal opportunities (OECD, 2021; Piketty et al., 2013). This is an important issue since, by 2021, IG taxes are still levied in 24 out of the 36 OECD countries.¹ Yet, empirical research on this topic is very limited since isolating the causal impact of IG taxation on wealth distributional outcomes is rather challenging due to identification and measurement issues. First, inheritance and gift tax reforms that could be used in a quasi-experimental setting are rare. Second, even if they have occurred, rich administrative or survey data containing detailed information on heirs' and donees' wealth has often been unavailable to researchers. These empirical challenges are also aggravated by a stark theoretical ambiguity about the impact of wealth transfer taxation on wealth distributional outcomes. For example, the quantitative macroeconomic literature examining the distributional effects of estate taxation in the U.S. finds that the effects of suppressing this form of bequest taxation range from mild to substantial, depending on specific modeling assumptions. For instance, Cagetti and De Nardi (2009); Castaneda et al. (2003) find negligible effects of abolishing estate taxation on wealth inequality and mobility, while Benhabib et al. (2011) finds rather sizable effects. In addition, recent developments in the theoretical literature on optimal

¹See data: OECD Report 2021

bequest taxation also argue in favor of a positive optimal inheritance tax rates but again its magnitude depends explicitly on the modeling assumptions (Brunner and Pech, 2012; Piketty and Saez, 2013).²

In this paper, I study the wealth mobility consequences of the Spanish IG taxation. The Spanish setting serves as an ideal testing ground as it allows me to tackle the above-mentioned identification and measurement challenges. First, it provides rich survey household panel data on wealth from 2002 to 2018. The Spanish Survey of Household Finances (or EFF for its acronym in Spanish) contains detailed information on the wealth and debt of Spanish households, including information on pre-tax inheritances and inter-vivos gifts amounts and their asset composition. Second, Spain offers promising quasi-experimental variation in effective IG tax rates among its regions for any tax bracket.

The Spanish IG tax is designed at the national level. The law contemplates a progressive tax schedule with 16 brackets and tax rates ranging from 7.65% to 34%. In 1996 the administration and regulation of this tax were decentralized to regional governments, which were awarded regulatory power to introduce tax credits and deductions for any tax bracket as well as to modify the marginal tax schedule at their will. Regions started to exercise this right in the mid-2000s resulting in large regional cross-bracket variation in the effective tax rates due to differences in (i) the timing of the tax reforms, (ii) the number of tax brackets affected and (iii) the magnitude of the tax discounts introduced. I collect information on all regional IG tax reforms between 2002-2018 relying on different official data sources. Most of these tax reforms took the form of tax credits and deductions that targeted a tax burden relief for close heirs and donees (i.e., spouses, descendants older than 21, and ascendants) and were applicable to any asset included in the tax base. With this novel information, I construct a tax simulator for inheritance and gift taxes for all Spanish regions. Then, I apply this tax simulator to the inheritance and gifts reported by households in the EFF survey and leverage the regional variation in tax payments across tax brackets and time to estimate the effects of IG taxation on wealth mobility and household wealth and debt.

I estimate the average treatment effect of IG tax changes, as well as their dynamics, using an event-study specification. For my empirical strategy, I compare changes in wealth mobility and wealth and debt holdings of those households that receive an inheritance or gift (before and after they receive it) across different regions (i.e., different tax rates). In the absence of a pre-trend, the identifying assumption is that there is no systematic regional factor driving both IG tax rates and outcome

²Piketty and Saez (2013) show that the optimal inheritance tax rate should be positive and large if the elasticity of bequests to the tax rate is low, bequest concentration is high, and society cares mostly about those receiving small bequests. Brunner and Pech (2012) show the introduction of the inheritance tax can have an ambiguous effect on welfare depending on whether the external effect related to altruism is accounted for in the social objective.

variables. The most relevant threat to identification is that local economic shocks at the regional level simultaneously determine the IG tax setting and household wealth outcomes. In this respect, I show that IG tax changes do not react to past regional economic conditions or the state of regional public finances but only to the political orientation of the regional government. Further, the ideology of the party in power happens to be uncorrelated with systematic differences in economic and fiscal performance across regions. This mitigates the concerns about biases in the estimates of the treatment effects due to these confounding factors. In addition, I argue that IG tax-induced regional mobility should not play a major role in this setting due to the frequency of the tax changes and the specific design of the tax, as inheritance taxes are paid in the region of residence of the deceased person during the last 5 years and gift taxes are paid where the assets being transferred are located.

By comparing heirs and donees who pay taxes in different regions, I find that higher inheritance taxes have a negative impact on net wealth mobility, but only at the bottom of the wealth distribution. Specifically, a one percentage point increase in inheritance tax rate makes households below the 50th net wealth percentiles between 0.01 to 0.33 percent less likely to improve their position in the net wealth distribution. For heirs at the very bottom of the wealth distribution (i.e. those at the 10th net wealth percentile), these point estimates represent a wealth mobility decrease of 36 to 77 percent in the years after the tax payment relative to their average pre-inheritance wealth mobility. Interestingly, this negative effect is persistent, remaining statistically significant during 3 to 6 years after the inheritance receipt for heirs at the first two percentiles. Instead, gift taxes on cash transfers do not seem to affect differently wealth mobility at any part of the wealth distribution. Next, I investigate the empirical drivers behind these wealth mobility dynamics more deeply by studying debt and gross wealth responses to inheritance taxation for different groups of households depending on their position within the wealth distribution before the tax payment. I provide evidence that a one percentage point increase in the inheritance tax rate decreases heirs' gross wealth by 9 to 12 percent in the years after the tax payment for households at the bottom of the wealth distribution. This negative effect of taxes on gross wealth is mostly driven by a reduction in their financial wealth, particularly in liquid assets, that goes in parallel with a rise in the non-mortgage debt-to-wealth ratio by 3.2 and 4.7 percentage points in the years after the tax payment. In contrast, higher taxes do not seem to affect differently gross wealth and debt of heirs and donees placed above the 50th net wealth percentile, besides a short-lived negative effect on financial wealth for middle-wealth households. Accordingly, this mechanism uncovers an important link between inheritance taxes and household debt in the presence of liquidity constraints which the literature has so far overlooked and connects it with wealth mobility outcomes.

These results altogether suggest that the negative effects of inheritance taxes on bottom-wealth mobility are mostly explained by lower financial wealth and higher

debt of these households. I argue that liquidity constraints and restricted access to financial instruments are relevant factors in explaining the positive effect of inheritance taxes on personal credit debt at the time of the tax payment. Despite getting smaller inheritances in absolute terms, less-wealthy heirs in Spain receive larger inheritances relative to their stock of wealth than wealthier ones. More concretely, households below the 40th net wealth percentile in Spain receive on average inheritances as large as 6 times their gross wealth (or 86 times their liquid assets) at the time of their receipt.³ The higher relative size of inheritances with respect to households' stock of liquid wealth at the left tail of the distribution is explained by bottom-wealth households inheriting a large proportion of illiquid assets in form of real estate property. This particular feature of Spain⁴ increases the tax burden of the bottom-wealth households disproportionately, even after taking into account the corresponding tax discounts for real estate assets contemplated in the law. The liquidity constraints faced by bottom-wealth households at the time of the tax payment are reinforced by several Spanish IG tax law mandates, which limit heirs' access to different financial instruments and leave them with few options besides relying on personal credit debt to pay the corresponding tax liabilities. First, heirs are required to pay taxes in the next 6 months following the death event to gain ownership of the deceased person's estate, which becomes frozen by the bank system and public registry on the same day of the death (including bank accounts and deposits). Heirs can ask for a tax payment moratorium and/or installment but this comes with an additional cost and does not grant access to the deceased person's estate until the tax payment is completed. Second, the Spanish bank system does not allow heirs to put the yet-to-be-inherited real estate assets as collateral for loans, which reduces the number of debt instruments available for liquidity-constraint households who might need extra cash to pay tax liabilities when subject to higher levels of taxation.

Although the singularities of the Spanish IG tax system help rationalize the rise of personal credit debt of less-wealth heirs who might face liquidity constraints at the time of the tax payment, it is less obvious why the detrimental effects of inheritance taxes on bottom-wealth mobility and personal credit debt persist over time. In combination with this channel, I provide evidence that the illiquidity of inheritances and delays in selling inherited real estate property help explain the persistence of the negative effect of taxes on bottom-wealth mobility. To do so, I leverage regional variation in tax-induced restrictions to sell the inherited dwelling. In Spain, the inheritance tax law allows heirs to benefit from generous tax credits applicable to the deceased's main dwelling under the condition that inherited property must not

³These averages are computed using a sample of EFF households with positive net wealth.

⁴Home ownership rate for households below the 20th net wealth percentile in Spain amounts to almost 30%. This is a sizable rate compared to the one in France or Germany for bottom-wealth households, which is around 2% and 7% respectively. These averages have been obtained from the 2014 wave of the Household Finance Consumer Survey of the Euro area.

be sold for a certain amount of years. Heirs are allowed to sell the property before but they would lose the corresponding fiscal benefits in favor of the Treasury, which can result in a considerable cash disbursement. Although the default law establishes a 10-year period, regions have reduced this time restriction since the mid-2000s resulting in plausibly exogenous variation in the delay to sell real estate property due to differences in (i) the timing and (ii) the magnitude of these time limit reductions. I show that the effects of inheritance taxes on less wealthy heirs' personal credit debt and financial wealth are stronger in regions with longer restrictions to sell inherited real estate without cost. These results suggest that delays in selling illiquid inherited assets might prevent households at the bottom from deleveraging and improving their net wealth position sooner.

Related literature. This paper contributes to several strands of the literature. First, it speaks to the scant literature exploring the empirical effects of inheritances on wealth inequality using rich household data (Nekoei and Seim, 2022; Elinder et al., 2018). These two studies find that inheritances reduce wealth inequality upon receipt as heirs at the bottom of the wealth distribution receive larger inheritances relative to their pre-inheritance wealth than wealthier heirs do. In light of this empirical evidence, Elinder et al. (2018) also study the role of inheritance taxation by exploiting the Swedish tax repeal in 2005 finding that taxing inheritances dampens the equalizing effect that inheritances have at the baseline. In turn, Nekoei and Seim (2022) discuss the potential role of inheritance taxation in Sweden by simulating different tax changes (expected vs unexpected) and tax revenue redistribution schemes. These authors highlight that the direct mechanical effect of inheritance taxation, which increases wealth inequality, is of first order compared to the behavioral effects. Their results suggest that taxation can play a role in mitigating the rise of wealth inequality by taxing only wealthy heirs who deplete their bequests at a slower pace due to higher returns on inherited wealth. Different from these studies whose primary focus is to investigate the role of inheritances in shaping wealth inequality, I provide direct evidence on the effects of inheritance taxation on wealth and debt outcomes at the household level as well as on wealth mobility by leveraging a novel and more compelling source of variation in inheritance rates across Spanish regions. By doing so, I shed light on a yet unexplored empirical channel that associates the debt of less wealthy heirs with higher inheritance taxation, highlighting the importance of liquidity constraints and the asset composition of inheritances in deterring net wealth mobility at the bottom. In line with previous results, my findings also underscore the distribution of wealth among the descendants as a key factor in explaining the negative effect of the inheritance taxes on bottom-wealth mobility.

Next, this paper is also related to the empirical research exploring the effects of wealth taxation on wealth (Jakobsen et al., 2020; Ring, 2020) and reported wealth (Seim, 2017; Agrawal et al., 2020; Brühlhart et al., 2019). In a similar spirit as

Agrawal et al. (2020); Brülhart et al. (2019) who leverage regional variation in wealth taxes in Spain and Switzerland to study how reported wealth responds to changes in wealth tax rates, this paper also exploits regional cross-bracket differences in effective IG tax rates in Spain. However, rather than looking at wealth taxation which affects a very small share of households concentrated at the right tail of the wealth distribution (0.5% of the adult population in 2015), my contribution here is to pay attention to the effect of IG taxes, which is another form of wealth taxation that affects a broader group of the population (3.1% of the adult population in 2015). Finally, this paper is further related to the empirical work studying the effects of taxation on household debt (Poterba and Sinai, 2008; Gruber et al., 2021). These studies have mainly explored the effects of property taxes or housing-related fiscal policy changes on household debt. Unlike them, I study the effects of IG taxation rather than property taxation and relate household debt to wealth mobility patterns across the wealth distribution.

The rest of the paper is organized as follows. Section 1.2 introduces the Spanish inheritance and gift tax system and describes the methodology used to construct effective regional tax schedules. Section 1.3 describes the household survey data used in the paper. Section 1.4 presents the empirical strategy used to study the effects of inheritance and gift taxes on wealth mobility and net wealth of heirs and donees. Section 1.5 presents the empirical results and discusses them. Section 1.6 presents additional robustness checks exercises and Section 1.7 concludes. An Appendix gathers further Tables and Figures briefly discussed throughout the paper.

1.2 Institutional Setting

The Spanish IG tax dates back to the 18th century when it was first introduced in the tax system during the reign of Charles IV. It suffered several modifications during the 19th and 20th centuries until it became finally regulated in 1987 (Law 29/1987) as part of one the major tax system reforms undertaken after the arrival of democracy in Spain. All regions are subject to this law except for the Basque Country and Navarre (the *Foral* regions) which, due to their special fiscal status, enjoy regulatory power to design most taxes, including the IG tax.⁵

Different from other countries, Spanish law regulates inheritances and gift taxes jointly. The Spanish IG tax is levied on heirs and donees and depends on their degree of kinship with the deceased or donor, respectively. The law distinguishes four groups of heirs/donees: (i) descendants younger than 21, (ii) descendants older than 21, spouses and ascendants, (iii) siblings, stepchildren, nephews/nieces, un-

⁵Notwithstanding this special status, these two regions have regulated IG tax rates similar to the rest of Spain. Appendix A1.1 provides a more detailed description of the institutional setting of these two regions.

cles/aunts, and (iv) more distant relatives and non-relatives. Heirs' tax base is defined as the sum of the individual portion inherited and life insurance benefits derived from the deceased's bequests⁶ while donees' tax base is defined as the sum of assets transferred *inter vivos* by an alive donor. The net tax base is calculated after applying any eligible tax deductions. These depend on the degree of kinship with the deceased or donor as well as on the type of assets being inherited. If the net tax base is positive, a progressive marginal tax schedule is applied to obtain the net tax liability. The tax schedule defines 16 brackets with tax rates ranging from 7.65% to 34%. The final tax liability to be paid is obtained after considering any tax credit and the corresponding scaling factor, which depends on the pre-bequest wealth of the taxpayer and group.

The Spanish IG tax system establishes that inheritance taxes must be paid in the region of residence of the deceased person. By contrast, the region where gift taxes are paid depends on the type of assets transmitted. For example, inter-vivos transfers involving real assets are paid in the region where assets are located while taxes for gifts entailing any other type of asset are paid in the region of residence of the grantee.

In terms of tax revenues, the IG tax represented 3.78%⁷ of annual total revenues at the regional level between 2002-2019. This percentage increases to 19.7% if only tax revenues directly controlled by the regions are considered (i.e those coming from decentralized taxes).⁸

1.2.1 Regional Inheritance and Gift Tax Credits and Deductions

The administration and regulation of the IG tax in Spain were decentralized in 1996. This meant that regions were awarded regulatory power to introduce tax credits and tax deductions as well as to modify the tax schedule or the scaling factors at their will. I collect information on the inheritance and gift tax reforms introduced by regional governments contained in the regional tax books (*Libros de Tributación Autonómica*) published by the Spanish Ministry of Finance and the regional fiscal reports from the Spanish General Council of Economists (*Consejo General de Economistas de España*). I complement this data with the official tax codes and their successive modification of the Basque Country and Navarre.

⁶The inheritance tax base also includes those assets transferred to the heirs by the deceased in a short period before her death. An illustrative example is gifts made by the deceased to heirs during the four years preceding the moment of death.

⁷This percentage has been computed using homogeneous data series of regional tax revenues available at Fundacion de Estudios de Economia Aplicada (FEDEA) See here

⁸The taxes decentralized to regions are: wealth tax, real estate transfer tax, and tax on gambling machines. Regional governments have limited regulatory power regarding the labor income tax, the vehicle registration tax, and the tax on gambling activities

It is worth noticing that, though IG taxes were decentralized to the regions since 1996, regional governments did not exercise this right until the beginning of the 2000s when they started to modify the IG tax code rather frequently. Most of these tax reforms implied the introduction of tax deductions and tax credits, the latter in form of sizable tax refunds as a percentage of the net tax base. Some regions also introduced their own marginal tax schedule or reduced the size of the scaling factors which turned out to work as implicit tax credits. Interestingly, almost all of these tax discounts were designed to apply to *any asset* included in the tax base.⁹

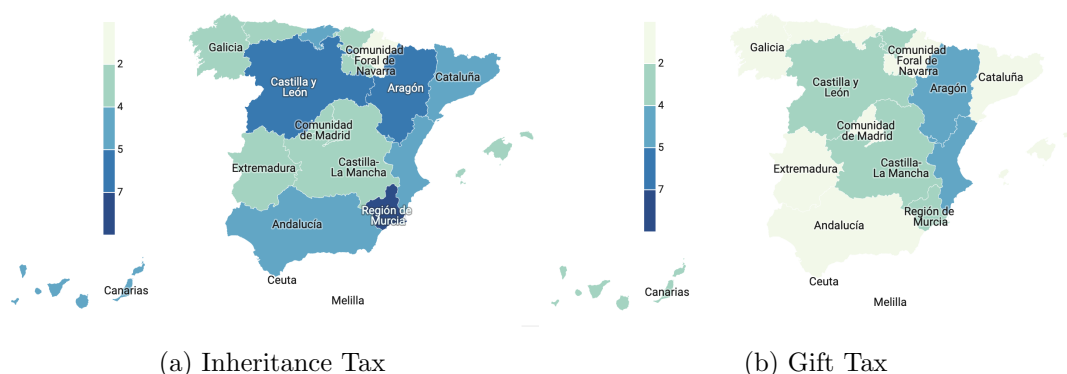
Close heirs and donees

The majority of these tax reforms were introduced to reduce the tax liability of close heirs and, to a lesser extent, of close donees with respect to the default. I refer to close heirs and donees as descendants older than 21, ascendants and spouses (group (ii)), and descendants younger than 21 (group (i)). Group (ii) is the largest group of taxpayers as it concentrates 86% and 93% of the total inheritance and gift taxpayers in Spain, respectively.

To illustrate how frequently regions have modified the regional tax schedule, the regional maps displayed in Figure 1.1 depict the number of tax reforms for heirs and donees of group (ii) introduced by each Spanish region. Both maps reveal substantial heterogeneity in the regional tax reform activity, with Murcia, Castile and Leon, and Aragon as the regions which have modified their tax code more frequently. All regions, except Ceuta and Melilla, have reformed the IG tax code at least once over the time period considered.¹⁰

⁹The rationale behind this legislative action is that the default rule already includes generous tax deductions for the most common inherited assets, such as family business or main dwelling, and thus regions did not have much room to reduce these asset-specific tax liabilities for close heirs and donees.

¹⁰Figure F1.1 reproduces the same maps focusing on heirs and donees from group (i) and shows that young descendants' tax liabilities have also been subject to several reforms

FIGURE 1.1 Number of Inheritance and Gift Tax Reforms 2002-2019 - Group (ii)

This Figure depicts the number of tax reforms for close heirs and donees (group (ii)) introduced by Spanish regions. Panel 1.1a refers to the inheritance tax while Panel 1.1b refers to the gift tax. These figures have been constructed using the inheritance tax regulation contained in the regional tax books published by the Spanish Ministry of Finance, as well as in the regional fiscal reports produced by the General Council of Spanish Economists.

Even though most tax changes introduced by regional governments were aimed to reduce the tax liabilities of close heirs and donees, some of them implied a considerable reduction in the tax discounts previously introduced if not their repeal. For instance, Murcia abolished a tax credit in form of a tax refund of 99% of the net tax base¹¹ for heirs of group (ii) in 2013. Likewise, the Canary Islands also revoked a tax credit of 99.9% for this group in 2012 and replaced it with a 0% tax credit plus a tax deduction of just 40,000 euros. Appendix Figures B1.2 - B1.3 distinguish between changes in IG tax regulation for close heirs and donees that implied a proper introduction of a tax discount from those that involved a repeal or a significant reduction in those previously legislated. Both figures reveal that most of these tax reforms led to the introduction of tax discounts or their expansion, while only very few regions actually limited or abrogated them at the end of 2000s.¹²

1.2.2 Inheritance and Gift Tax Calculator

Using the information on tax reforms, I construct a tax calculator for heirs and donees belonging to group (ii). The net tax base for an inheritance or gift amount

¹¹With a limit of 300,000 euros

¹²Regional governments introduced very few tax reforms for more distant relatives and non-relatives (i.e. those belonging to group (iii) and (iv)). Figure F1.2 shows that only very four regions introduced tax reforms for heirs of group (iii) and only one for heirs of group (iv), while donees in either group did not experience any tax reform over this period. Online Appendix Figures F1.5 and F1.6 show that the few tax reforms for heirs of group (iii) and (iv) also targeted tax relief for this group in line with the tax reforms introduced for close heirs and donees.

in tax bracket j , region r , and year t is computed as follows:

$$\text{Net Tax Base}_{jrt}^i = \min \left\{ 0, (\text{Main Dwelling} - k_{rt}) \times (1 - tc_{rt}^{h,i}) + \text{Business Assets} \times (1 - tc_{rt}^{b,i}) + \text{Other Assets} - td_{rt}^i \right\}$$

where $tc_{rt}^{h,i}$ denotes the tax credit specific to the main dwelling up to some limit k and $tc_{rt}^{b,i}$ refers to the tax credits specific to business assets¹³ and td_{rt}^i denotes any general tax deduction applicable to the gross tax base for descendants older than 21, descendants, and spouses. Other assets include land, life insurance, financial assets, etc.¹⁴ Next, if the net tax base is positive, the tax quota is computed as follows:

$$\text{Tax Quota}_{jrt}^i = (q_{jr} + (\text{Net Tax Base}_{jrt}^i - b_j^{lb}) \times \tau_{jrt}) \times (1 - tc_{rt}^i) \times SF_{rt} \quad i \in \{\text{Inheritance, Gift}\}$$

where q_{jr} is the tax payment corresponding to the first X euros of the net tax base for bracket j and τ_{jrt} is the marginal tax rate applicable to the remaining amount (i.e. $\text{Net Tax Base}_{jrt}^i - b_j^{lb}$ where b_j^{lb} is the lower bound of tax bracket j). Finally, tc_{rt}^i denotes any general tax credit, which usually takes form of a tax refund expressed as a fraction of the net tax base¹⁵, and SF_{rt} refers to the scaling factor, which is increasing in heirs or donees' pre-inheritance or pre-gift wealth¹⁶. Once the tax quota and the net tax base are computed, the effective tax rate can be obtained as:

$$\tau_{jrt}^{E,i} = \frac{\text{Tax Quota}_{jrt}^i}{\text{Net Tax Base}_{jrt}^i} \quad i \in \{\text{Inheritance, Gift}\}$$

Notice that the effective tax rate is allowed to vary across regions and time as local governments introduced different tax deductions (td_{rt}^i) and credits (tc_{rt}^i) as well as modified the marginal tax schedule (τ_{jrt}) at various points in time. Regions have also increased the generosity of the tax credit specific to inherited main dwellings over time. Appendix A1.2 provides a more detailed description of the construction of the effective tax rates for each bracket.

Figure 1.2 presents the inheritance tax quota to be paid in each Spanish region by an heir inheriting the main dwelling of the deceased person valued at 150,000

¹³The default law contemplates a tax credit in form of a tax refund of 95% of the net tax base for the main dwelling of the deceased person up to a 120,000 euros limit. Inherited business-related assets enjoy a tax credit in form of a tax refund of 95% of the net tax base with no limit.

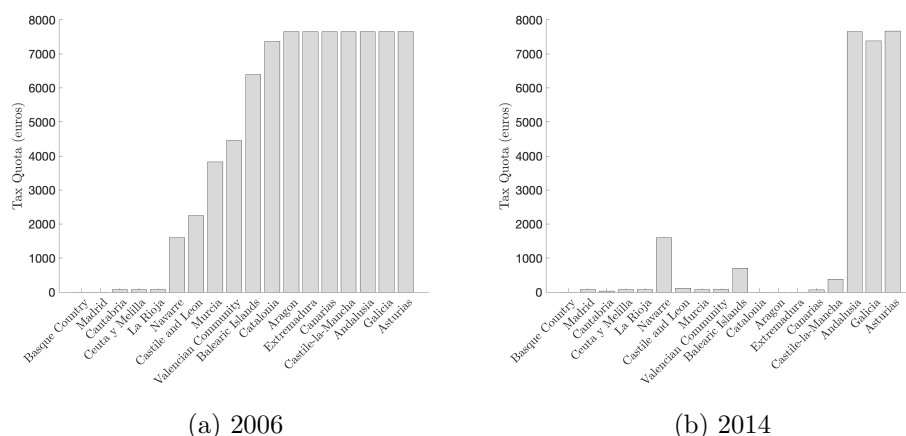
¹⁴Life insurance amounts and assets declared as cultural heritage have traditionally been subject to specific tax deductions. I do not consider life insurance-specific tax deductions as I cannot observe the pre-tax amount corresponding to this asset. To avoid not accounting for these discounts to become a potential source of bias in my estimates, I drop from the sample those inheritances including life insurance.

¹⁵An example: suppose region r has in place a 90% tax credit for close heirs and donees. This implies that these taxpayers will only have to pay 10% of their net tax base

¹⁶The scaling factor takes values between 1 to 1.20 under the default law and it is equal to 1 for close heirs and donees. Some regions changed the scaling factor to a number close to 0, which worked as an implicit tax credit. See Appendix A1.2 for more details

euros and 50,000 euros cash in 2006 and 2014, as an illustrative example. As can be inspected, the difference in tax quotas paid for the same inheritance across regions in 2006 could be as high as 8000 euros.

FIGURE 1.2 Regional Differences in Inheritance Tax Quota - Group (ii)



This figure depicts the inheritance tax quota to be paid by an heir (ascendant or descendant) inheriting the main dwelling valued at 150,000 euros and 50,000 euros cash by region in 2006 and 2014, respectively. The tax quota has been obtained by applying the inheritance tax calculator, which has been constructed using the information on tax reforms contained in the regional tax books published by the Spanish Ministry of Finance, as well as in the regional fiscal reports produced by the General Council of Spanish Economists.

Figure 1.3 presents the average effective inheritance and gift tax rate for heirs and donees of group (ii) by region and year. These average effective rates have been constructed by taking the average gross tax base value for each bracket and applying the corresponding general tax deductions and credits regulated at the regional level to obtain the corresponding tax quota and net tax base. The depicted average effective tax rates vary from 0.0% (0.0%) to 11.46% (12.8%) for inheritance (gift) tax showing substantial regional variation induced by the tax reforms regulated. As can be seen, the average trend in all Spanish regions has been to reduce the tax liabilities of this group. The cumulative reduction in both average effective tax rates has been sizable: the effective average inheritance and gift tax rates fell by 85% and 50% in 2019, respectively.

FIGURE 1.3 Average Effective Inheritance and Gift Tax Rate - Group (ii)

(a) Regional Inheritance Tax Rates

(b) Regional Gift Tax Rates

This figure depicts the average effective inheritance tax rate (Panel 1.3a) and gift tax rate (Panel 1.3b) for group (ii) for each of the 19 Spanish regions and year

This downward pattern in IG tax rates also masks important heterogeneity along the tax schedule. Figures B1.4 and B1.5 in the Appendix display average bracket-specific IG tax rates for each region and year. The heatmaps reveal a considerable degree of regional heterogeneity for middle-top and top tax brackets. As can be inspected, regional dispersion in the bottom brackets rates is lower than in the top brackets, mainly due to the timing of the introduction of the tax discounts, whereas differences between middle and top bracket rates are accounted by both the degree of the generosity of the tax discounts and the timing of their introduction.

1.3 Household Data

I use household-level data from the EFF survey between 2002 and 2018. This survey is conducted every two years by the Bank of Spain and provides rich information on households' wealth, income, consumption, and demographics. Note that, although the survey is actually conducted at triennial frequency, every wave contains household observations in two consecutive years leading to biannual information.¹⁷ To identify households in the survey who receive an inheritance, I exploit information on two survey questions. First, I use the information on the form and year of acquisition of real estate assets and business-related assets, which includes *inheritance* as a possible answer, as well as the percentage of the property owned by the household and their value at the time of the acquisition. Second, I use the information on the reception of an inheritance or gift from someone who does not currently belong to

¹⁷For example, the 2002 wave contains information on households surveyed in the years 2002 and 2003

the household.¹⁸ In case of a positive answer, households are additionally requested to report the actual pre-tax amount, the year of its reception as well as the type of assets involved (i.e. cash, land, real estate, etc.). I classify households as heirs whenever they report (i) the inheritance of real estate assets or/and business assets (ii) a cash transfer in form of inheritance or gift from someone who does not currently belong to the household in the same year. Next, I classify households as donees whenever they only report a cash transfer in form of inheritance or gift from someone who does not currently belong to the household. This disaggregated information allows me to better approximate the net tax base of each household for both inheritances and gifts, as inherited real estate and business assets have enjoyed generous tax discounts.¹⁹

The EFF has a panel dimension in which households might be included at most for four consecutive waves. This implies that heirs and donees are observed up to a maximum of 10 years with gaps²⁰. Since households are asked retrospectively, I construct an unbalanced panel of households that can be tracked for at least two consecutive waves and report the reception of one inheritance/gift within that period. Households reporting more than one inheritance or gift are excluded. Table 1.1 presents summary statistics for all inheritances and gifts. Spanish households receive around 58,000 euros on average in form of inheritances or gifts. This average goes up to almost 100,000 when considering only bequests in form of cash, real estate, and other assets. Table C1.1 provides net wealth descriptive statistics of heirs and donees at the year of the wealth transfer receipt along with the wealth distribution.

¹⁸Households have been asked retrospectively this question in the last four EFF waves. In the way the question is formulated, it does not differentiate between inheritances and gifts.

¹⁹The default law contemplates a tax credit for the main dwelling of the deceased person in form of a tax refund equal to the 95% of the tax base of this asset up to a 120,000 euros limit. Inherited business-related assets enjoy an unconditional tax credit in form of a tax refund equal to the 95% of the tax base of this asset

²⁰Notice that the household panel is unbalanced because households can be tracked between 2 and 4 consecutive waves. In addition, the survey is conducted at triennial frequency with each wave containing information from two consecutive years. This means that heirs can be observed up to 10 years before and up to 7 years after the inheritance or gift receipt with gaps. To be more precise, one period before/after the tax payment can be either 2, 3, or 4 years

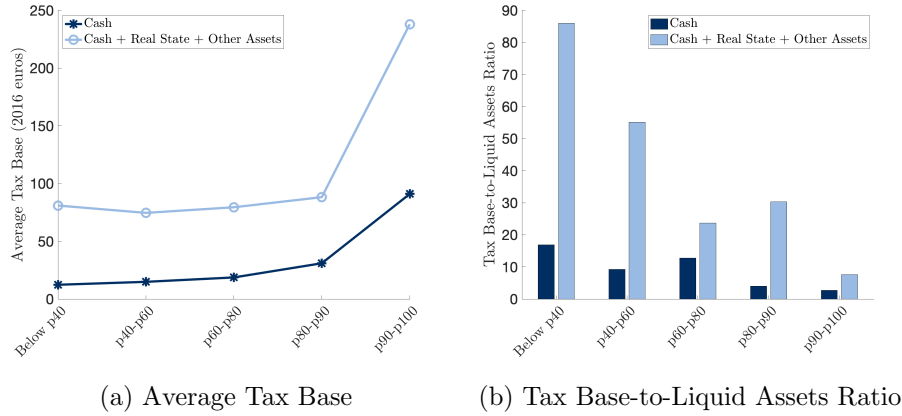
TABLE 1.1 Summary Statistics Inheritance and Gift Receipts

All Inheritance and Gifts						
	Mean	sd	Min.	Max.	N	# Obs
Bequest value	58.26	135.94	1.24	9979.74	530	1759
Bequest year	2009	4.29	2002	2018	530	1759
Gifts (cash transfers)						
Gift value	29.04	57.00	1.29	1038.82	270	887
Gift year	2009	4.30	2002	2018	270	887
Inheritance						
Inheritance value	99.76	193.00	1.24	9979.74	260	872
Inheritance year	2009	4.26	2002	2017	260	872

Bequest value is expressed in thousand euros and is CPI-adjusted to the year 2016. EFF survey weights are applied such that averages are representative of the Spanish population

To examine how the absolute and relative size of the tax base varies along the wealth distribution, Figure 1.4 plots the average tax base and its share out of households' liquid assets in the year of the bequest receipt for different net wealth percentiles. The tax base is constructed after applying the tax deductions applicable to housing and business-related assets, which have been roughly constant for all regions since the beginning of the period. For the sake of comparability with the Swedish study by Elinder et al. (2018), I include only heirs and donees with positive net wealth. Panel 1.4a depicts the average tax base along the wealth distribution. As expected, the average value of bequests increases as we move up in the net wealth distribution, particularly at the top. Conversely, the relative size of the tax burden with respect to household stock of liquid wealth follows the opposite pattern and becomes particularly large at the bottom of wealth distribution for inheritances (i.e. it amounts to 86 times households' stock of liquid wealth).²¹

²¹ Although the negative relationship between tax liabilities and the distribution of wealth of recipients is also present in Sweden (Elinder et al., 2018; Nekoei and Seim, 2022), the relative size of the tax liabilities with respect to household stock of gross wealth at the bottom in Spain is 6 which more than doubles the one in Sweden where it takes a value of 0.9.

FIGURE 1.4 Absolute and Relative Size of the Tax Base by Wealth Percentile

Wealth percentiles are constructed using net wealth. Panel 1.4a shows the average tax base (net of real assets and business assets tax deductions) in 2016 euros. Panel 1.4b shows the ratio of the tax base (net of real assets and business assets tax deductions) with respect to household stock liquid financial wealth in the year of the bequest receipt. Liquid assets include checking, savings accounts, and stocks. Only households with positive net wealth are considered. EFF survey weights are applied such that the reported values are representative of the Spanish population

1.3.1 Sample Selection

The survey is uninformative about the degree of kinship between the heirs/ donees and the deceased person/donor and thus, about the specific group of taxpayers to which heirs and donees belong to. By looking at heirs' and donees' characteristics, it can be ensured that no taxpayer belongs to group (i) in the sample as there is no one-person household reporting an inheritance or gift who is younger than 21. For the main analysis, I will assume that heirs and donees belong to group (ii) (i.e spouses, descendants, and descendants older than 21) as this group represented around 86% and 93% of the total inheritance and gift taxpayers in 2015, respectively.²²

Inheritance taxes are paid in the region of residence of the deceased person while taxes on gifts involving only cash are paid in the donees' region of residence. Therefore, for households receiving only cash transfers, I will input the gift effective tax rate in their region of residence while for households receiving inheritances, I will use the effective tax rate in their region of birth as a proxy for the region of residence of the deceased person. If households consist of couples at the time of the inheritance receipt, I only consider those households where both spouses were born in the same region. At any rate, this could pose a threat to the identification strategy if cash transfers are not gifts, given that inheritance and gifts are subject to different effective tax schedules for any group. To overcome this caveat, I will

²²Unfortunately, there is very scarce information about the distribution of taxpayers according to their group of kinship. The most updated official information on this matter can be found in Libro blanco sobre la reforma tributaria, 2022

consider cash transfers as inheritances and compute the corresponding tax rate as an exercise in the robustness check section.

1.4 Empirical Analysis

1.4.1 Identification Strategy

The variation in inheritance or gift tax rates paid by heirs and donees stems from the regional differences in bracket-specific tax reforms undertaken by local governments after the decentralization of the tax. To interpret the coefficient on the regional effective IG tax rate as the causal effect of the tax change on wealth mobility and household wealth and debt, there should not be other systematic regional factor driving both IG tax rates and outcome variables.

A concern when studying the effect of geographical differences in taxation is whether these regional tax changes are correlated with macroeconomic aggregates or regional government finances that could affect household outcomes (Cloyne and Surico, 2017). Appendix Table B1.2 presents the estimation results of separately regressing the average inheritance tax rate and gift tax rate on lags of unemployment, CPI, and GDP per capita controlling for year and region-fixed effects. Appendix Table B1.3 presents the estimation results of regressing the public expenditure per capita²³ and debt-to-GDP ratio on the average inheritance tax rate and gift tax rate. As can be inspected, changes in the inheritance and gift tax rates do not seem to be correlated with past macroeconomic aggregate conditions or local finances at the regional level. They are, however, correlated with the political orientation of the regional government. Appendix Table B1.4 reveals that there is a negative and significant statistical correlation between having a right-wing party in power and IG tax rates. Instead, Appendix Table B1.5 shows there is not a systematic difference in terms of economic performance or government spending between right-wing and left-wing regional governments. These results altogether suggest that while there seems to be politically-driven variation in IG taxes, they could be taken as exogenous to regional macroeconomic conditions influencing household wealth decisions and wealth mobility.

In contrast to wealth taxation, for which there is evidence of wealth-tax induced regional mobility of taxpayers (Brühlhart et al., 2019; Agrawal et al., 2020), selection into regional inheritance tax treatment does not represent a concern in this setting given the nature of death itself, the frequency of the tax changes, and the fact that inheritors in Spain pay taxes in the region of residence of the deceased person during the last 5 years prior to death. Moreover, gift-tax-induced regional mobility seems even less of a concern as gift taxes in the form of cash are filed in the region of

²³Public expenditures in health, schooling, and social protection programs.

residence of the donee.

1.4.2 Empirical Specification

To estimate the effect of IG taxation on heirs' and donees' wealth mobility and wealth and debt outcomes separately, I rely on an event-study strategy:

$$y_{irt} = \sum_{\substack{k=-3 \\ k \neq -1}}^2 \beta_k \cdot \mathbf{1}(k = t - t_{wi}) \times \tau_{ijrt=t_{wi}} + \zeta_i + \zeta_t + \nu_{irt}$$

where y_{irt} denotes the outcome variable of household i who pay taxes in region r in year t , $\mathbf{1}(k = t - t_{wi})$ are indicators for each event period k before and after the year of the inheritance/gift receipt, t_{wi} , $\tau_{ijrt=t_{wi}}$ is the average effective tax rate for household i with tax base corresponding to tax bracket j and paying taxes in the region r at time $t = t_{wi}$. The reference period is the last year each household is observed before it receives the inheritance or gift, $y = -1$, which is omitted.²⁴

Notice that since the inheritance tax system is progressive, the average effective tax rate will vary across households within a region-year for both inheritances and gifts. Household-fixed effects (ζ_i), as well as year-fixed effects (ζ_t), are included to account for any household-specific and time-varying shocks that might influence heirs and donees' wealth mobility and wealth. The event-study coefficients of interest are $\sum_{k=0}^3 \beta_k$, which recover the difference in wealth or mobility between those heirs or donees subject to a higher bracket-specific average tax rate and those subject to a lower one. Standard errors are robust to heteroskedasticity and clustered at the region-of-residence-bracket level for gift recipients and at the region-of-birth-bracket level for inheritance recipients, respectively.²⁵

1.5 Results

1.5.1 Wealth Mobility

I start by studying how Spanish IG taxation affects the wealth mobility of heirs and donees. To that end, I follow one of the most standard approaches to measure intragenerational wealth mobility (Jäntti and Jenkins, 2015; Bayaz et al., 2010; Elinder et al., 2018), which consists in comparing transition probabilities in the wealth distribution for heirs and donees before and after receiving an inheritance/gift. I partition the net wealth distribution of taxpayers into 10 percentiles and define nine

²⁴Recall that a period can be either 2, 3 or 4 years

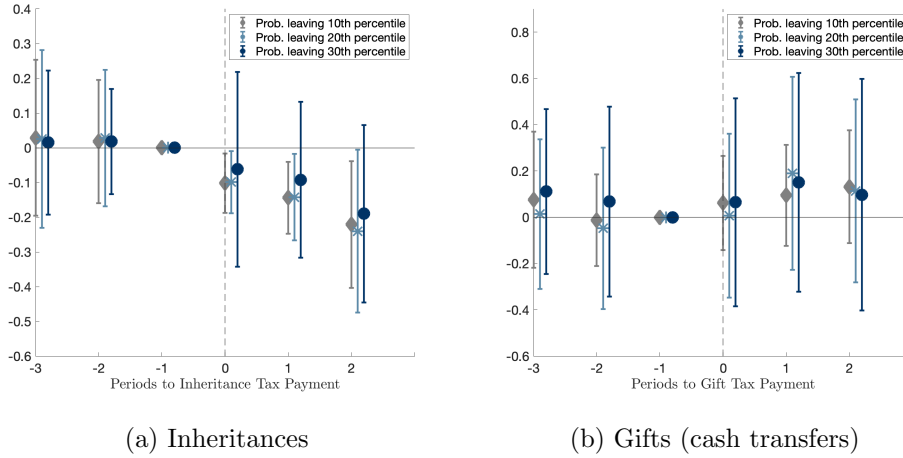
²⁵There are 19 regions \times 16 brackets = 304 clusters.

transition probabilities, each of them as the probability of moving upwards from the th percentile of the net wealth distribution of Spanish heirs and donees each year²⁶.

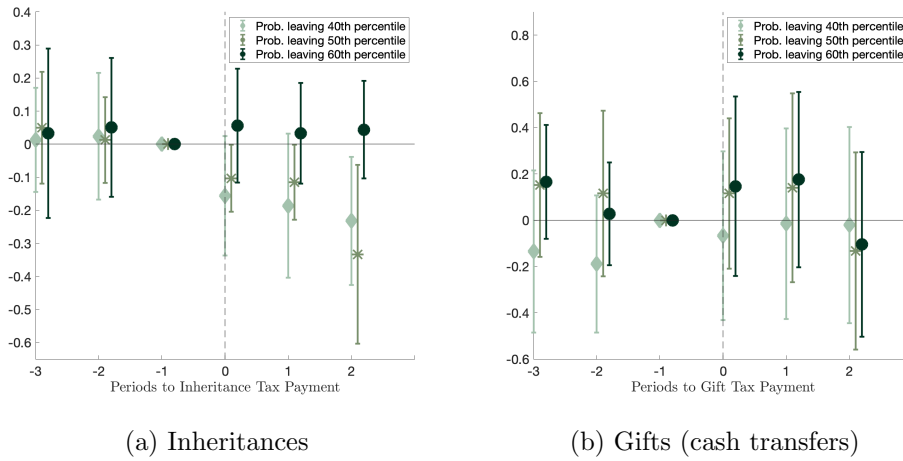
Figure 1.5-1.7 reports the estimated $\beta_k \times 100$ coefficients from Equation 2.4 when the dependent variable is the probability of moving upwards for inheritances and gifts recipients conditional on being at different parts of the net wealth distribution at the time of the bequest receipt. The estimated coefficients in the previous periods to receive the inheritance or gift are not statistically significant, supporting the existence of parallel trends in wealth mobility between households subject to different tax rates. The effects of higher inheritance taxes display a hump-shaped response along the net wealth distribution: while higher tax rates significantly and persistently decrease the wealth mobility of heirs below the 50th percentile (see Panels 1.5a-1.6a), this effect becomes statistically insignificant and close to zero for heirs belonging to the top of the wealth distribution (see Panel 1.7a). Specifically, a one percentage point increase in the inheritance tax rate reduces the probability of heirs at the 10th percentile moving upwards by 0.01%-0.22% in the period after the inheritance receipt (between 4 to 7 years after). The point estimates for heirs placed between the 20th-50th percentile at the time of the inheritance receipt are similar, with these ranging between 0.01% to 0.33%. In contrast, higher gift taxes on cash transfers do not seem to affect significantly wealth mobility at any part of the net wealth distribution (see Panels 1.5b-1.7b).

To be more precise in determining the magnitude of the wealth mobility effect of a rise in the inheritance tax rate, Table D1.1 presents the estimated coefficients of Equation 2.4 and the corresponding percentage change in the outcome variables. The latter is computed as the inheritance tax effect divided by the mean of the outcome variable one period before the tax payment. As can be inspected, the negative effect of an increase in inheritance taxes on bottom-wealth mobility is considerable. In particular, an increase in inheritance tax rates decreases the wealth mobility of heirs at the 10th percentile by 35% to 76% in the following years after the tax payment compared to their pre-inheritance average wealth mobility. These effects continue to be sizable for heirs at the 40th-50th percentiles, whose wealth mobility decreases between 17% to 56%.

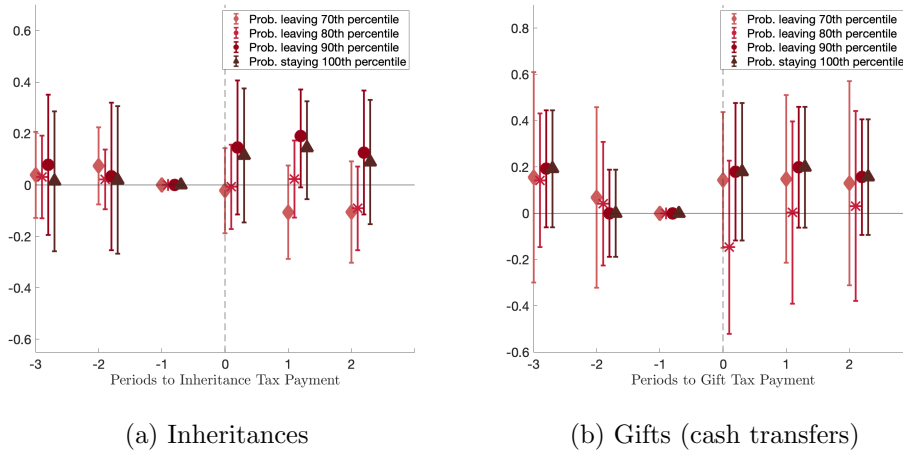
²⁶I use survey weights provided in the EFF to ensure households' rank position is representative of the Spanish population

FIGURE 1.5 Effect of Inheritance and Gift Taxes on Bottom-Wealth Mobility

This figure plots the event study estimates ($\hat{\beta}_k \times 100$) and corresponding 90 percent confidence bands of the specification of Equation 2.4. The dependent variable is the probability of moving upwards in the net wealth distribution for households at the 10th-30th net wealth percentile at the time of the bequest receipt. The treatment variable is the average bracket-specific effective tax rate. Standard errors are robust and clustered at the region-of-residence bracket level for donees and at the region-of-birth bracket level for heirs. Wealth transfers in form of only cash are assumed to be gifts.

FIGURE 1.6 Effect of Inheritance and Gift Taxes on Middle-Wealth Mobility

This figure plots the event study estimates ($\hat{\beta}_k \times 100$) and the corresponding 90 percent confidence bands of the specification of Equation 2.4. The dependent variable is the probability of moving upwards in the net wealth distribution for households at the 40th-60th net wealth percentile at the time of the bequest receipt. The treatment variable is the average bracket-specific effective tax rate. Standard errors are robust and clustered at the region-of-residence bracket level for donees and at the region-of-birth bracket level for heirs. Wealth transfers in form of only cash are assumed to be gifts.

FIGURE 1.7 Effect of Inheritance and Gift Taxes on Top-Wealth Mobility

This figure plots the event study estimates ($\hat{\beta}_k \times 100$) and the corresponding 90 percent confidence bands of the specification of Equation 2.4. The dependent variable is the probability of moving upwards in the net wealth distribution for households placed at the 70th-90th net wealth percentile and the probability of staying for households placed at the 100th net wealth percentile at the time of the bequest receipt. The treatment variable is the average bracket-specific effective tax rate. Standard errors are robust and clustered at the region-of-residence bracket level for donees and at the region-of-birth bracket level for heirs. Wealth transfers in form of only cash are assumed to be gifts.

1.5.2 Household Wealth and Debt

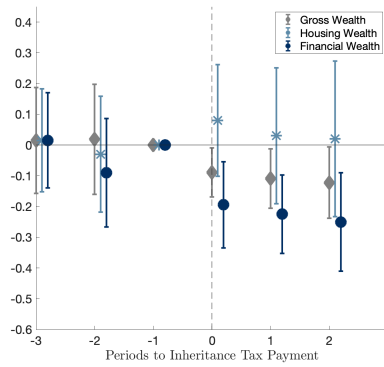
To better understand the empirical drivers behind these bottom-wealth mobility patterns, I investigate how inheritance taxes affect households' gross wealth and debt separately. The EFF survey distinguishes between households' types of wealth, such as financial or housing wealth. Financial wealth includes bank deposits, stocks, mutual funds as well as fixed-income securities, and private pension plans. The survey also disaggregates debt between mortgage-related debt and non-mortgage-related debt. The latter includes personal loans, credit lines, current account overdrafts, advances as well as loans from friends or family.

Figure 1.8 presents the estimated β_k coefficients when the dependent variables are (logged) gross wealth and their components (Panel 1.8a-1.8e) or debt-to-wealth ratios expressed in percentage terms (Panel 1.8b-1.8f) for different groups of households depending on their net wealth position before the inheritance receipt. All variables are CPI-adjusted to 2016 prices. First, the estimated coefficients in the previous periods before paying inheritance taxes are not significant, supporting the existence of parallel trends in household wealth and debt before the change in taxes. Panel 1.8a shows that a one percentage point increase in tax rates reduces gross wealth by 8.9-12.2 percent in the following years to the reception of inheritance for bottom-wealth households (i.e. those below the 40th percentile of the net wealth

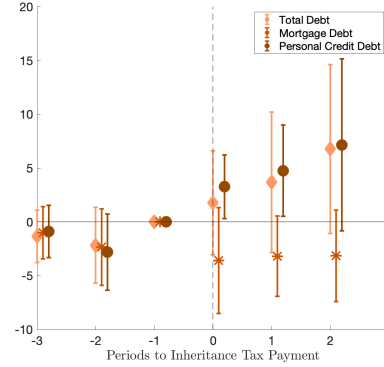
distribution). It is clear from this figure that the negative effect of inheritance taxation on gross wealth is mainly explained by its negative impact on financial wealth rather than housing wealth. Heirs subject to higher levels of taxation experience a reduction in financial wealth equal to 19.4-24.1 percent in the years following the reception of the inheritance in comparison to those subject to lower tax rates. In relative terms with respect to the pre-inheritance wealth averages, these point estimates imply a drop in gross wealth and financial wealth between 0.78-1.07 percent and 1.77-2.82 percent, respectively (see Table D1.2). Appendix Figure D1.1a shows that this decrease in financial wealth is explained mostly by a decrease in liquid financial wealth, that is, bank deposits and savings accounts.

In addition, Panel 1.8b shows this negative effect of inheritance taxes on less-wealthy heirs' gross wealth goes in parallel with a rise in personal credit debt. Specifically, a one percentage point increase in the inheritance tax rate rises bottom-wealth households' personal credit debt-to-wealth ratio between 3.2 to 7.1 percentage points in the years following the tax payment. The effect is statistically significant up to one period after the tax payment (i.e. between 2 to 4 years after). These point estimates imply an increase in the personal credit debt-to-wealth ratio between 3.9-8.6 percent in the years after the tax payments with respect to their pre-inheritance average ratio (see Table D1.2). Appendix Figure D1.1b plots the estimates for the sum of other types of debt such as credit lines, current account overdrafts, advances, and loans from relatives as a percentage of gross wealth. As can be inspected, higher taxes do not seem to affect significantly other types of debt holdings of households at the bottom of the wealth distribution.

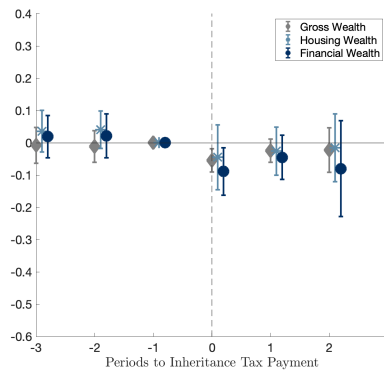
Panel 1.8c shows that middle-wealth households (i.e. those between the 40th and 70th percentiles of the net wealth distribution) subject to higher tax rates decrease also their total gross wealth on impact in comparison to those subject to lower tax rates. Again, this decrease in gross wealth is explained by a drop in financial wealth. Specifically, a one percentage point increase in tax rates decreases total gross wealth and financial wealth by 5.5 and 8.8 percent, respectively. In comparison with the bottom-wealth group, the negative effect of inheritance taxes on gross wealth is smaller in magnitude on impact and dissipates after one period. Moreover, middle-wealth households' debt does not react significantly to higher levels of taxation as shown in Panel 1.8d. Finally, results in Panel 1.8e and 1.8f suggest that higher tax rates seem to affect significantly neither top-wealth households' gross wealth nor debt at any point in time.

FIGURE 1.8 Effect of Inheritance Taxes on Household Wealth and Debt

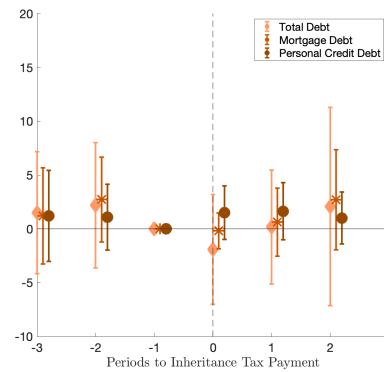
(a) Bottom-wealth households



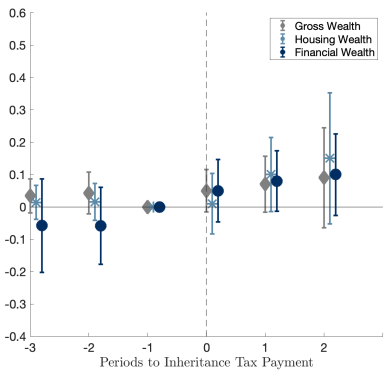
(b) Bottom-wealth households



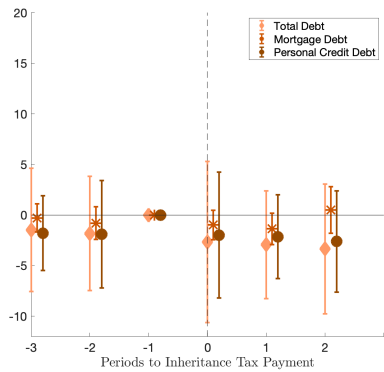
(c) Middle-wealth households



(d) Middle-wealth households



(e) Top-wealth households



(f) Top-wealth households

This figure plots the event study estimates ($\hat{\beta}_k$) and corresponding 90 percent confidence bands of the specification of Equation 2.4. Bottom-wealth households are between the 10th-40th percentile of the net wealth distribution, middle-wealth are those between the 40th-70th percentiles and top-wealth are those above the 70th percentile at the time of the inheritance receipt. The dependent variable in Panels 1.8a-1.8e is (logged) gross wealth, financial wealth, or housing wealth. The dependent variable in Panels 1.8b-1.8f total debt-to-wealth ratio, mortgage debt-to-wealth ratio, or personal credit debt-to-wealth ratio in percent. Financial wealth includes bank deposits, stocks, mutual funds, pension plans, and life insurance. Housing wealth includes real estate property. Standard errors are robust and clustered at the region-bracket level. The sample includes only heirs

1.5.3 Understanding the Effects of Inheritance Taxes on Bottom-Wealth Mobility

Liquidity constraints and restricted access to financial instruments. The results so far suggest that bottom-wealth households decrease their financial wealth and increase their non-mortgage debt when subject to higher levels of taxation, which translates into serious detrimental effects in terms of wealth mobility for these households. However, it is not straightforward that liquidity constraints necessarily induce an increase in personal credit debt at the time of the tax payment. One reasonable explanation relies on heirs' restricted access to financial instruments. First, the Spanish IG tax law makes the bank system liable for the tax liabilities on the deceased person's assets held by the bank (i.e bank accounts, shares, etc.) in case heirs do not make the tax payment on time.²⁷ As a result of this law mandate, the bank system freezes all assets of the deceased person on the same day of her death until heirs give proof of tax payment, which prevents heirs from using the liquid assets of the deceased person to meet the tax requirements. Second, the Spanish bank system does not allow heirs to put the yet-to-be-inherited real estate assets as collateral for loans. Thus, liquidity-constrained heirs have few options besides taking on personal credit debt to pay the tax liabilities. In addition to this limitation in terms of debt instrument availability, the Spanish IG tax law requires heirs to pay taxes in the next 6 months following the death event to obtain access to the deceased person's estate. If heirs fail to do so, the government gains ownership of all assets comprising the deceased person's estate. Heirs can ask for a tax moratorium of 6 extra months and/or tax installment in a maximum of 5 quotas. However, asking for a tax moratorium or installment entails additional costs in form of interest on late payment as the Treasury considers the tax payment within the extended time period as tax debt.²⁸ On top of that heirs would not gain full ownership rights over the deceased person's estate until the tax payment is completed. This limited access to financial instruments together with the short time window to pay the tax liabilities might force liquidity-constrained heirs to resort to personal debt to meet the tax payments when being subject to higher levels of inheritance taxation.

Illiquidity of inheritances and delays in selling inherited real estate property. Although the above-mentioned singularities of the Spanish IG tax system might translate into higher household debt on impact due to restricted access to financial instruments, it is less obvious why the detrimental effects of inheritance taxes on bottom-wealth mobility and personal credit debt persist over time. In combination with this channel, the illiquidity of inheritances and delays in selling inherited real estate property could help explain the lasting negative effect of taxes on

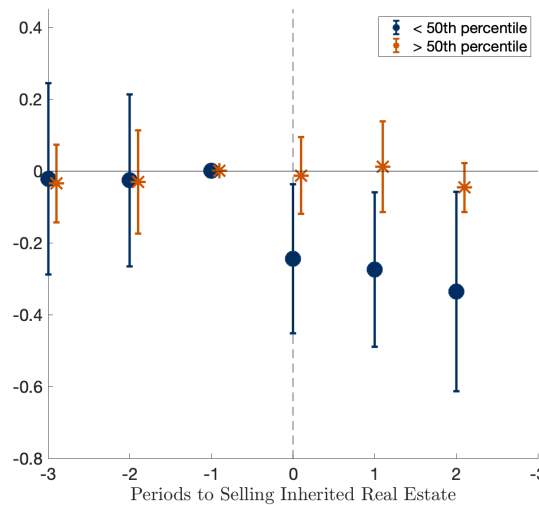
²⁷See: Ley 29/1987, de 18 de diciembre, del Impuesto sobre Sucesiones y Donaciones.

²⁸See Ley General Tributaria. If heirs ask for tax installment they have to additionally fulfill a collateral requirement with the Treasury. The annual interest on late payment has been on average 5% between 2002-2019

bottom-wealth mobility. First, a large proportion of households at the bottom tend to inherit real estate property as Spain features one of the highest homeownership rates at the bottom of the wealth distribution among OECD countries. In 2014, this rate was almost 30% for households below the 20th net wealth percentile compared to the 2% and 7% rates in France and Germany.²⁹ This higher homeownership rate at the left tail of the wealth distribution is also reflected in the composition of bequests for bottom-wealth households: 44% of the total bequests received by households below the 40th net wealth percentile include some form of real estate asset.³⁰

Having received real estate property as inheritances, delays in selling this property might help sustain the liquidity constraints of bottom-wealth households who take on personal credit debt at the time of the tax payment. To explore this channel, I first take a look at whether selling inherited housing is correlated with lower personal credit debt independently of the tax rates. Figure 1.9 shows that selling inherited real estate property decreases personal credit debt in the periods after the inheritance receipt for heirs below the median net wealth distribution. In contrast, no effect is found for heirs above the median.³¹

FIGURE 1.9 Effects of Selling Inherited Housing on Personal Credit Debt



This figure plots the event study estimates and corresponding 90 percent confidence bands of regressing log of personal credit debt on event dummies around the time of selling inherited real estate. The blue coefficients refer to the estimation in the sample of heirs below the median of the net wealth distribution at the time of selling inherited property while the orange coefficients refer to the sample of heirs above the median. Standard errors are robust and clustered at the household level. The sample includes only heirs receiving at least one residential real estate asset

²⁹Data from 2014 Household Survey of Consumer Finance (HCF) wave conducted by the ECB

³⁰See Appendix Table C1.2

³¹Because of sample size restrictions, I divide heirs into two groups (i.e. below and above the median net wealth). Note that I am only considering those heirs receiving at least one real estate asset as inheritance

Delays in selling the inherited real estate property might arise from market conditions, selling frictions due to shared ownership³², etc. To provide causal estimates of these delays, I exploit regional heterogeneity in tax-induced restrictions to sell the inherited dwellings together with the regional variation in effective tax rates. The Spanish IG tax system offers generous tax discounts for the main dwelling of the deceased person (i.e. 95% tax credit up to a limit of 120,000 euros) with the condition that heirs must keep this property for a certain amount of years. Heirs can sell the property before but they will have to give back the corresponding fiscal benefits to the Treasury and pay interest on late payments. The default law establishes a minimum period of 10 years although regions have reduced these time restrictions since the mid-2000s. Appendix Figure B1.6 shows the regional heterogeneity in tax-induced time restrictions to sell inherited housing. As can be inspected, this heterogeneity arises from regional governments reducing these time restrictions at different years and with different magnitudes. I estimate the following event-study specification:

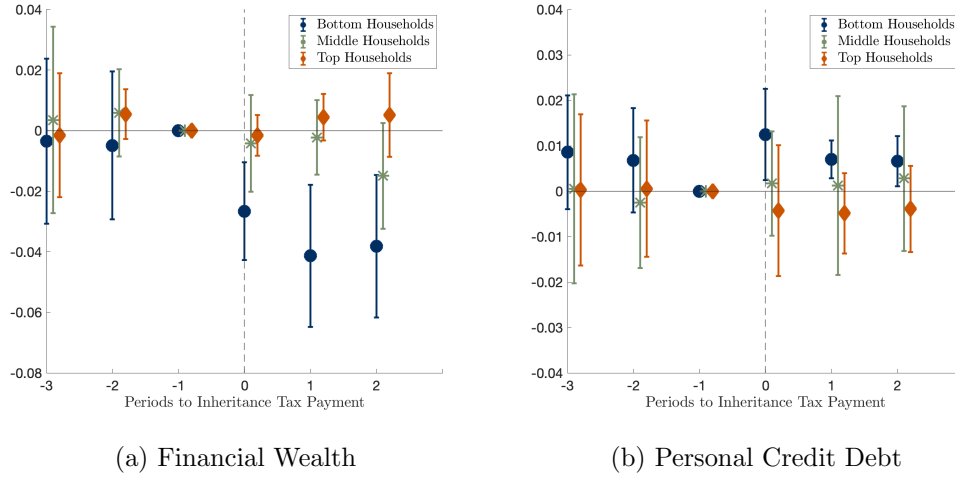
$$y_{irt} = \sum_{\substack{k=-3 \\ k \neq -1}}^2 \gamma_k \cdot \mathbf{1}(k = t - t_{wi}) \times \tau_{ijrt=t_{wi}} \times Z_{rt} + \zeta_i + \zeta_t + \nu_{irt}$$

where Z_{rt} is the time restriction to sell inherited housing without cost in region r in year t . The parameter γ estimates the additional impact of tax-induced restrictions to sell inherited dwelling on household wealth and debt for heirs subject to 1 percentage point higher tax rates.

Figure 1.10 presents the estimated γ coefficients in Equation 1.5.3 for bottom-wealth, middle-wealth, and top-wealth households when the dependent variable is financial wealth and personal credit debt-to-wealth ratio. The estimates in Panels 1.10a-1.10b suggest that longer tax-induced time restrictions to sell inherited dwellings increase the personal credit debt and decrease the financial wealth of less wealthy heirs subject to higher tax rates. This effect remains statistically significant up to 6 years after the tax payment. In contrast, these tax-induced time constraints do not seem to have any significant effect on wealthier heirs' personal credit debt and financial assets. In all, these results point to delays in selling inherited as a relevant factor in explaining the persistence of the effects of inheritance taxes on bottom-wealth mobility as they seem to prevent them from canceling their personal loans and improving their net wealth position earlier.

³²Heirs at the bottom tend to hold a lower percentage of ownership than heirs at the top, which might difficult the selling of the property. In the sample, heirs below the 40th net wealth percentile hold own 56% of the inherited property on average while heirs above the 90th net wealth percentile own 76%.

FIGURE 1.10 Effects of Tax-induced Restrictions To Sell Inherited Dwellings on Household Wealth and Debt



This figure plots the event study estimates ($\hat{\gamma}_k$) and corresponding 90 percent confidence bands of the specification of Equation 1.5.3. Bottom-wealth households are between the 10th-40th percentile of the net wealth distribution, middle-wealth are those between the 50th-70th percentiles and top-wealth are those between the 80th-100th percentile at the time of the inheritance receipt. The dependent variable in Panel 1.10a is (logged) total financial wealth while the dependent variable in 1.10b is the personal-credit-debt-to-wealth ratio. Financial wealth includes bank deposits, stocks, mutual funds, pension plans, and life insurance. Standard errors are robust and clustered at the region-bracket level. The sample includes only heirs

1.6 Robustness

1.6.1 Inherited Debt

In Spain, the deceased person's estate includes all assets and their associated liabilities. This implies that heirs become liable for all debts of the deceased person once they accept the inheritance and pay the corresponding taxes. Therefore, it could be that the effect of an increase in inheritance taxes on bottom-wealth heirs' personal credit debt is driven to bottom-wealth heirs inheriting systematically more personal credit debt in regions with higher taxation. Unfortunately, the survey does not provide information about inherited financial liabilities. Yet I explore this mechanism by investigating whether total debt and, in particular, personal credit debt holdings of old-age bottom-wealth households are systematically higher in regions with higher inheritance taxation. Appendix Table E1.1 suggests that the personal credit debt-to-wealth ratio of bottom-wealth households above 70 years old is not significantly higher in regions with traditionally higher levels of inheritance taxation.

1.6.2 Age Profile of Heirs

One possible concern is that the negative effect of inheritance taxes on bottom-wealth mobility is driven by a small group of young heirs who, for standard life-cycle reasons, have almost no wealth at the time of paying the tax liabilities and are forced to take on debt (Elinder et al., 2018). Appendix Tables E1.2 present the average age of heirs and the proportion of those younger than 40 along the wealth distribution. First, the average age for different net wealth percentiles clearly suggests that less wealthy heirs are not significantly younger than wealthier ones. Second, although the percentage of younger heirs at the bottom of the wealth distribution is higher than at the top, it only represents 22% of total heirs below the 40th percentile of the net wealth distribution. This percentage remains above 14% up to the 80th percentile of the net wealth distribution. In all, this descriptive evidence suggests that young heirs do not seem to be an important driver of the estimated wealth mobility effects of inheritance taxes.

1.6.3 Cash Transfers as Inheritances

So far I have assumed that households receiving bequests in form of cash are donees and hence they file taxes in their region of residence which is observed in the survey. If these cash transfers turn out to be inheritances, this could pose a threat to the identification strategy as households should be paying taxes in the region of residence of the deceased person, and gifts and inheritances are subject to different tax rates. To overcome this caveat, I assume these cash transfers to be inheritances and input the corresponding effective tax rates. Appendix Figure E1.1 shows that the estimates are similar to the ones in Panels 1.5b-1.7b. In all, these results suggest that higher wealth transfer taxes do not significantly affect wealth mobility as long as these entail only cash, highlighting the liquidity dimension of inheritances as an important factor in explaining the wealth mobility effects of inheritance taxation.

1.6.4 Rejected Inheritances

In Spain, heirs have the right to reject inheritances. The inheritance rejection rate amounts to 9.01% between 2007-2019³³, which is a non-negligible number. Figure E1.4 presents the correlation between the regional average effective inheritance tax rate and the rejection rate for both bottom tax brackets and top tax brackets. As it is shown in Panel E1.4a, there is a weak positive correlation between the average tax rates for bottom brackets and the percentage of rejected inheritances. If we were to extrapolate the effects of inheritances taxes on heirs' wealth mobility to the whole Spanish population, this suggestive evidence points towards inheritance taxes

³³Data from Consejo General de Notariado

having even more sizable effects on wealth mobility at the bottom of the wealth distribution.

1.6.5 Alternative Specifications

This section explores whether the results are robust to alternative treatment definition. One possible concern is that differences in the asset composition of inheritances along the wealth distribution influence how inheritance taxation affects wealth mobility and household wealth and debt responses as some fiscal benefits have been specific to the type of asset inherited. For instance, middle and top-wealth heirs tend to inherit more business assets, which have enjoyed generous tax credits during the sample period considered, compared to bottom-wealth heirs (See Figure C1.1). To account for this I estimate Equation 2.4 and use the value of net-of-tax inheritance as the treatment variable. Appendix Figures E1.2-E1.3 present the estimates for wealth mobility and household wealth and debt for different groups of heirs when using this alternative definition of treatment variable. As can be inspected, the main results survive this alternative definition of treatment.

1.6.6 Other Confounding Factors

Finally, the last concern is whether other types of wealth taxation may confound the inference drawn about the effect of inheritance taxes on household wealth and debt and wealth mobility. Although there is also substantial regional variation in wealth tax rates across Spanish regions as the regulation of this tax was also decentralized in 1998, wealth tax filers in Spain belong to the top 1% of the wealth distribution.³⁴ Therefore, the average impact of the wealth tax on the whole wealth distribution would thus be too small to become a meaningful confounder. In contrast, I cannot rule out that the capital gains tax on urban real estate property (*Impuesto sobre el Incremento de Valor de los Terrenos de Naturaleza Urbana*) can represent a relevant confounder in this setting. In Spain, real estate property received as inheritance must pay a capital gain tax which varies at the municipality level. If any, the estimated effects of inheritance taxes on household wealth outcomes would represent an upper bound as they could be reflecting the effect of this additional tax.

³⁴(Agrawal et al., 2020) report that wealth tax filers amounted to 2.7% of the total Spanish adult population in 2007. This percentage decreased to approximately 0.5% of the 2015 adult population.

1.7 Conclusion

Understanding the empirical effects of inheritance and gift taxation on wealth mobility is at the heart of the current debate about how taxing transferred wealth could improve equality of opportunity. Although wealth mobility is not equivalent to wealth inequality, there are strong reasons why we should care about how wealth transfer taxation influences the wealth position of households within the wealth distribution. Using Spain as a laboratory, I document that higher inheritance taxes reduce upward wealth mobility at the lower part of wealth distribution through lower financial wealth and higher non-mortgage debt of bottom-wealth recipients. While liquidity constraints and restricted access to financial instruments help explain this negative impact effect at the time of the bequest receipt, illiquidity of inheritances and delays in selling real estate property help rationalize the persistence of the negative effects as the latter might prevent bottom-wealth households from canceling their personal debt, and therefore, improve their net wealth position earlier. The Spanish Inheritance and Gift Tax law contemplates the use of scaling factors depending on the pre-inheritance wealth of heirs. However, these scaling factors have almost always been equal to 1 for close heirs and donees, who represent the majority of taxpayers and have been barely changed by regional governments in a way to control for pre-inheritance differences in wealth among taxpayers. From a more policy-oriented perspective, investigating how the design of the tax could release the tax burden of liquidity-constraint households by taking into account the pre-inheritance wealth of recipients is in my current research agenda.

A1 Appendix A to Chapter 1

A1.1 Inheritance and Gift Tax in Navarre and Basque Country

The Spanish Constitution passed in 1987 conceded complete fiscal autonomy to Navarre and Basque Country (the *Foral* territories), that is, recognized the legal capacity of these regions to regulate and manage their taxes independently.

Basque Country's fiscal system is composed of three different and independent fiscal authorities, each of them belonging to each provincial government (known as *diputaciones forales*). The *Foral* treasuries of Álava, Bizkaia and Gipuzkoa enjoy a high degree of fiscal regulatory power and are in charge of the collection of their own taxes. The first law regulating the general aspects of the inheritance and gift tax system in Gipuzkoa was introduced in 1987 (Foral norm 5/1987) while Alava and Bizkaia introduced theirs two years later in 1989 (Foral Norm 25/1989 and Foral Norm 2/1989). Navarre's first inheritance and gift tax framework was properly introduced in 2002 (Foral Law 3/2002)

Differently from the rest of the regions, the information about the tax reforms undertaken in Navarre and Basque Country is not included in the regional tax books from the Spanish Ministry of Finance. Therefore, I have relied on the regional fiscal reports provided by the Spanish General Council of Economists and the official tax codes published by the regional governments to collect this information. Table A1.1 summarizes the years in which the *Foral* territories legislated a tax reform and the corresponding information sources.

TABLE A1.1 Tax reforms and data sources

Year of Implementation		Data Source
Basque Country		
Alava	2012,2014	Spanish Council of General Economists, Foral Norm 18/2011
Bizkaia	2012,2014	Spanish Council of General Economists, Foral Norm 1/2012
Gipuzkoa	2012, 2014	Spanish Council of General Economists Foral Norm 5/2011, Foral Norm 1/2014
Navarra	2018	Spanish Council of General Economists, Foral Norm 16/2017

The inheritance and gift tax legal framework in the Foral territories shares common features with the one in force for the rest of Spanish regions. The tax systems designed by the Basque and Navarre treasuries established 9 and 13 tax brackets³⁵, respectively, which is a smaller number compared to the national rule, and a different progressive tax schedule depending on the degree of kinship between the heir

³⁵Alava and Bizkaia have the same tax bracket bounds, which slightly differ from the ones regulated in Gipuzkoa

(grantee) and the deceased person (donor)³⁶. In general, the progressivity of the tax schedule for more distant heirs in these regions has been higher than the default for the rest of Spain. In contrast, gifts and inheritances of close heirs and donees (spouses and direct ascendants and descendants) have been traditionally subject to a very low tax rate in these regions: they were exempted in the whole Basque country until mid-2012 and subject to a flat rate of 0.8% in Navarre until 2017. In terms of tax deductions and credits, the fiscal authorities in Basque Country have regulated various tax discounts for different groups of heirs and donees. These have been traditionally more generous on average in Gipuzkoa compared to Alava and Bizkaia for more distant heirs (i.e. Gipuzkoa has had in force a tax deduction of 8000 for heirs of group (iv)) but less so for close heirs. Navarre introduced a tax deduction of 250,000 euros for close heirs for the first time in 2018.

A1.2 Constructing Regional Average Effective Tax Rates

Using the information on tax regulation changes contained in Tables A1.6-A1.9, I first apply each household's pre-tax base tb_j the corresponding business assets and main-dwelling specific tax credits and obtain \hat{b}_j . Next, I calculate the average effective tax rate corresponding to tax base \hat{b}_j in bracket j in the region r at time t as follows:

$$\bar{\tau}_{jrt}^{E,i} = \left(\frac{q_{jr} + (\bar{tb}_j - td_{jrt}^i - tb_j^{lb}) \times \tau_{jrt}}{\bar{tb}_j - td_{jrt}^i} \right) \times (1 - tc_{jrt}^i) \times SF_{rt} \quad i \in \{H, G\} \quad j \in \{1, \dots, 16\}$$

where \bar{tb}_j refers to the average tax base in bracket j , tb_j^{lb} denotes the lower bound of tax bracket j , and SF_{rt} refers to the scaling factor which depends on heirs or donees' pre-bequest wealth.

Whenever there is a change in tax regulation in the middle of the year, the average effective tax schedule is computed as a monthly weighted mean. For instance, Galicia introduced a tax credit of 100% for tax bases lower than 125,000 euros as well as simplified the marginal tax for heirs of group (ii) in June 2008. Therefore, the average effective tax rate for heirs of group (ii) in Galicia in the year 2008 is computed as:

$$\bar{\tau}_{i,2008}^H = \bar{\tau}_{i,2007}^H \times \frac{5}{12} + \tilde{\tau}_{i,2008}^H \times \frac{7}{12} \quad i \in \{1, \dots, 16\}$$

where $\tilde{\tau}_{i,2008}^H$ is the average effective tax rate for each bracket i that considers the tax discounts and new tax schedule introduced in June 2008.

³⁶The definition of groups of heirs and donees by degree of kinship in these regions also varies with respect to the national law. In Basque Country, group (i) and (ii) include taxpayers qualified as belonging to group (iii) in the national law. The same applies to group (iii) in this region with respect to group (iv) in the national law. Navarre's inheritance and gift tax system does not define groups but directly refers to degrees of kinship

A group of regions introduced implicit tax credits by reducing the scaling factors with respect to the default rule. For example, Cantabria reduced the scaling factor (ϕ) for heirs of group (i) and (ii) in 2003 from 1-1.4 to 0.02-0.04, which implied a tax credit ranging between 97% and 99% as computed in de La Fuente et al. (2018). The regions that used the scaling factors as a tool to diminish the tax liabilities of close heirs are gathered in Table A1.2 and the corresponding implicit tax credits in Table A1.3, respectively. For the regions and years that reduced the scaling factor with respect to the national rule, I use the average implicit tax credit.

TABLE A1.2 Reduction in the scaling factor - Regions

Region	Group	Default ϕ	New ϕ	Years in force
Cantabria	(i),(ii)	1-1.2	0.01-0.04	2003-2009
Asturias	(i)	1-1.2	0.01-0.04	2004-2018
Galicia	(i)	1-1.2	0.01-0.04	2004-2008

TABLE A1.3 Reduction in the scaling factor and Implicit Tax Credit - Groups (i) and (ii)

Pre-inheritance wealth	Change SF	Default SF	Implicit tax credit
0-400k	0.01	1	99.00%
400k-2M	0.02	1.05	98.10%
2M-4M	0.03	1.10	97.27%
> 4M	0.04	1.20	96.67%
Average			97.76%

Finally, some regions introduced tax credits that applied to a specific group of taxpayers within a group. In these particular cases, I follow de La Fuente et al. (2018) and compute the average tax credit taking into account the weight of each group of taxpayers in the tax base of the region. For example, Catalonia in 2014 regulated an unconditional tax credit of 99% for spouses while introducing a progressive tax credit for ascendants and descendants:

TABLE A1.4 Tax Credit for Ascendants and Descendants - Catalonia 2014

	Tax credit	Weight Taxpayers*	Average Tax Credit
< 100k	99%	16.91%	16.74%
100-200k	98%	16.33%	16.00%
200-300k	97%	9.73%	9.44%
300-500k	94.20%	12.19%	11.49%
500-750k	89.47%	10.81%	9.67%
750k-1M	84.60%	8.33%	7.05%
1-1.5M	76.40%	6.17%	4.72%
1.5-2M	69.8%	6.17%	4.31%
2-2.5M	63.84%	6.17%	3.94%
2.5-3M	55.37%	6.17%	3.54%
> 3M	30%	1%	0.30%
Average			70.46%

* These weights are taken from a report of Grupo de Trabajo sobre Imposición Patrimonial de la Comisión Mixta de Coordinación de la Gestión Tributaria (CMCGT, 2007). See de La Fuente et al. (2018) for more details

TABLE A1.5 Taxpayers weights, heirs group (ii) - Catalonia 2014

	Weight Tax Payers*
Spouses	23.42%
Ascendants, descendants	76.58%

*These weights are taken from a report of Grupo de Trabajo sobre Imposición Patrimonial de la Comisión Mixta de Coordinación de la Gestión Tributaria (CMCGT, 2007). See de La Fuente et al. (2018) for more details

The average net tax rate for heirs of group (ii) would be computed as:

$$\bar{\tau}_{i,2,2014}^H = \bar{\tau}_{i,2,2014}^{H,Default} \times \underbrace{(1 - 0.99)}_{\text{spouses' tax credit}} \times \underbrace{0.2342}_{\text{spouses' weight}} + \bar{\tau}_{i,2,2014}^{H,Default} \times \underbrace{(1 - 0.7046)}_{\text{others' tax credit}} \times \underbrace{0.7658}_{\text{others' weight}} \quad \forall i$$

TABLE A1.6 Tax Credits and Deductions for Heirs - Group (ii)

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Andalucia			td 100% if tb<125k				td 100% if tb<175k td 100% max 150k		
Aragon									tc 100% if tb<150k
Asturias						tc 100% if tb<125k			
Balearic Islands				td 25k		tc such that $\tau = 1\%$			
Canary Islands				td 18.5k	tc 99.9%				
Cantabria		tc 97-99%*							tc 90-99%
Castile and Leon				td 30k	td 60k	tc 99%			
Castile la Mancha							tc 95%		
Catalonia	td 18k								td 150-500k tc 25%,50% + own τ
Valencian Community				td 25k	td 40k	tc 99%			
Extremadure									
Galicia							0/ tc 100% if tb<125k + own τ	tc 100% if tb<125k + own τ	
Madrid				td 50k	td 100k	tc 99%			
Murcia				tc 25% if tb<300k	tc 50% if tb<300k	tc 99% if tb<450k	tc 99% max 450k		
Navarre									
Basque Country									
La Rioja			tc 99%						
Ceuta and Melilla									

td = tax deduction; tc = tax credit; tb = tax base; own τ = regional tax schedule; *Implicit tax credit. The information on tax reforms has been retrieved from the regional tax books from the Spanish Ministry of Finance and from the regional fiscal reports produced by the General Council of Spanish Economists

TABLE A1.7 Tax Credits and Deductions for Heirs - Group (ii)

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Andalucia							td 100% if tb<250k max 200K if 250k<tb<350k	td 100% max 1M	td 100% max 1M / tc 99%
Aragon		tc 20% or td 100% max 150k	tc 33% or td 100% max 150k	tc 50% or td 100% max 150k	tc 65% or td 100% max 150k	td 100% max 150k		td 100k max 500k	
Asturias							tc 100% if tb<200k / tb<300k + own τ	tb<300k + own τ	
Balearic Islands						td 25k + own τ			
Canary Islands		tc 99% / td 20-40k	td 20-40k			tc 99%			
Cantabria		tc 99%							
Castile and Leon			td 175k					td 50k	tc 100% if tb<100k
Castile la Mancha						td 175k/ td 250k tc 95% / tc 80-100%	td 250k/ td 300k	tc 90% if tb>100k td 400k	tc 100%
Catalonia	tc 99% + own τ			tc 99% / td 50-100k + tc 20-99%; 99% if spouse + own τ	td 50-100k + tc 20-99%; 99% if spouse + own τ				
Valencian Community			tc 99%/ td 100k + tc 75%	td 100k + tc 75%			td 100k + tc 50%		
Extremadure	td 100% max 175k if inher<600k				tc 90-99% if tb<600k	td 400k + own τ		tc 99%	
Galicia									
Madrid		tc 99% max 450k/ tc 99% if tb <300k		default / tc 50%	tc 50%	tc 60%	tc 99%		
Murcia									
Navarre									
Basque Country		exempt/ td 400k, 220k + own τ	td 400k, 220k + own τ *		td 400k + own τ			td 250k spouse + own τ	
La Rioja						tc 98%-99%			
Ceuta and Melilla									

td = tax deduction; tc = tax credit; tb = tax base; own τ = regional tax schedule; *400K in Alava and Bizkaia, 220k in Gipuzkoa

TABLE A1.8 Tax Credits and Deductions for donees - Group (i) and (ii)

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Andalucia									
Aragon								tc 100% if tb<300k	
Asturias									
Balearic Islands						td such that net $\tau = 7\%$			
Canary Islands							tc 99.9%		
Cantabria									
Castile and Leon							tc 99%		
Castile la Mancha							tc 95%		
Catalonia								own τ	
Valencian Community					td 40k g (ii) tc 99% if tb<420k g (i)	tc 99% if tb<420k g (ii)			
Extremadure									
Galicia								own τ	
Madrid					tc 99%				
Murcia									
Navarre									
Basque Country									
La Rioja									
Ceuta and Melilla									

td = tax deduction; tc = tax credit; tb = tax base; own τ = regional tax schedule. The tax discounts in bold are the ones that coincided with the ones introduced for heirs of group (ii). The information on tax reforms has been retrieved from the regional tax books from the Spanish Ministry of Finance and from the regional fiscal reports produced by the General Council of Spanish Economists

TABLE A1.9 Tax Credits and Deductions for donees - Group (i) and (ii)

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Andalucia									
Aragon				tc 50%	tc 65%	tc 65% if tb<75k			
Asturias									
Balearic Islands									
Canary Islands			default			tc 99.9%			tc 100%
Cantabria									
Castile and Leon			default						
Castile la Mancha							tc 95% if tb<120k tc 90% if tb 120-240k tc 85% if tb>240k		
Catalonia									
Valencian Community				tc 75 % if tb<150k					
Extremadure									
Galicia									
Madrid									
Murcia							tc 60%	tc 99% td 250k spouse + own τ	
Navarre									
Basque Country		exempt/ td 400k, 220k + own τ	td 400k, 220k + own τ		td 400k + own τ				tc 99% if tb<500k tc 98% if tb>500k
La Rioja									
Ceuta and Melilla									

td = tax deduction; tc = tax credit; tb = tax base; own τ = regional tax schedule. The tax discounts in bold are the same ones for heirs of group (ii). The information on tax reforms has been retrieved from the regional tax books from the Spanish Ministry of Finance and from the regional fiscal reports produced by the General Council of Spanish Economists

B1 Appendix B to Chapter 1

B1.1 Additional Figures and Tables

FIGURE B1.1 Number of Inheritance and Gift Tax Reforms by Year - Group (ii)

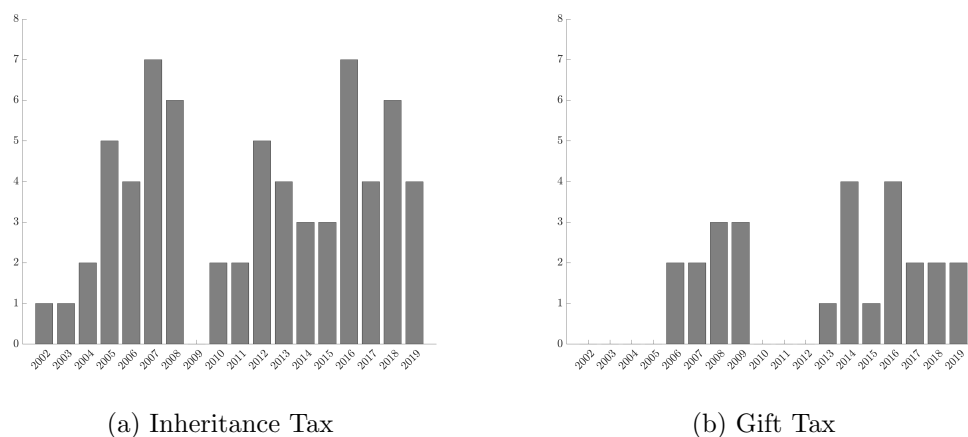
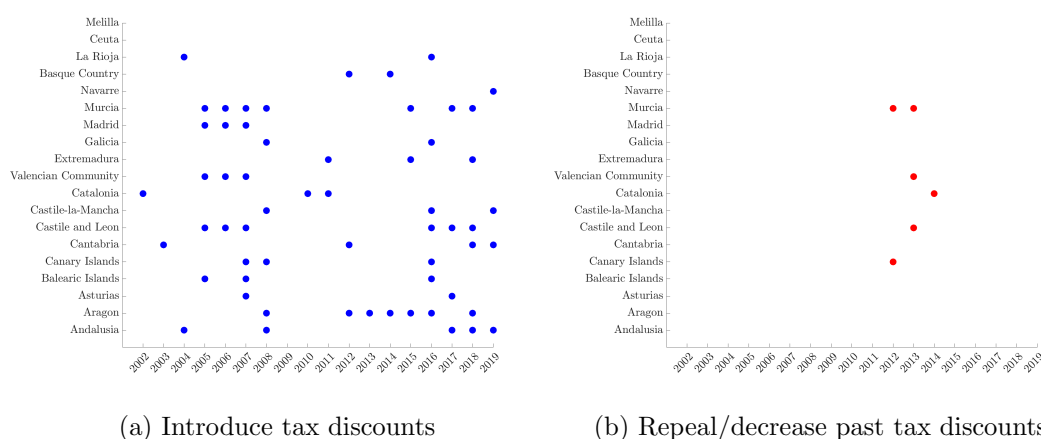


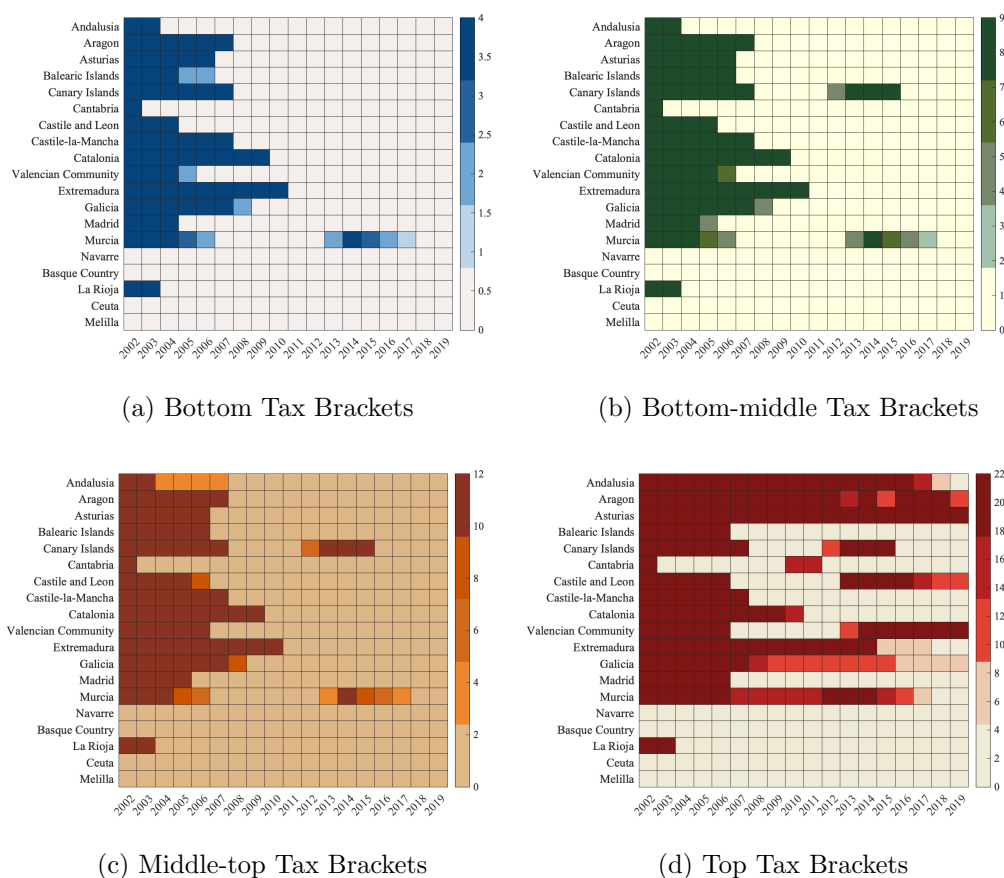
FIGURE B1.2 Regional Inheritance Tax Reforms by Type - Group (ii)



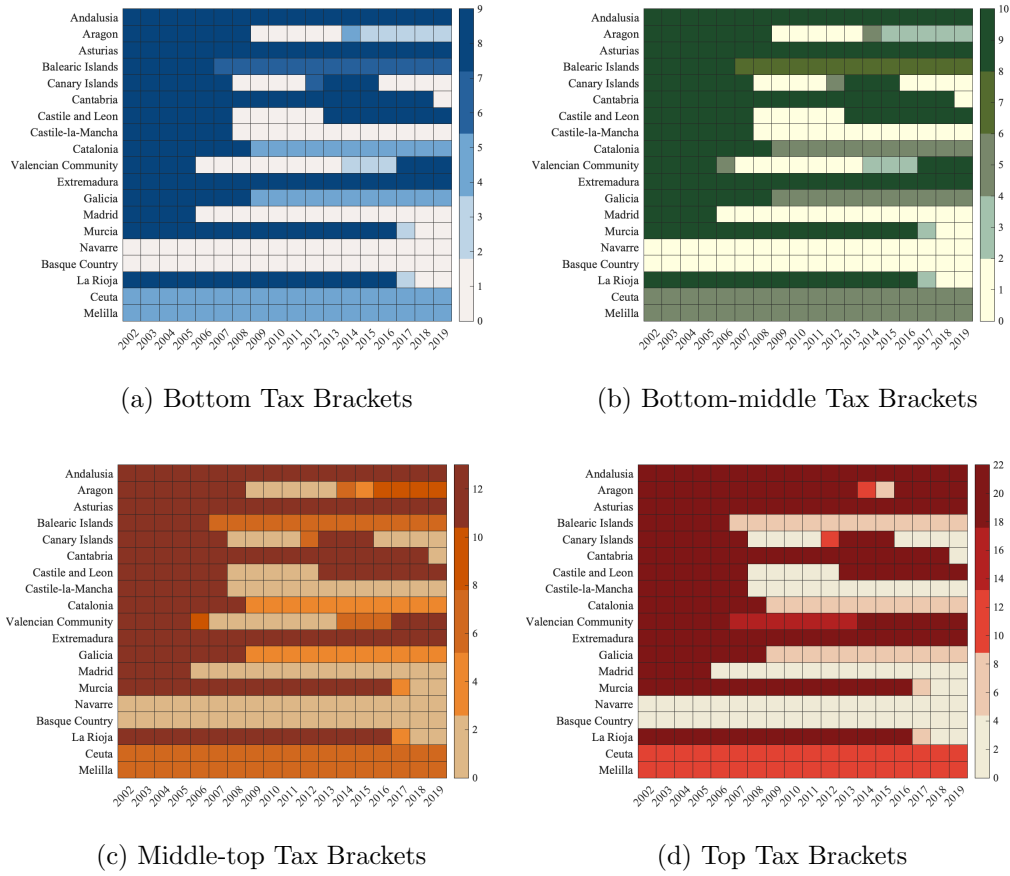
This figure depicts the years for which each Spanish region introduced a different inheritance tax credit or/and tax deduction for heirs of group (ii) (i.e descendants older than 21, ascendants and spouses). Panel B1.2a presents those tax changes that implied the introduction of an actual tax credit/deduction by region and year while Panel B1.2a shows those changes that involved a large reduction in past tax discounts or their repeal. These figures have been constructed using the inheritance tax regulation contained in the regional tax books published by the Spanish Ministry of Finance and in the regional fiscal reports produced by the General Council of Spanish Economists.

FIGURE B1.3 Regional Gift Tax Reforms by Type - Group (ii)

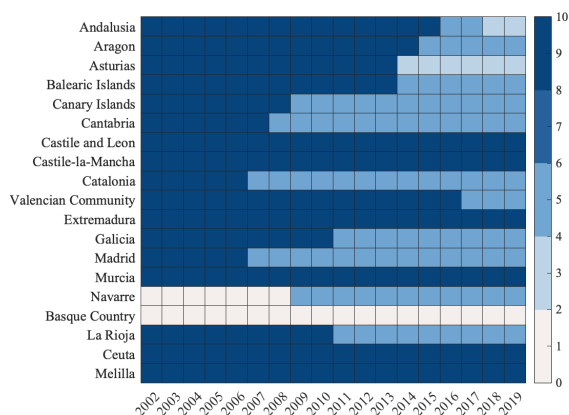
This figure depicts the years for which each Spanish region introduced a different inheritance tax credit or/and tax deduction for donees of (ii) (i.e. ascendants, descendants older than 21 and spouses). Panel B1.3a presents those tax changes that implied the introduction of an actual tax credit/deduction by region and year while Panel B1.3b shows those changes that involved a large reduction in past tax discounts or their repeal. These figures have been constructed using the inheritance tax regulation contained in the regional tax books published by the Spanish Ministry of Finance and in the regional fiscal reports produced by the General Council of Spanish Economists.

FIGURE B1.4 Average Effective Inheritance Tax Rate across Regions - Group (ii)

This figure depicts the average effective inheritance tax rate by bracket for group (ii) in all Spanish regions in 2013. *Bottom brackets* range from 0 to 32,000 euros, *bottom-middle brackets* from 32,000 to 64,000 euros, *middle-top brackets* from 64,000 to 160,000 euros and *top brackets* from 160,000 euros on

FIGURE B1.5 Average Effective Gift Tax Rate across Regions - Group (ii)

This figure depicts the average effective gift tax rate by bracket for group (ii) in all Spanish regions. *Bottom brackets* range from 0 to 32,000 euros, *bottom-middle brackets* from 32,000 to 64,000 euros, *middle-top brackets* from 64,000 to 160,000 euros and *top brackets* from 160,000 euros on

FIGURE B1.6 Regional Heterogeneity in Tax-induced Time Restrictions to Sell The Inherited Main Dwelling

This heatmap shows the heterogeneity in the number of mandatory years that heirs need to keep the inherited main dwelling of the deceased person to avoid giving back to the Treasury the fiscal benefits applicable to this asset.

TABLE B1.1 Average Variation in Inheritance and Gift Tax - Group (ii)

	Avg. Var.	Median Var.	Std. Dev	Average Rate in 2002
Inheritance Tax	-0.46	-0.59	0.02	9.10%
Bottom Tax Brackets	-0.18	-0.23	0.01	3.12%
Bottom-middle Tax Brackets	-0.41	-0.52	0.02	7.11%
Middle-top Tax Brackets	-0.51	-0.66	0.02	9.00%
Top Tax Brackets	-0.76	-1.05	0.04	17.15%
Gift Tax	-0.32	0.00	0.02	10.98%
Bottom Tax Brackets	-0.20	0.00	0.02	6.92%
Bottom-middle Tax Brackets	-0.27	0.00	0.02	8.64%
Middle-top Tax Brackets	-0.30	0.00	0.02	10.23%
Top Tax Brackets	-0.53	0.00	0.04	18.49%

TABLE B1.2 Regional Inheritance and Gift Taxation and Macroeconomic Aggregates

	(1) ATR Inheritance	(2) ATR Gift
GDP pc _{t-1}	-0.000 (0.000)	0.000 (0.000)
UR _{t-1}	-0.003 (0.003)	-0.001 (0.001)
CPI _{t-1}	-0.015 (0.014)	-0.006 (0.009)
GDP pc _{t-2}	0.000 (0.000)	-0.000 (0.000)
UR _{t-2}	0.001 (0.001)	0.000 (0.001)
CPI _{t-2}	0.015 (0.009)	0.005 (0.009)
Region FE	Yes	Yes
Year FE	Yes	Yes
Observations	272	272

TABLE B1.3 Regional Inheritance and Gift Taxation and Regional Public Finances

	(1) Public Expenditure pc	(2) Public Expenditure pc	(1) Debt-to-GDP	(2) Debt-to-GDP
ATR Inheritance	0.183 (0.124)		-6.435 (10.836)	
ATR Gift		0.204 (0.151)		-1.829 (14.074)
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	170	170	272	272

Public Expenditure pc refers to regional public expenditure in health, education, and social protection per capita. Data series have been retrieved from IVIE.

TABLE B1.4 Regional Inheritance and Gift Taxation and Political Orientation

	ATR Inheritance	ATR Gift	ATR Inheritance	ATR Gift
Right-wing party (dummy)	-0.020* (0.011)	-0.022*** (0.007)	-0.024** (0.011)	-0.024*** (0.008)
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Macroeconomic Controls	No	No	Yes	Yes
Observations	323	323	255	255

Right-wing government takes value equal to 1 if the regional government is conformed by a right-win party or a right-win coalition. Macroeconomic controls are one-year lagged values of the unemployment rate, GDP per capita, and debt-to-GDP ratios. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE B1.5 Regional Macroeconomic Aggregates and Political Orientation

	GDP pc	Unemployment Rate	Debt (% GDP)
Right-wing party (dummy)	0.006 (0.008)	0.840 (0.592)	-0.278 (1.658)
Region FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	323	323	289

Right-wing government takes value equal to 1 if the regional government is conformed by a right-wing party or a right-wing coalition.

C1 Appendix C to Chapter 1

C1.1 Summary Statistics

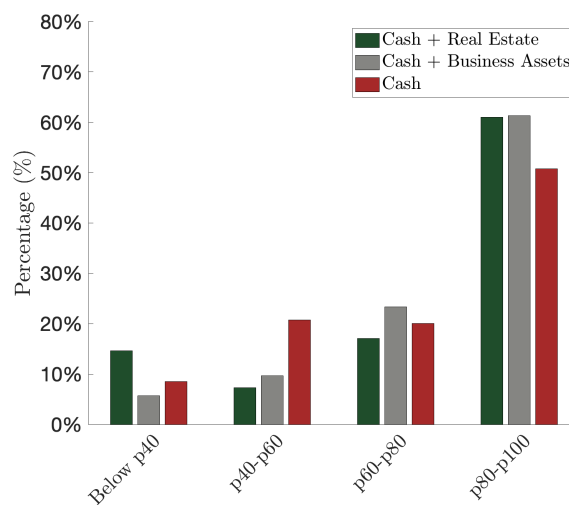
TABLE C1.1 Household Summary Statistics at the time of the Inheritance or Gift

	Mean	sd	Min	Max	N
Households below p40					
Net Wealth	55.41	52.98	-71.60	169.59	106
Mortgage Debt (%Wealth)	28.04	42.26	0.00	157.88	106
Non-mortgage Debt (%Wealth)	7.25	17.11	0.00	126.16	106
Personal Credit Debt (%Wealth)	7.49	17.63	0.00	126.16	106
Households p40-p60					
Net Wealth	158.08	47.66	91.84	276.47	68
Mortgage Debt (% Wealth)	8.49	13.14	0.00	58.16	68
Non-mortgage Debt (% Wealth)	0.96	3.23	0.00	23.54	68
Personal Credit Debt (% Wealth)	0.96	3.23	0.00	23.54	68
Households p60-p80					
Net Wealth	271.96	60.40	155.52	407.41	107
Mortgage Debt (% Wealth)	5.00	9.84	0.00	53.45	107
Non-mortgage Debt (% Wealth)	0.77	2.61	0.00	16.75	107
Personal Credit Debt (% Wealth)	0.78	2.68	0.00	33.21	107
Households p80-p90					
Net Wealth	471.67	74.46	306.99	660.02	67
Mortgage Debt (% Wealth)	5.68	9.62	0.00	41.24	67
Non-mortgage Debt (% Wealth)	0.27	0.86	0.00	4.51	67
Personal Credit Debt (% Wealth)	0.31	0.91	0.00	4.51	67
Households p90-p100					
Net Wealth	1170.43	3197.03	465.75	194519.11	232
Mortgage Debt (% Wealth)	3.73	6.92	0.00	42.55	232
Non-mortgage Debt (% Wealth)	0.34	1.70	0.00	14.82	232
Personal Credit Debt (% Wealth)	0.36	1.82	0.00	21.02	232

Monetary amounts are expressed in thousands and have been CPI-adjusted to the year 2016. EFF survey weights are applied to obtain representative averages of the Spanish population.

TABLE C1.2 Share of Inheritance and Gifts by Net Wealth Percentiles

	% Gifts (cash transfers)	% Inheritances	Total
Households < p40	56%	44%	100%
Households p40-p60	52%	45%	100%
Households p60-p80	53%	47%	100%
Households p80-p90	45%	55%	100%
Households p90-p100	43%	57%	100%

FIGURE C1.1 Asset Composition of Bequests Along the Wealth Distribution

This figure shows the proportion of bequests received by asset composition along the net wealth distribution. All color bars sum 100%. EFF survey weights are applied to obtain representative averages of the Spanish population

D1 Appendix D to Chapter 1

D1.1 Additional Results

TABLE D1.1 Event-study Estimates of Inheritance Taxes on Wealth Mobility

	(1)	(2)	(3)	(4)	(5)
	Probability of moving upwards from				
	10th percentile	20th percentile	30th percentile	40th percentile	50th percentile
$t = -3$	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
$t = -2$	0.000 (0.002)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
$t = 0$	-0.001** (0.001)	-0.001** (0.001)	-0.001 (0.002)	-0.002 (0.001)	-0.001 (0.002)
$t = 1$	-0.002** (0.001)	-0.001** (0.001)	-0.001 (0.001)	-0.002 (0.001)	-0.001* (0.001)
$t = 2$	-0.002** (0.001)	-0.002* (0.001)	-0.002 (0.001)	-0.002** (0.001)	-0.003** (0.002)
	Change in outcome %				
$t = 0$	-35,50	-6,63	-4,32	-27,14	-17,54
$t = 1$	-50,11	-9,50	-6,40	-32,36	-19,58
$t = 2$	-76,91	-16,06	-13,22	-40,37	-56,69
Mean $t - 1$ (%)	0.287	1.494	1.437	0.575	0.587
Obs.	887	887	887	887	887

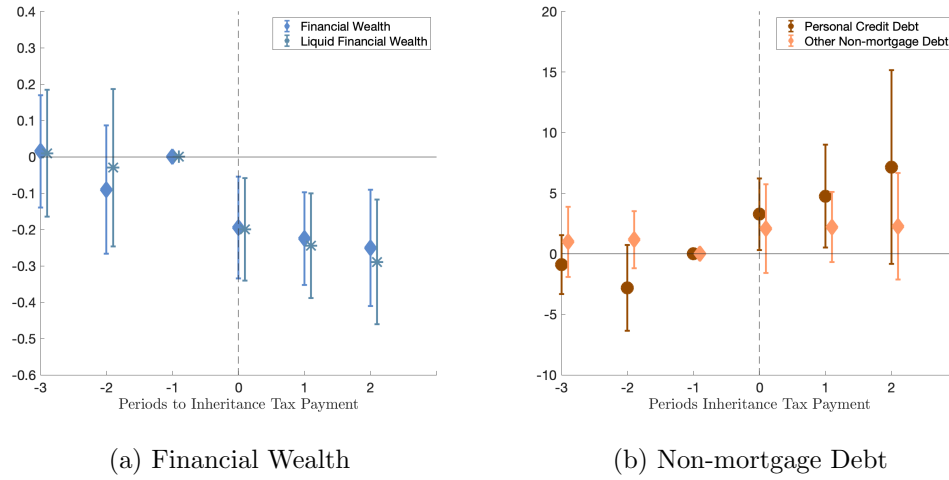
This table presents the estimated coefficients from the event-study specification given by Equation 2.4 using the average bracket-specific inheritance tax rate as the independent variable. The dependent variable for columns (1)-(5) is the probability of moving upwards in the net wealth distribution conditional on being at the -th percentile at the time of the inheritance tax payment. Standard errors are robust and clustered at the region-bracket level. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE D1.2 Event-study Estimates of Inheritance Taxes on Household Wealth and Debt
- Households below 40th percentile before the tax payment

	(1)	(2)	(3)	(4)	(5)	(6)
	Gross Wealth	Housing Wealth	Financial Wealth	Total Debt	Mortgage Debt	Personal Credit Debt
$t = -3$	0.015 (0.105)	0.014 (0.102)	0.011 (0.095)	-1.350 (1.44)	-1.022 (1.08)	-0.893 (1.22)
$t = -2$	0.019 (0.109)	-0.030 (0.115)	-0.090 (0.108)	-2.171 (2.148)	-2.353 (2.160)	-2.824 (2.160)
$t = 0$	-0.089* (0.049)	0.082 (0.111)	-0.194*** (0.086)	1.780 (2.947)	-3.587 (3.001)	3.263* (1.800)
$t = 1$	-0.109* (0.059)	0.033 (0.135)	-0.225*** (0.077)	3.686 (3.984)	-3.193 (2.279)	4.759* (2.580)
$t = 2$	-0.122 (0.071)	0.024 (0.154)	-0.250 *** (0.095)	6.770 (4.780)	-3.154 (2.592)	7.152 (4.876)
Change in outcome %						
$t = 0$	-0.783	1.011	-1.771	1.165	-6.049	3.911
$t = 1$	-0.955	0.379	-2.048	2.412	-5.384	5.703
$t = 2$	-1.074	0.253	-2.282	4.430	-5.319	8.571
Mean $t - 1$	11.388	7.910	10.978	152.810	59.300	83.400
Obs	201	201	201	201	201	201

This table presents the estimated coefficients from the event-study specification given by Equation 2.4 using the average bracket-specific inheritance tax rate as the independent variable. The dependent variable for columns (1)-(3) is (logged) gross wealth, housing, and financial wealth and for columns (4)-(6) is total debt, mortgage debt, and personal credit debt as a percentage of total gross wealth. Standard errors are robust and clustered at the region-bracket level. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

FIGURE D1.1 Effect of Inheritance Taxes on Bottom-wealth Households' Financial Wealth and Other Non-mortgage debt



This figure plots the event study estimates ($\hat{\beta}_k$) and corresponding 90 percent confidence bands of the specification of Equation 2.4. Liquid assets in Panel D1.1a refer to bank deposits and saving accounts holdings. Other non-mortgage debt in Panel D1.1b refers to total debt in credit lines, current account overdrafts, advances, and loans from friends or family. Standard errors are robust and clustered at the region-bracket level.

E1 Appendix E to Chapter 1

E1.1 Robustness

TABLE E1.1 Inheritance Taxes and Debt Holdings of Old Households

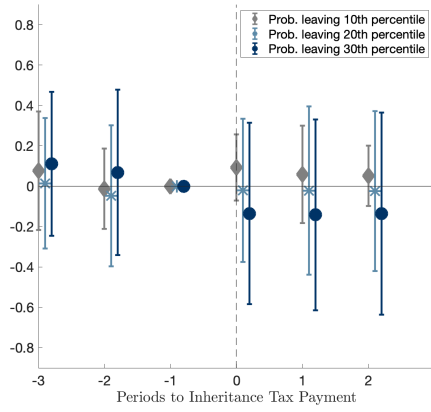
	Age ≥ 70 , All		Age ≥ 70 , Below p40	
	Total debt	Personal credit debt	Total debt	Personal credit debt
ATR Inheritance	-0.013	-0.019	0.052	0.015
	0.054	0.048	0.419	0.424
Time FE	Yes	Yes	Yes	Yes
Region FE	Yes	Ye	Yes	Yes
Observations	4799	4799	1085	1085

The dependent variable is either total debt-to-wealth ratio or personal credit debt-to-wealth ratio. The sample includes households that have not reported any inheritance or gift in any survey wave between 2002 and 2018.

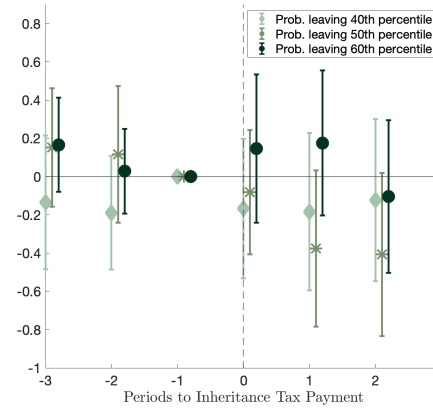
TABLE E1.2 Age profile of heirs

	Average Age	Heirs ≤ 40 years old (% Total heirs)
Below p40	49	22.5%
p40-p60	54	14.3%
p60-p80	51	15.6%
p80-p90	56	2.85%
p90-p100	57	0.80%

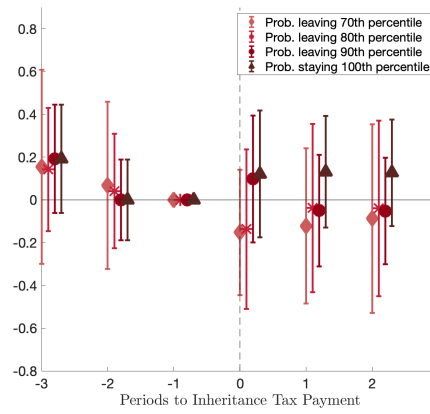
The average age of heirs is computed at the time of the wealth transfer receipt. For households consisting of couples, the average age of both spouses is used. EFF survey weights are applied to obtain representative averages of the Spanish population.

FIGURE E1.1 Cash transfers as Inheritances

(a) Bottom-wealth Mobility

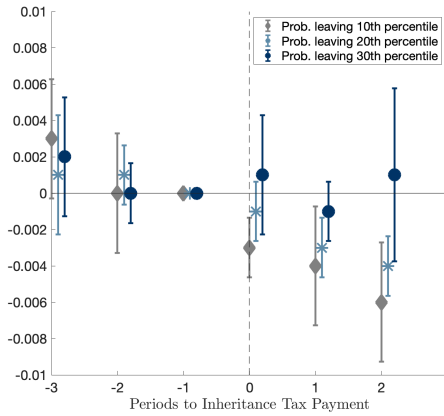


(b) Middle-wealth Mobility

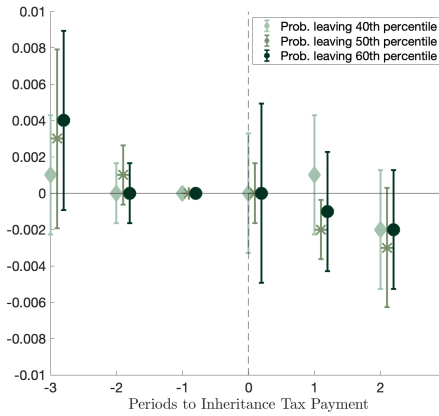


(c) Top-wealth Mobility

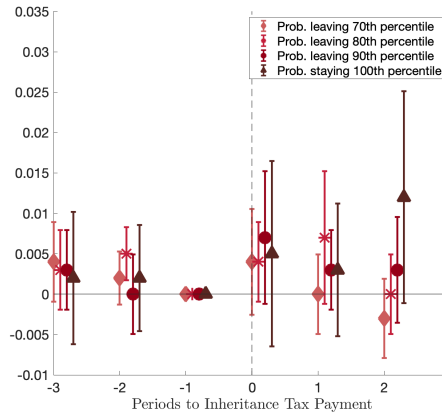
This figure plots the event study estimates ($\hat{\beta}_k$) and corresponding 90 percent confidence bands of the specification of Equation 2.4. The treatment variable is the average bracket-specific effective tax rate. Cash transfers are assumed to be inheritances. Standard errors are robust and clustered at the region-bracket level.

FIGURE E1.2 Effects of Inheritance Taxes on Wealth mobility - Alternative definition of treatment

(a) Bottom-wealth Mobility



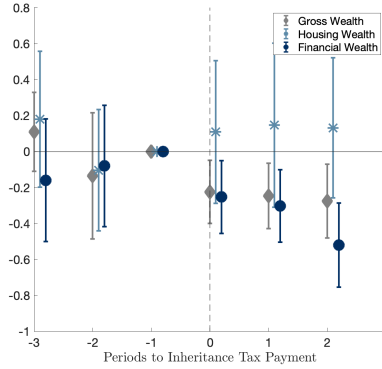
(b) Middle-wealth Mobility



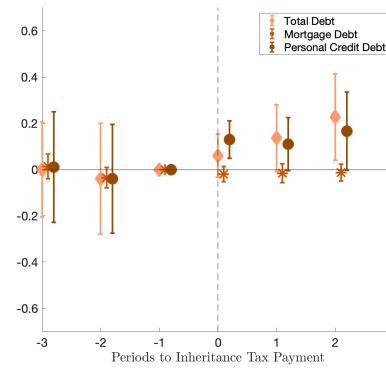
(c) Top-wealth Mobility

This figure plots the event study estimates ($\hat{\beta}_k$) and corresponding 90 percent confidence bands of the specification of Equation 2.4. The treatment variable is log of net-of-tax inheritance value. Standard errors are robust and clustered at the region-bracket level. Only heirs are included in the sample

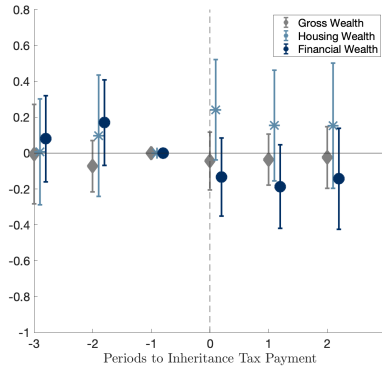
FIGURE E1.3 Effect of Inheritance Taxes on Household Wealth and Debt - Alternative definition of treatment



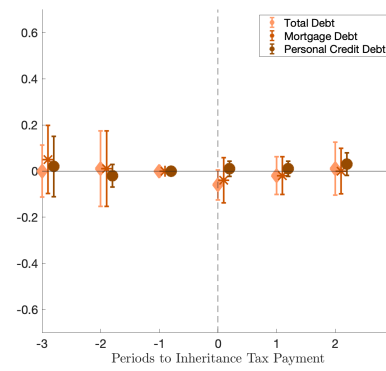
(a) Bottom-wealth households



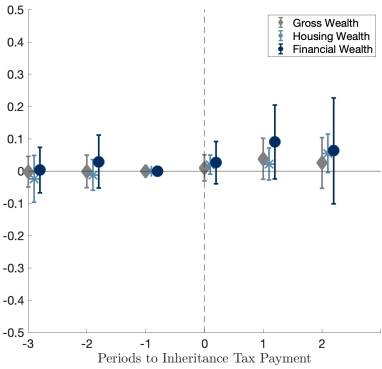
(b) Bottom-wealth households



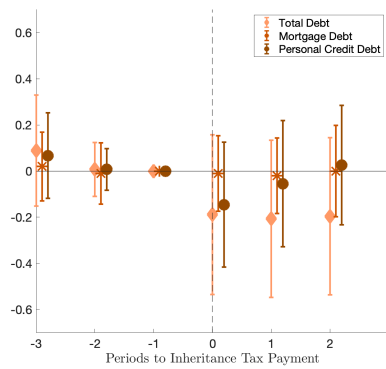
(c) Middle-wealth households



(d) Middle-wealth households

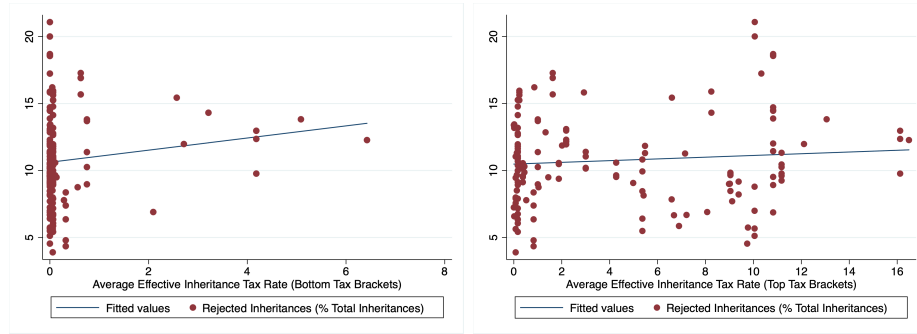


(e) Top-wealth households



(f) Top-wealth households

This figure plots the event study estimates ($\hat{\beta}_k$) and corresponding 90 percent confidence bands of the specification of Equation 2.4. Bottom-wealth households are between the 10th-40th percentile of the net wealth distribution, middle-wealth are those between the 40th-70th percentiles and top-wealth are those above the 70th percentile at the time of the inheritance receipt. The dependent variable in Panels E1.3a-E1.3e is (logged) gross wealth, financial wealth, or housing wealth. The dependent variable in Panels E1.3b-E1.3f total debt-to-wealth ratio, mortgage debt-to-wealth ratio, or personal credit debt-to-wealth ratio in percent. Financial wealth includes bank deposits, stocks, mutual funds, pension plans, and life insurance. Housing wealth includes real estate property. The treatment variable is log of net-of-tax inheritance value. Standard errors are robust and clustered at the region-bracket level. The sample includes only heirs

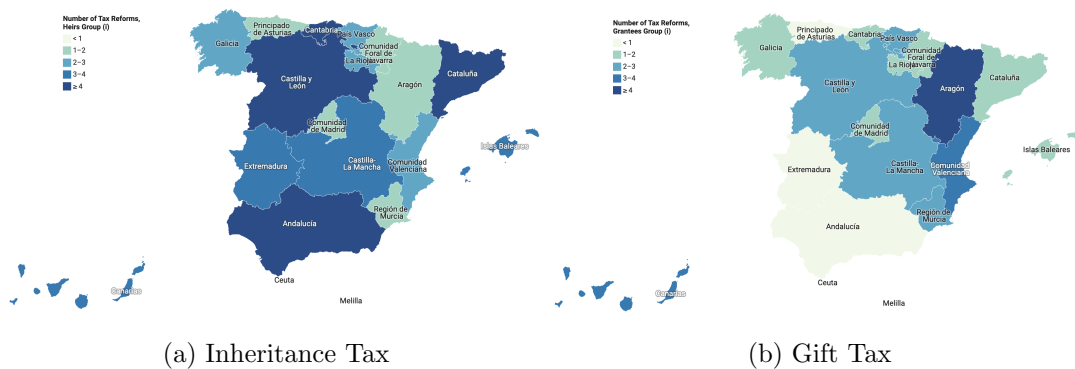
FIGURE E1.4 Correlation between Average Effective Inheritance Tax Rate and Rejected Inheritances Rate

(a) Bottom-brackets Average Tax Rate (b) Top-brackets Average Tax Rate

This figure plots the correlation between the regional average effective tax rate for bottom tax brackets (inheritances below 72,000 euros) or for top tax brackets (inheritances above 72,000 euros) and the rejection rate. The rejection rate has been computed using data on the number of official inheritances declarations and the number of rejected inheritances at the regional level from *Consejo General del Notariado*.

F1 Appendix F to Chapter 1

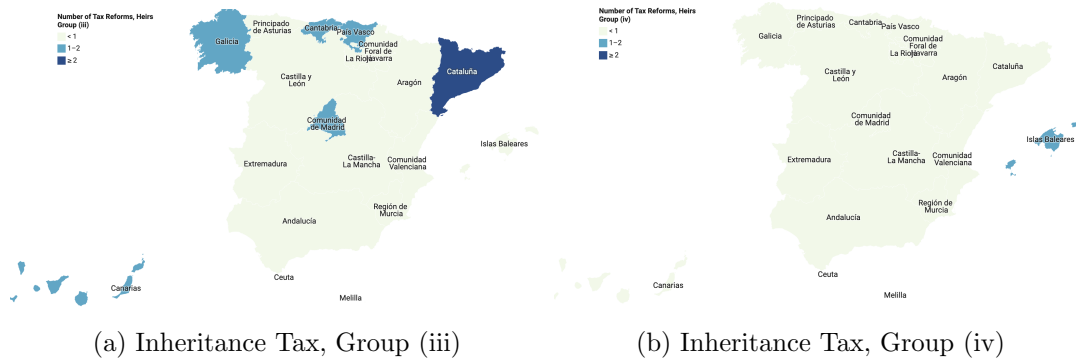
F1.1 Tax Reforms for Other Groups of Heirs and Donees

FIGURE F1.1 Regional Inheritance and Gift Tax Reforms - Group (i)

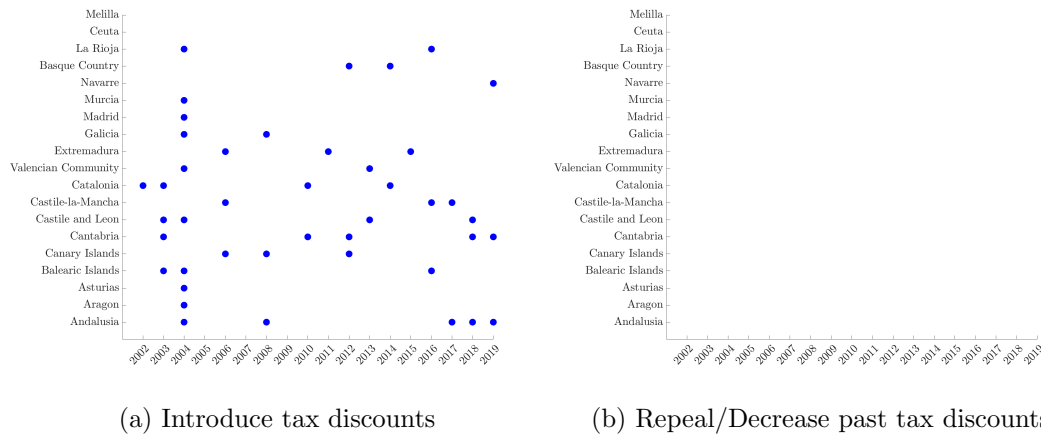
(a) Inheritance Tax

(b) Gift Tax

This figure depicts the number of different tax reforms for heirs and donees of group (i) (i.e. descendant younger than 21) introduced by each Spanish regions. Panel F1.1a refers to the inheritance tax while Panel F1.1b refers to the gift tax. These figures have been constructed using the inheritance tax regulation contained in the regional tax books published by the Spanish Ministry of Finance and in the regional fiscal reports produced by the General Council of Spanish Economists.

FIGURE F1.2 Regional Inheritance Tax Reforms - Group (iii)-(iv)

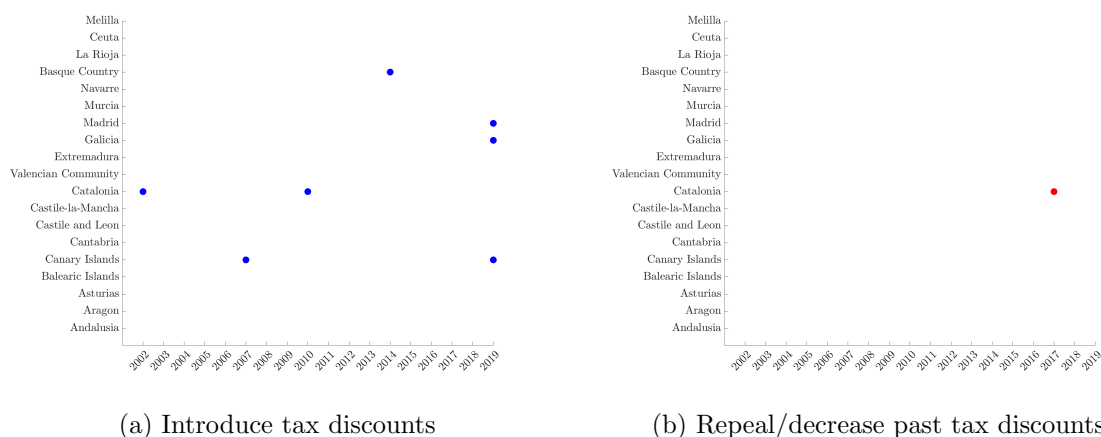
This figure depicts the number of different tax reforms for heirs of group (iii) (i.e. siblings, stepchildren, aunts/uncles and nephews/nieces) and (iv) (i.e. other distant relatives and non-relatives) introduced by each Spanish region. The change in tax regulation in Basque Country refers only to Bizkaia. This figure has been constructed using the inheritance tax regulation contained in the regional tax books published by the Spanish Ministry of Finance and in the regional fiscal reports produced by the General Council of Spanish Economists.

FIGURE F1.3 Regional Inheritance Tax Reforms by Type - Group (i)

This figure depicts the years for which each Spanish region introduced a different inheritance tax credit or/and tax deduction for donees of group (i) (i.e. descendants younger than 21). Panel F1.3a presents those tax changes that implied the introduction of an actual tax credit/deduction by region and year while Panel F1.3a shows those changes that involved a large reduction in past tax discounts or their repeal. These figures have been constructed using the inheritance tax regulation contained in the regional tax books published by the Spanish Ministry of Finance and in the regional fiscal reports produced by the General Council of Spanish Economists.

FIGURE F1.4 Regional Gift Tax Reforms by Type - Group (i)

This figure depicts the years for which each Spanish region introduced a different inheritance tax credit or/and tax deduction for donees of group (i) (i.e descendants younger than 21). Panel F1.4a presents those tax changes that implied the introduction of an actual tax credit/deduction by region and year while Panel F1.4a shows those changes that involved a large reduction in past tax discounts or their repeal. These figures have been constructed using the inheritance tax regulation contained in the regional tax books published by the Spanish Ministry of Finance and in the regional fiscal reports produced by the General Council of Spanish Economists.

FIGURE F1.5 Regional Inheritance Tax Reforms by Type - Group (iii)

This figure depicts the years for which each Spanish region introduced a different inheritance tax credit or/and tax deduction for heirs of group (iii) (i.e siblings, stepchildren, nephews/nieces, uncles/aunts). Panel F1.5a presents those tax changes that implied the introduction of an actual tax credit/deduction by region and year while Panel F1.5a shows those changes that involved a large reduction in past tax discounts or their repeal. These figures have been constructed using the inheritance tax regulation contained in the regional tax books published by the Spanish Ministry of Finance and in the regional fiscal reports produced by the General Council of Spanish Economists.

FIGURE F1.6 Regional Tax Reforms by Type - Group (iii)

This figure depicts the years for which each Spanish region introduced a different inheritance tax credit or/and tax deduction for heirs of group (iv) (i.e. cousins, grand nephews/nieces, more distant relatives and non-relatives). Panel F1.6a presents those tax changes that implied the introduction of an actual tax credit/deduction by region and year while Panel F1.6a shows those changes that involved a large reduction in past tax discounts or their repeal. These figures have been constructed using the inheritance tax regulation contained in the regional tax books published by the Spanish Ministry of Finance and in the regional fiscal reports produced by the General Council of Spanish Economists.

FIGURE F1.7 Number of Inheritance and Gift Tax Reforms by Year - Group (i)

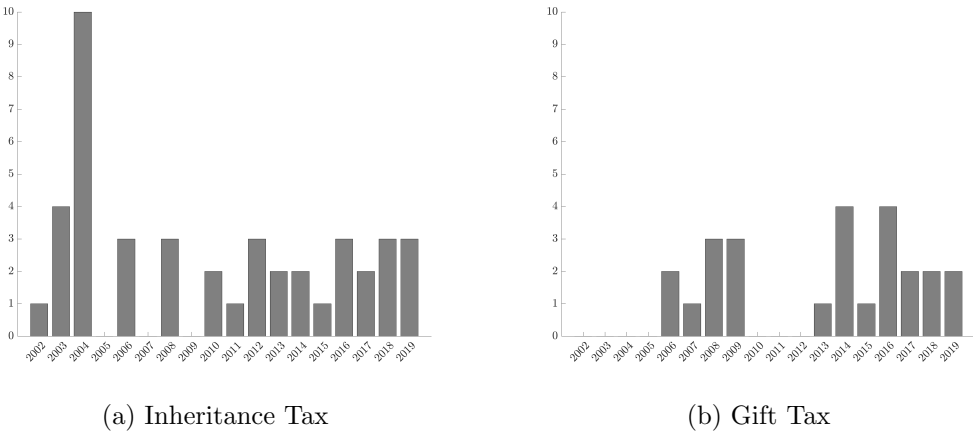


FIGURE F1.8 Number of Inheritance Tax Reforms by Year - Group (iii) and (iv)

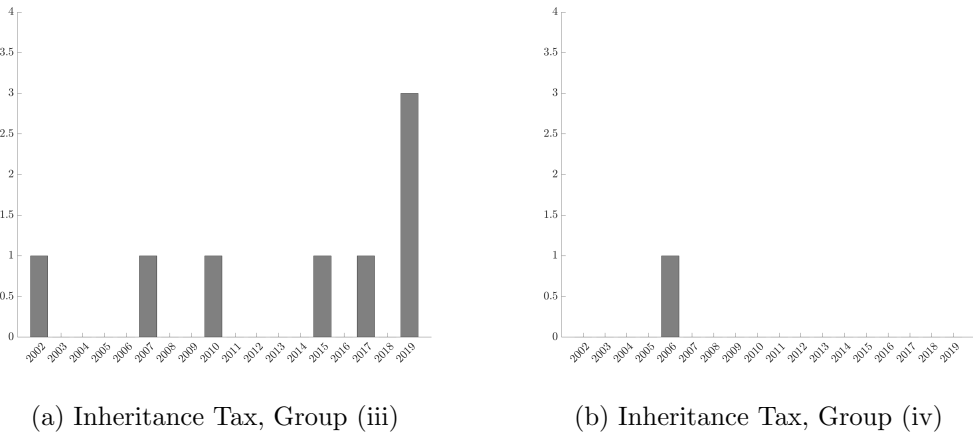


TABLE F1.1 Tax Deductions and Credits for Heirs - Group (i)

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Andalucia			td 100% if tb<125k				td 100% if tb<175k		
Aragon			td 100% max 3M						
Asturias			tc 97-99%*						
Balearic Islands		td 3k	tc 99%						
Canary Islands						td 100% max 1 M	tc 99.9%		tc 90-99%
Cantabria		tc 97-99%*							
Castile and Leon		td 6-120k age	tc 99%						
Castile la Mancha					tc 95%				
Catalonia	td 18-54k age	td 18-114k age							td 275-539k age tc 25%,50% + own τ
Valencian Community			tc 99%						
Extremadure					td 18-70k				
Galicia			tc 97-99%*				tc 97-99%* / tc 99% + own τ	tc 99% + own τ	
Madrid			tc 99%						
Murcia			tc 99%						
Navarre									
Basque Country									
La Rioja			tc 99%						
Ceuta and Melilla									

td = tax deduction; tc = tax credit; tb = tax base; own τ = regional tax schedule; *Implicit tax credit. The information on tax reforms has been retrieved from the regional tax books from the Spanish Ministry of Finance and from the regional fiscal reports produced by the General Council of Spanish Economists

TABLE F1.3 Tax Reforms for Heirs - Group (iii) and (iv)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Andalucia																		
Aragon																		
Asturias																		
Balearic Islands						td 1k group (iv)												
Canary Islands						td 9.3k			td 50k									tc 99%
Cantabria																		
Castile and Leon																		
Castile la Mancha																		
Catalonia	td 9k									td 50k						default		
Valencian Community																		
Extremadure																		
Galicia																		td 16k
Madrid																		tc 15%-10%
Murcia																		
Navarre																		
Basque Country														td 20,000- 40,000 only Bizkaia				
La Rioja																		
Ceuta and Melilla																		

td = tax deduction; tc = tax credit; tb = tax base; own τ = regional tax schedule.

Chapter 2

When wives command: household portfolio choices and marital property regime

2.1 Introduction

The marital property regime has been a key determinant of the economic nature of marriage. The degree of shared ownership of assets acquired during the marriage defines two broad types of marital property regimes: separate and community property. In separate property, each spouse maintains sole ownership of assets accumulated during the marriage and takes them upon dissolution. Contrary, in community property, most assets acquired during the marriage become jointly owned and split between spouses if the marriage ends.¹ The type of marital property regime has relevant implications for savings decisions because of two reasons. First, the marital property regime affects married couples' incentives to save because property division rules determine the allocation of spouses' savings *ex-post* marriage (Voena, 2015). While separate property limits the ability to tap into the spouse's savings, community property regulates that the common pool of assets accumulated during marriage must be divided fifty-fifty in case of divorce, irrespective of who contributed the most to its acquisition. The different property division rules distort spouses' optimal savings decisions during the marriage, as spouses can differ in their contribution to household income or consumption levels. Second, property division rules also affect the economic cost of terminating the marriage (Imre, 2022). Unlike separate property, community property entails a mandatory dissolution process involving an inventory of the common net assets, which is costly in terms of time and

¹Under community property, labor income and profits earned by either spouse belong to the pool of commonly owned assets, while inheritance, gifts, and assets bought before marriage remain separate property. We denote this regime as community property or joint ownership throughout the paper.

money.

An aspect that has received less attention in the literature is how property division rules interact with couples' financial portfolio choices. This paper fills this gap by investigating the impact of property division rules on household financial investment choices. The Spanish institutional setting serves as an ideal testing ground to address this question as the marital property regime law is regulated at the regional level, resulting in variation in the default rules across Spanish regions. Separate property is the default regime in Catalonia and the Balearic Islands, while some form of community property is the default in the rest of the regions. Couples adopt the default marital property regime in their region of residence unless spouses agree on a different one by signing a prenuptial agreement. By means of an IV strategy, we exploit this regional variation in marital law in combination with rich survey data from the Spanish Survey of Household Finances to provide causal estimates of the effects of property division rules on couples' financial portfolio choices. The Spanish Survey of Household Finances (or EFF for its acronym in Spanish) gathers rich information on Spanish households' wealth, debt, and demographics. Particularly relevant for our study, it contains detailed information on household financial investment by asset class (i.e., bank deposits, shares, bonds, etc.) and on the marital property regime when households consist of married couples.²

We find that separate-property couples take significantly more financial risk when wives are most knowledgeable about household finances. The definition of the household head in the EFF makes it very likely that this household member is the primary decision-maker regarding the household economy and finances. Specifically, the household head is the spouse most knowledgeable about the household economy and investments, being able to give detailed information about household wealth and debt holdings. In particular, we find that separate property couples are 9% more likely to participate in risky assets than their counterparts married under community property when wives are the household heads. We also find that these couples hold more diversified portfolios towards risky assets than those married in community property. On average, couples married under separate property hold a share in risky asset classes 5 percentage points higher than couples married under community property when wives take a primary role in household finance investments.

In addition to including a wide range of socioeconomic characteristics and gaps between spouses, we show that our empirical findings remain stable and strongly significant when controlling for differences in risk aversion, financial sophistication, or gender norms promoting female financial independence. Our identification strategy relies on assuming that the marital property regime affects financial outcomes only

²Information about the marital property regime of surveyed households is not available in other surveys like the Bank of Italy's Survey of Households Income and Wealth (SHIW) or the Federal Reserve's Survey of US Consumer Finances (SCF)

through the induced variation resulting from couples adopting the default regime in their region. However, the regional variation in default property regimes in Spain emanates from old legal traditions: Catalonia and the Balearic Islands adopted separate property during the Roman Empire’s rule, while other Spanish regions acquired community property from the Visigothic Kingdom law system. Therefore, it is not unreasonable to think that the same legal traditions have shaped attitudes towards risk or cultural norms differently between the two groups of regions over the course of history. In this way, we ensure that our results are robust to controlling for some of these idiosyncratic differences that can affect household financial behavior and could have been captured by our instrument.

To rationalize these findings, we develop a two-period model of financial portfolio choice where couples differ in their marital property regime. Households consist of two spouses who are born married and face an exogenous probability of divorce. The household head decides on the level of consumption, which is public within the household, and her savings in safe and in risky financial assets given her spouse’s savings decisions, forming expectations about both spouses’ future labor income, asset returns, and marital status.³ In the model, property division rules directly influence the asset allocation rule upon divorce and the corresponding dissolution costs of marital assets. When separate property couples divorce, spouses take their individual assets according to the title of ownership and face no dissolution cost of marital assets. In contrast, community property couples must incur dissolution costs of marital assets as household total savings need to be equally split between spouses. We introduce the dissolution cost of marriage for community-property couples by assuming that an exogenous fraction of total household permanent income is destroyed in the event of divorce (Cubeddu and Ríos-Rull, 2003; Bacher, 2021b). Divorce represents a source of financial risk in the model because it requires couples to split their assets and because it results in a state with lower income levels and higher income risk. However, the strength of the precautionary savings motive differs across marital property regimes and their associated dissolution costs of marital assets.

We calibrate the model to match key moments of Spanish married couples’ financial behavior for which wives are the most knowledgeable about household finances. In particular, we calibrate the model assuming that wives are the ones making portfolio choices given husbands’ savings decisions, which are retrieved from the data. By means of counterfactual simulations, we show that divorce risk and gender heterogeneity in labor income profiles are the most important determinants through which marital property regime affects financial portfolio choices, translating into the estimated marital property gap in risky financial investment in female-headed

³Our theoretical framework could be considered as a reduced-form version of the dynamic collective model of intra-household decision making (Mazzocco, 2005; Chiappori et al., 2002; Voena, 2015) where couples solve a constrained Pareto problem.

households. Relative to separate property, community property's higher marriage dissolution costs induce spouses to increase precautionary savings and lower their demand for risky assets. Low labor income levels and higher income risk for wives further strengthen couples' precautionary savings motive under divorce risk. This explains why the property regime gap in risky financial savings arises between couples for which wives are the primary decision-makers.

Related literature. A limited but growing literature has explicitly studied the implications of different marital property regimes for various household economic outcomes. Brassiolo (2013), Piazzalunga (2016), Imre (2022) and Huang et al. (2021) examine empirically how divorce laws interact with different marital property regimes in shaping households economic behavior. Like us, Imre (2022) exploit the regional variation in default marital property regime law in Spain. Still, she investigates the effects of the marital property regime on female labor supply, fertility, marriage, and marital dissolution rates. We contribute to this literature by studying how property division rules shape household financial decisions.

This paper broadly complements the theoretical literature studying the interaction of marital transition dynamics and household savings behavior (see Yamaguchi et al. (2014); Voena (2015); Cubeddu and Ríos-Rull (2003); De Nardi et al. (2021)). Our paper is closely related to Voena (2015), which studies the interaction between property division rules and divorce laws in the US through the lens of a dynamic collective model of intra-household decision-making. Exploiting panel variation in U.S. divorce and property division laws, she finds that the parameter estimates of the model are consistent with a collective model where wives' share of household resources in marriage is low. This implies that women benefit from the laws that impose an equal division of property upon divorce, which gives couples incentives to increase total asset accumulation and reduce wives' labor supply compared to separate property. Differently from Voena (2015), our theoretical framework nests into the class of unitary models of household decision-making but explicitly models how property division rules shape couples' financial portfolio allocation between safe and risky assets in the presence of uninsurable divorce and income risk. In this respect, we contribute to the literature studying how marital dynamics affect household portfolio allocation. Love (2010), Hubener et al. (2016) and Bacher (2021b) develop a joint framework of household structure and financial portfolio choice to study how couples and singles make portfolio choices following family shocks such as divorce or/and marriage. Our contribution relies on introducing the two types of property division rules in a theoretical portfolio choice framework and studying their implications for married couples' risky financial investments under different property division rules.

Our paper also contributes to the growing economic literature on gender and finance. In this literature, there is consensus regarding the fact that men invest more and less conservatively in financial assets than women because of differences in risk

aversion (Bajtelsmit and Bernasek, 1996; Croson and Gneezy, 2009; Dohmen et al., 2011), financial literacy (Van Rooij et al., 2011; Lusardi and Mitchell, 2014; Hospido et al., 2021) or self-confidence (Barber and Odean, 2001; Bucher-Koenen et al., 2017; Klapper and Lusardi, 2020). More recently, the role of traditional gender norms has also been highlighted as another potential driver behind the gender gap in financial investment (Ke, 2021). Guiso and Zaccaria (2021) also show that more egalitarian norms increase household participation in financial markets, equity holdings, and asset diversification in Italy. Instead, we examine the impact of the marital property regime on household financial investment decisions, given the gender differences found in the previous literature regarding psychological traits, risk-taking, or social norms.

The rest of the paper proceeds as follows. The next section covers the Spanish institutional background. Section 2.3 presents the data, while section 2.4 empirically examines the role of the marital property regime for household financial behavior. Next, section 2.5 lays down the theoretical model that rationalizes the empirical results. Section 2.10 offers concluding remarks.

2.2 Institutional Background

Spanish regions enjoy considerable legislative autonomy. Particularly relevant for this paper, marital property regimes are regulated at the regional level. The marital property regime defines the legal ownership structure of assets acquired during the marriage, and thus, it regulates the division rule over couples' property upon marriage dissolution (due to divorce or death). Figure 2.1 shows that two marital property regimes coexist in Spain. While Catalonia and the Balearic Islands have separate property as their default property regime, some form of community property applies in the rest of the regions.⁴ Under community property, assets acquired during the marriage are jointly owned, and they are split equally between the spouses upon marriage dissolution. By contrast, under separate property, each spouse retains full ownership of the assets she has acquired during the marriage in case of divorce or death.

⁴The Valencian Community, as an exceptional case, changed its default regime from community to separate property during the period 2008-2016.

FIGURE 2.1 Default Marital Property Regimes in Spain

Notes: The figure plots the regional variation in default property regime across Spanish regions. Separate-property regions are Catalonia, and the Balearic Islands are in blue, while community-property regions are in green. Valencian Community changed to default separate property between 2008 and 2016.

The default marital property regime in the region where couples get married applies unless spouses agree on a different marital property regime signing a prenuptial agreement (*Capitulación Matrimonial* in Spanish). Prenuptial contracts can be signed ex-ante or ex-post marriage, can be modified at any time during the marriage if both spouses agree and their monetary cost is relatively small (about 60 euros in 2021). Appendix Figure A2.1 shows the evolution of total prenuptial agreements as a share of marriages and prenuptial agreements for separate property as a share of total contracts in Spain. Despite the simplicity of the procedure, most marriages merely adopt the default property regime in their region; the number of prenuptial agreements remains below 17% of marriages. Among those prenuptial agreements, 90% corresponds to a change from a community property regime to a separate property regime, thus opting out of a community property system.⁵

Community and separate property imply different costs of distributing marital assets between spouses ex-post marriage (i.e., divorce or death) (Imre, 2022). Unlike couples married under separate property, community-property spouses are required to dissolve the community property regime by law. The procedure starts by making an inventory and valuing all common assets and liabilities, which requires both spouses' approval, and finishes by assigning the ownership of half the net value of the shared pool of assets to each spouse.⁶ Therefore, divorce is more costly and

⁵We find similar trends for the evolution of prenuptial contracts to adopt separate property by region.

⁶This procedure needs to be done before a public notary. The average cost ranged between

lengthier for couples married under community property compared to those married under separate property.

2.3 Data

We use household-level data from the Spanish Survey of Household Finances. The survey is conducted every two years by the Bank of Spain and spans from 2002 to 2020 (7 waves in total). The survey reports detailed information on households' income, wealth, portfolio composition, and a rich set of socio-economic characteristics based on personal interviews. We exploit particular features of the EFF, which are rarely included in surveys reporting information about household wealth. First, the survey includes information on the marital property regime of couples, which is not available in other surveys such as the Bank of Italy's Survey of Households Income and Wealth (SHIW) or the Federal Reserve's Survey of US Consumer Finances (SCF). Second, the definition of the household head makes it very likely that he or she is the main decision-maker of the household economy and finances. The specific definition provided to households reads: "the person who knows more about the economy and finances of the household living at this address". Thus, the household head is the person who is the most knowledgeable about the household's finances, i.e. household income, expenditures, investments, assets, etc. It is not simply a household member, but who is in charge/knows the most about the household's finances. We restrict the estimation sample to married couples over 25 years old with both spouses employed so that both contribute to household income. We drop self-employed workers because their financial decisions are most likely to be determined by other motives than the general population.⁷

Table 2.1 reports summary statistics of our sample of married couples. Panel A and B present summary statistics of households' socioeconomic characteristics and financial outcomes, respectively. As shown in Panel A, about 75% of households are married under community property. This is not surprising since all Spanish regions have community property as the default marital property regime except for two. In addition, wives take a more prominent role in managing household finances in about one-third of households, independently of the marital property regime. On average, the spouse most knowledgeable about the household finances (i.e. the household head) is 46 years old, more educated, slightly older, and earns more than his/her spouse. Looking at the differences in socioeconomic characteristics between the two types of regimes, we can observe that, on average, the household head in separate-property couples is more educated and more likely to work in the financial sector. In addition, these couples are wealthier and earn a higher income compared to their

1,000 and 1,500 euros in 2022.

⁷For instance, self-employed individuals tend to opt for the separation of property because this regime provides a way of sheltering a fraction of household assets from the risk of bankruptcy

counterparts married under community property. Regarding financial outcomes, we classify shares and mutual funds as risky financial assets, while fixed-income securities, savings, and checking accounts are categorized as safe financial assets. Panel B shows that separate property couples' average participation rate in risky assets and the risky portfolio share is higher.⁸

Appendix Tables A2.1 and A2.2 reproduce the summary statics below by gender of the household head. As can be inspected, the average differences in socioeconomic characteristics and financial outcomes hold irrespective of the gender of the household head except for wage differential between spouses. In particular, male household heads earn about twice as much as their spouses, while female household heads earn less. Finally, it is worth noticing that the gap in risky investment is considerably larger for households led by females.

⁸The high participation rates are driven by the fact that the EFF survey oversamples at the top of the wealth distribution

TABLE 2.1 Household Summary Statistics

	Mean	St. dev.	Separate	Community
Panel A. Socioeconomic characteristics				
<i>Household head</i>				
Separate property	0.26	0.44		
Female	0.34	0.47	0.32	0.35
Age	46	8.69	46	46
Education				
Less than high school	0.23	0.43	0.16	0.26
High School	0.34	0.47	0.31	0.35
College	0.43	0.49	0.53	0.39
Occupation in financial sector	0.05	0.22	0.08	0.04
<i>Comparative ratios bw spouses</i>				
Education ratio bw spouses	1.10	0.48	1.10	1.11
Age ratio bw spouses	1.03	0.10	1.04	1.03
Wage ratio bw spouses	1.58	1.82	1.74	1.53
<i>Other controls</i>				
Home-ownership				
Rent	0.09	0.29	0.10	0.09
Ownership	0.87	0.33	0.86	0.88
Other	0.04	0.18	0.05	0.03
Household size	3.52	0.99	3.47	3.53
Income (thousands eur)	66.95	92.96	90.35	58.79
Net wealth (thousands eur)	552.02	3418.54	1123.63	351.35
Panel B. Financial Variables				
<i>Financial Variables</i>				
Participation risky assets	0.30	0.48	0.38	0.27
Risky asset classes (%Total asset classes)	0.15	0.24	0.19	0.14
Risky assets share	0.15	0.29	0.21	0.13

Notes: This table shows summary statistics for two-spouse households characteristics and by marital property regime of the household head. The sample includes information from the 2002-2020 waves of the Spanish Survey of Household Finances and is restricted to two-spouse households aged above 25 years old who are employed. Self-employed households are excluded from the sample. Observations: 4910 (4800 for the education ratio, 4791 for the risky asset classes share, and 4774 for the risky assets share)

2.4 Instrumental Variable Strategy

To investigate whether property division rules in marriage affect couples' risky financial investment, we rely on an instrumental variable strategy. The reason for this is that the choice of marital property regime is potentially endogenous, as spouses can opt out of the default regime by signing prenuptial contracts. (Frémeaux and Leturcq, 2020) shows using French administrative data that separate property could

be used strategically by the wealthiest spouse to protect their wealth in case of divorce in unequal partnerships. If wealthier couples self-select into separate property, regressing directly financial participation in risky assets on a separate property dummy would overestimate the effect of this property division rule on risky financial investment.

In our sample, 86% of those households living in community-property regions followed the status quo and adopted the default regime. This means that around 13% of couples in this group of regions changed to separate property. Figure A2.3 disaggregates the share of households opting out of community property by net wealth percentile and shows that couples in the highest percentile are more likely to choose separate property. To avoid this source of endogeneity in our setting, we exploit the regional variation in default regimes across Spanish regions and use the region of residence as an instrument for marital property regime as follows:

$$Y_{i,t} = \beta_0 + \beta_1 \text{Sep. Property}_{i,t} + \beta_2 \text{Female}_{i,t} + \beta_3 (\text{Sep. Property} \times \text{Female})_{i,t} + \delta' X_{i,t} + \lambda_t + v_{i,t}$$

$$\text{Sep. Property}_{i,t} = \alpha_0 + \alpha_1 \text{Region}_{i,t} + \gamma' X_{i,t} + \lambda_t + \varepsilon_{i,t}$$

where $\text{Sep. Property}_{i,t}$ equals 1 if household i is married under separate property and 0 if married under community property, while $\text{Region}_{i,t}$ equals 1 if the couple lives in Catalonia and Balearic Islands and 0 if otherwise. To investigate whether there are heterogeneous effects depending on the gender of the household head, we add an indicator variable, $\text{Female}_{i,t}$, that equals 1 if the household head is the wife and its interaction with the property division rule variable. We additionally control for a full range of household socio-economic characteristics, X_{it} , including household income and net wealth deciles, number of individuals living in the household, household head's age, education, homeownership, civil union status, occupation in the financial sector and comparative proxies between spouses (education, age, and wage ratios). Finally, we include survey year λ_t fixed effects to capture time trends affecting household financial investment. The identifying assumption is that couples' region of residence is correlated with their marital property regime choice but uncorrelated with household financial portfolio choices.

Table 2.2 reports the first-stage results. The coefficients are positive and statistically significant, suggesting that living in Catalonia or the Balearic Islands is strongly correlated with being married under separate property. This, together with the high F-stat values, confirm the relevance of our instrument. Table 2.3 presents the 2SLS estimation results. Consistent with the literature on gender differences in finance, the negative coefficients for the female dummy indicate that couples are less likely to take financial risks when wives take a more prominent role in managing household finances compared to husbands. However, property division rules introduce significant differences in the participation and portfolio diversification of risky assets among female-headed couples. In particular, households married under separate property regime are 9% more likely to invest in risky assets than their community property counterparts when wives are the ones most knowledgeable about household finances. In addition, these couples also hold a share in risky asset classes up to 5 percentage points higher compared to couples married under community property.

TABLE 2.2 First-stage Regressions

	(1) Sep. Property	(2) Sep. Property \times Female
Regions with Default Sep. Property	0.542*** (0.016)	
Regions with Default Sep. Property \times Female		0.541*** (0.029)
Household Characteristics	Yes	Yes
Survey FE	Yes	Yes
F-value	103.223	46.941
Prob > F	0.000	0.000
Observations	4262	4262
R^2	0.341	0.413

Notes: The sample includes all two-earner married households in 2002-2020 except for households living in Valencian Community since this region changed the default marital property regime law between 2008-2016. This table provides results of the first-stage regression of the separate-property variable on a dummy variable that takes a value equal to 1 when the couple's region of residence is Catalonia or the Balearic Islands. Standard errors are robust.

TABLE 2.3 Instrumental Variables Estimates

	(1)	(2)
	Risky Financial Assets	% # Risky Financial Asset Classes
	IV-2SLS	IV-2SLS
Separate Property	-0.059 (0.041)	-0.037 (0.026)
Female	-0.075*** (0.015)	-0.039*** (0.010)
Female \times Sep. Property	0.090*** (0.022)	0.051*** (0.015)
Households Characteristics	Yes	Yes
Survey Year FE	Yes	Yes
Observations	4262	4156

Notes: The sample includes all two-earner married households in 2002-2020. This table provides 2SLS results from a model where the dependent variable is a binary variable that equals 1 if households hold wealth in risky assets (i.e., listed shares, unlisted shares, and mutual funds) (Column (1)) or the share of different risky asset classes (Column (2)). Separate property is instrumented using a dummy for residence in Catalonia or the Balearic Islands. *Female* is a dummy variable that equals 1 if the household headship is female and 0 otherwise. We exclude from the sample couples living in Valencian Community as this region changed its default regime during the time period considered. Standard errors (in parenthesis) are robust and clustered at the regional level.

2.4.1 Robustness Checks

In our context, the exclusion restriction implies that property division rules affect financial outcomes only through the induced variation resulting from couples adopting the default regime in the region of residence. The most relevant threat to identification in our setting is that regional variation in default regimes captures cultural differences that might affect household financial behavior beyond property division rules themselves. The multiple marital property regimes result from different legal traditions: Catalonia and the Balearic Islands adopted separate property during the Roman Empire's rule, while other Spanish regions acquired community property from the Visigothic Kingdom law system. It is not unreasonable to think that such old legal traditions have shaped local cultural patterns differently, and this could translate into different household financial behavior. We exploit the information provided in the EFF survey to control for some of these potential confounders.

Different legal traditions could have influenced preference towards risk and financial sophistication levels. They can also promote or discourage female financial independence, which can be transmitted through family ties from generation to generation. Imre (2022) provides evidence on this channel by showing that separation of property promotes a higher female labor supply in Spain. We use a variable measur-

ing financial risk-taking as a proxy for household risk aversion, online banking and ownership of managed financial accounts as proxies for financial sophistication, and labor supply of household heads' mothers as a proxy for gender norms promoting female financial independence. Table A2.3 and A2.4 present 2SLS estimated results when controlling for risk attitudes, financial sophistication levels, and egalitarian gender norms and show that our results are robust to these alternative channels.

2.5 Theoretical Framework

We develop a two-period unitary household financial portfolio choice model to shed light on the mechanisms behind our empirical findings. Households consist of two individuals, $i = \{h, w\}$, who live for two periods and are born married. Both spouses are subject to idiosyncratic labor income shocks in the first period. The household head decides on consumption and the allocation of savings between a risk-free and a risky asset, given her spouse's savings decisions and portfolio choices, which are exogenous. In the second period, couples face an exogenous probability of divorce. The marital property regime only matters for the allocation of assets between spouses in case of divorce and the dissolution costs of marital assets. Under community property, the sum of spouses' total assets is divided equally between them. Moreover, spouses have to pay a dissolution cost of marital assets. In contrast, separate property spouses keep the property of their individual assets and pay no dissolution cost as there is no common pool of assets to be divided.

2.5.1 Preferences

Households have a time-separable CRRA preference over consumption, c . The period flow utility is given by

$$u(c) = \frac{c^{(1-\gamma)}}{1-\gamma}$$

where γ denotes the coefficient of relative risk aversion.⁹

2.5.2 Asset return

The safe asset earns a constant gross return r_s , and the risky asset a random gross return r_r . We assume the return of the risky asset follows a normal distribution $r_r \sim N(\mu_r, \sigma_r^2)$, is independent and identically distributed and such that $\mu_r > r_s$.

⁹Note that in this model we assume that the risk aversion is the same between genders and marital property regimes.

2.5.3 Income profiles

Income y^i for spouse i can be split into a deterministic and into a stochastic component and is expressed as:

$$y^i = \bar{y}^i \epsilon^i$$

where \bar{y}^i represents the deterministic gender specific component and ϵ^i is the stochastic component. In particular, we assume that the stochastic component follows an AR(1) process:

$$\ln(\epsilon^{i'}) = \rho \epsilon^i + v; \quad v \sim \mathcal{N}(0, \sigma_i^2).$$

2.5.4 Divorce and marital property regime

Divorce risk. In the second period, couples face an exogenous divorce probability, δ , common across marital property regimes.

Asset allocation rules and marital property regime. If couples divorce, the allocation of marital assets between spouses and the corresponding dissolution costs depend on the marital property regime, m . If married under community property, $m = c$, couples split total assets equally and have to pay a dissolution cost of marital assets, κ^i . This cost accounts for all legal fees spouses must pay to the public notary to dissolve the shared pool of marital assets (i.e., inventory, valuing the assets, etc.). In contrast, couples married under separate property, $m = s$, take their individual assets upon divorce and pay no dissolution costs of marital assets.

2.5.5 Timing

The household head learns both spouses' current productivity state, the risky-asset return, her spouse's savings decisions, and marital status at the beginning of period t . Afterward, she decides on consumption, which is public within the household, and her allocation of savings between safe and risky assets.

2.5.6 Recursive Formulation

As the risky asset follows an i.i.d process, we can combine safe and risky assets into one “asset cash-in-hand” state variable: $a = (1 + r_r)a_r + (1 + r_s)a_s$

Couples. The state variables for a couple are the household head's asset cash-on-hand (a^i), her spouse's asset cash-on-hand (a^j), her spouse's choices of risky and safe assets ($a_s^{j'}, a_r^{j'}$), both productivity realizations (ϵ^i, ϵ^j) and their marital property regime (m). For simplicity, we present the problem for the case when the wife is the

household head. The corresponding value function is as follows:

$$V^M \left(a^w, a^h, a_s^{h'}, a_r^{h'}, \epsilon^w, \epsilon^h, m \right) = \max_{a_s^{w'}, a_r^{w'}, c} \frac{c^{(1-\gamma)}}{1-\gamma} \\ + \beta \left[(1-\delta) \mathbb{E} V^M \left(a^{w'}, a^{h'}, 0, 0, \epsilon^{w'}, \epsilon^{h'}, m \right) + \delta \sum_{i=w,h} \mathbb{E} V^D \left(i, a^{w'}, a^{h'}, 0, 0, \epsilon^{i'}, m \right) \right]$$

$$c + \sum_{i=w,h} a_s^{i'} + \sum_{i=w,h} a_r^{i'} = \sum_{i=w,h} y_t^i + \sum_{i=w,h} a^i \\ a^{i'} = (1+r_r) a_r^{i'} + (1+r_s) a_s^{i'}, \quad \forall i = \{w, h\} \\ y^i = \bar{y}^i \epsilon^i, \quad \forall i = \{w, h\} \\ \epsilon^i \sim \mathcal{N}(0, \sigma_i^2), \quad \forall i = \{w, h\} \\ r_r \sim N(\mu_r, \sigma_r^2) \\ \mu_r > r_s \\ \epsilon^i \perp r_r, \quad \forall i = \{w, h\}$$

Divorcees. The value function of a divorced individual i in the second period is:

$$V^D \left(i, a^{w'}, a^{h'}, 0, 0, \epsilon^{i'}, m \right) = \max_{c^{i'}} \frac{(c^{i'})^{(1-\gamma)}}{1-\gamma} \\ c^{i'} = \begin{cases} y^{i'} + \frac{a^{w'} + a^{h'}}{2} - \kappa^i & \text{if } m = c \\ y^{i'} + a^{i'} & \text{if } m = s \end{cases} \\ y^{i'} = \bar{y}^i \epsilon^{i'} \quad \epsilon^{i'} \sim \mathcal{N}(0, \sigma_i^2)$$

2.6 Calibration

We calibrate the model using a two-step strategy. In the first step, we use data to estimate the parameters that can be cleanly identified outside the model. In the second step, we calibrate the remaining parameters to match the empirical gap in the risky share between separate and community-property couples. In the baseline calibration, women are assumed to be the household head. Table 2.4 summarizes the main parameter values.

TABLE 2.4 Parameters calibrated without and by solving the model.

Parameter	Value	Source
First step		
$\frac{\tilde{y}^h}{\tilde{y}^w}$	1.25	EFF
σ_h^2	0.292	EFF
σ_w^2	0.370	EFF
ρ_h	0.571	EFF
ρ_w	0.531	EFF
σ_r^2	0.206 ²	Bank of Spain
μ_r	2.03%	Bank of Spain
r_s	0	See text
δ	24%	INE
γ	10	Cocco et al. (2005)
β	0.96	Cocco et al. (2005)
α_1	20.9%	EFF
α_2	6%	EFF
Second step		
κ	5%	-

2.6.1 First step: Parameter values selected without solving the model

Income profiles of married couples. We set the permanent component of income \tilde{y}^i to match the average gender wage gap between spouses observed in the EFF data between 2002 and 2020. We focus on working married couples for which wives are the most knowledgeable about household finances (i.e., female-headed couples), which gives us a gender wage gap of $\frac{\tilde{y}^h}{\tilde{y}^w} = 1.25$. Regarding the stochastic component governing the income process, we estimate the following regression using the panel structure of the EFF:

$$\ln w_{jt}^i = \beta_1 age_{jt}^i + \beta_2 (age^2)_{jt}^i + \beta_3 occupation_{jt}^i + \lambda_j + u_{jt}^i \quad \forall i \in \{h, w\}$$

where w_{jt}^i denotes the monthly wage of spouse i in household j and λ_j refers to a household fixed effect.

We then regress the residuals obtained from this estimation on their time lags to obtain the persistence parameters of the AR(1) process for the stochastic shocks and the variance of the innovations. Table 2.4 presents the estimates of these two objects. The estimates indicate that the variance of married women's labor income innovations is higher than the one of their husbands' while the persistence of their stochastic income process is lower. When solving the model numerically, we discretize the labor income shock using Tauchen (1986) method.¹⁰

¹⁰In particular, we discretized the income shock using ten grid points.

Asset returns. The average return of the risky asset takes the value $\mu_r = 2.03\%$, and its variance $\sigma_r^2 = 0.206^2$, consistent with average annual total returns and volatility of the IBEX-35 index between 2002-2021¹¹ We set the return of the safe asset to 0, $r_s = 0$.

Divorce probability. The divorce probability is set to 24%, the average divorce rate for married couples between 25 and 60 years old, using the Divorce Indicators data from the Spanish Statistics National Institute (INE for its acronym in Spanish).

Risk aversion and discount factor. We borrow the risk aversion and discount factor parameter values from Cocco et al. (2005) and set them to $\gamma = 10$ and $\beta = 0.96$, respectively.¹²

Husband savings. The data from the EFF survey only provides information on household-level wealth holdings rather than individual savings. Since savings patterns and portfolio choices differ between married and single individuals (Bacher, 2021a; Love, 2010; Bertocchi et al., 2011), we cannot use the data for single individuals in the sample. To overcome this challenge, we make the assumption that the contribution of each spouse to household savings is proportional to their income. This implies that the distribution of savings between spouses is proportional to their wage gap.¹³ More formally, let's denote α_1 and α_2 the contribution of husbands to total savings and risky asset holdings, respectively. We compute these shares as follows:

$$\begin{aligned}\frac{a^h}{\tilde{y}^w + \tilde{y}^h} &= \alpha_1 \left(\frac{a}{\tilde{y}^w + \tilde{y}^h} \right) \\ \frac{a_r^h}{a_r^h + a_s^h} &= \alpha_2 \left(\frac{a_r}{a_r + a_s} \right)\end{aligned}$$

where $\frac{a}{y}$ and $\frac{a_r}{a_r + a_s}$ are retrieved from the data EFF 2002-2022 for households whose finances are led by wives. We obtain $\alpha_1 = 20.9\%$ and $\alpha_2 = 6\%$ by assuming these are proportional to husbands' contribution to total income, which is determined by the wage gap. Table A2.6 in the Appendix compares these shares with the total household savings to income ratio and household share in risky assets.

¹¹Series 'Cotización y contratación. Acciones. Sociedad de Bolsas y Sociedad Rectora de la Bolsa de Madrid. Índice cotización. Índice IBEX 35' downloaded from www.bde.es.

¹²See Gomes et al. (2021) for a literature discussion of the estimates of the coefficient of risk aversion, discount factor, and participation costs in models of asset allocation over the life cycle.

¹³In previous studies, such as Grabka et al. (2015) and Meriküll et al. (2021), show using German and Austrian individual-level data that labor earnings are one of the main factors explaining spouses' share in total household savings.

2.6.2 Second step: Parameter values selected by solving the model

We use the one remaining parameter, the dissolution cost of marriage κ^i , to target the gap in the risky assets participation rate between households married under separate and community property regimes. Recall that the dissolution cost of marriage is only paid by community property couples. We assume that both spouses bear the same cost, a fraction equal to half of the household's permanent income. Specifically, we set the individual cost such that:

$$\kappa^w = \kappa^h = \kappa \frac{\tilde{y}^w + \tilde{y}^h}{2},$$

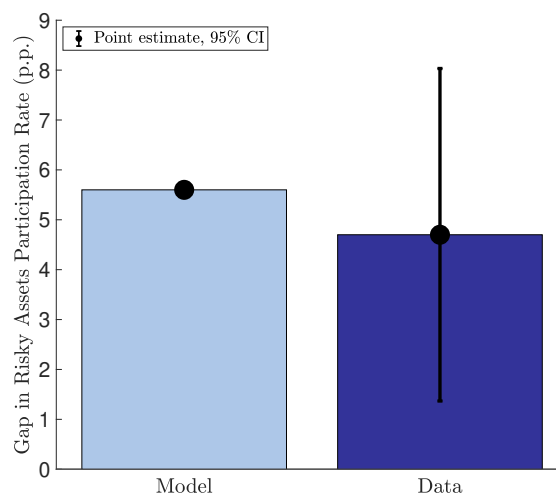
where \tilde{y}^w and \tilde{y}^h represent the permanent income of the wife and husband, respectively, and κ , represents the fraction of total household permanent income destroyed in the event of marital dissolution. We set $\kappa = 5\%$ to calibrate our model, which falls below the range of values explored in previous studies such as Cubeddu and Ríos-Rull (2003) for the US economy.

2.7 Model Results

2.7.1 Targeted Moment

Figure 2.2 compares the gap in the risky assets share between marital property regimes generated by the model and the one estimated in the data for couples whose household finances are led by wives. The model matches the data target well: it predicts a risky share gap between separate-property and community-property couples of 5.6 percentage points (pp), close to the estimated gap of 4.7 pp. We estimate the gap by regressing female-headed households' participation in risky assets on a separate property regime dummy. To be consistent with our empirical strategy described in Section 2.4, we instrument the property regime variable with households' region of residence in Catalonia and Balearic Islands and control for the full range of socio-economic characteristics. Column (1) in Appendix Table A2.5 shows the results of this estimation.

FIGURE 2.2 Property Regime Gap in Participation in Risky Assets: Model vs. Data



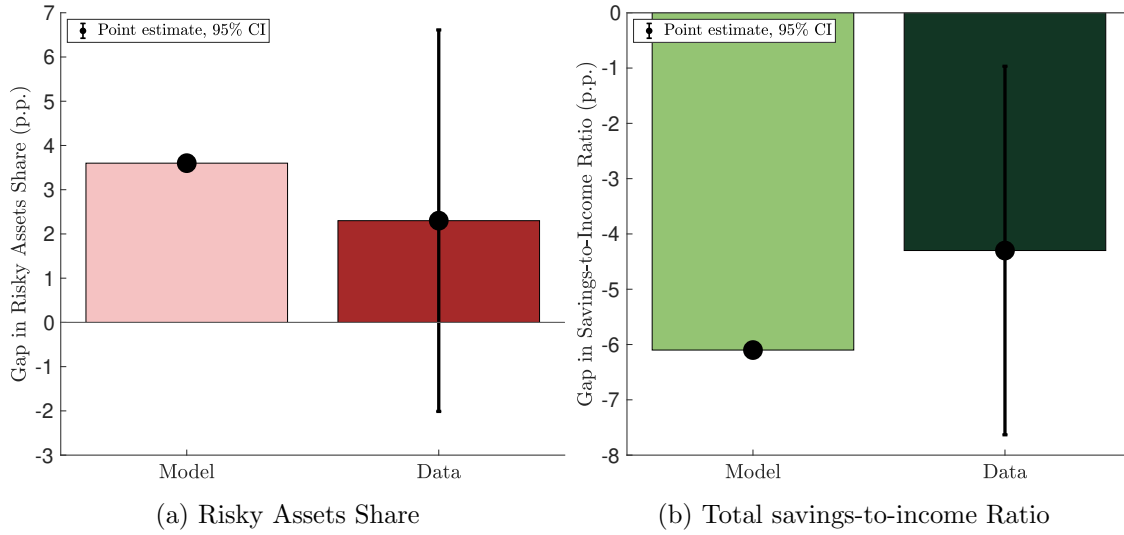
This figure plots the property regime gap in the participation in risky assets generated by the model and the one estimated in the data. The gap is computed as the difference between separate-property and community-property households' portfolio share in risky assets. The darker blue bar refers to the 2SLS estimate of the gap and the corresponding 95% CI using EFF survey waves 2002-2020. The lighter blue bar refers to the model simulation outcome.

2.7.2 Untargeted Moments

Figure 2.3 presents the model fit for the property regime gap in risky assets share and total savings-to-income ratio. Columns (2) and (3) in Appendix Table A2.5 show the 2SLS estimation results of these two savings outcome gaps, respectively. Notice that these gaps are untargeted in the calibration exercise. As can be inspected, the simulated model outcomes successfully replicate the positive gap in participation rates (Figure 2.7a) as well as the negative gap in financial savings (Figure 2.7b).

However, the model overpredicts the gap in total financial savings and risky asset shares between these couples.

FIGURE 2.3 Property Regime Gap in Risky Assets Shares and Total Savings: Model vs Data



This figure plots the property regime gap in the portfolio share in risky financial assets and the total savings-to-income ratio generated by the model, and the one estimated in the data. The gap is computed as the difference between separate-property and community-property households' outcomes. The darker bar refers to the 2SLS estimate of the gap and the corresponding 95% CI using EFF survey waves 2002-2020. The lighter bar refers to the model simulation outcome.

2.8 Explaining the Property Regime Gap in Risky Investment

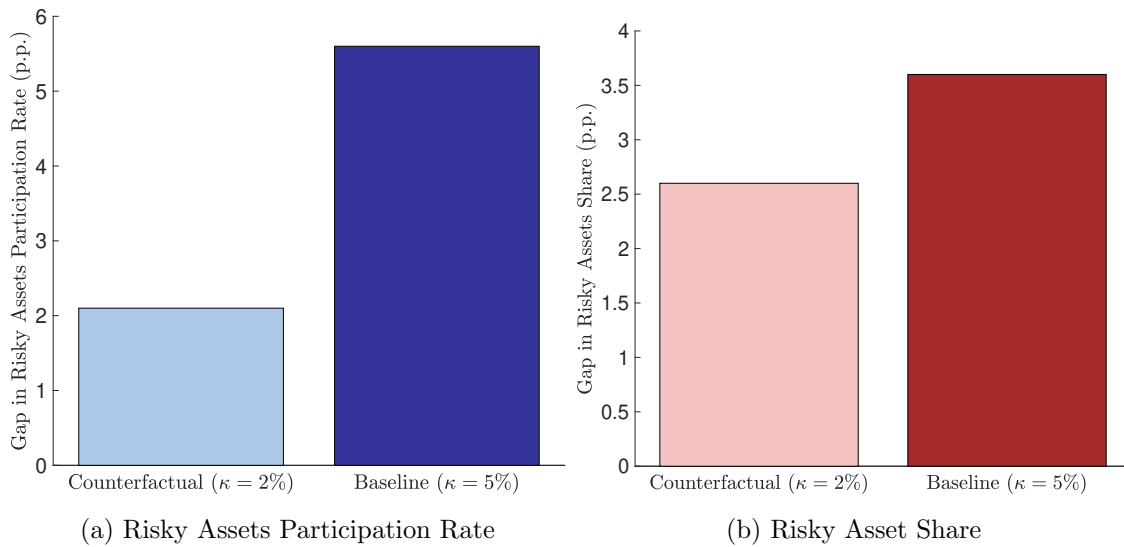
We now study the channels through which the marital property regime affects households' investment choices by means of counterfactual simulations. To do so, we change the parameter values of interest, re-solve, and contrast the resulting simulation outcome to the baseline economy.

Divorce risk. Divorce is a key driver of the marital property regime gaps in the model as property division rules directly influence the sharing rule of assets between spouses upon divorce as well as the dissolution costs of marriage. Without divorce risk, couples face the same optimization problem during marriage. Therefore, their optimal portfolio choice decisions should be the same. Table A2.9 shows that risky asset share, participation rate, and total savings gap collapse to 0 when shutting down the probability of divorce (i.e., $\delta = 0$).

Dissolution costs of marriage. The dissolution costs of marriage are a source of heterogeneity across marital property regimes. In the model, we assume that

community-property couples must pay the cost of dissolving the common pool of assets while separate-property couples face no cost. The strength of the precautionary savings motive increases with the dissolution costs of marriage (i.e. with the proportion of permanent income destroyed in the event of divorce). Figure 2.4 shows the model simulation outcome for the gap in the risky assets participation rate and the risky share for a lower value of κ . As can be inspected, both gaps increase with the dissolution costs of marriage as wives married in community property demand more safe assets to self-insure against divorce risk.

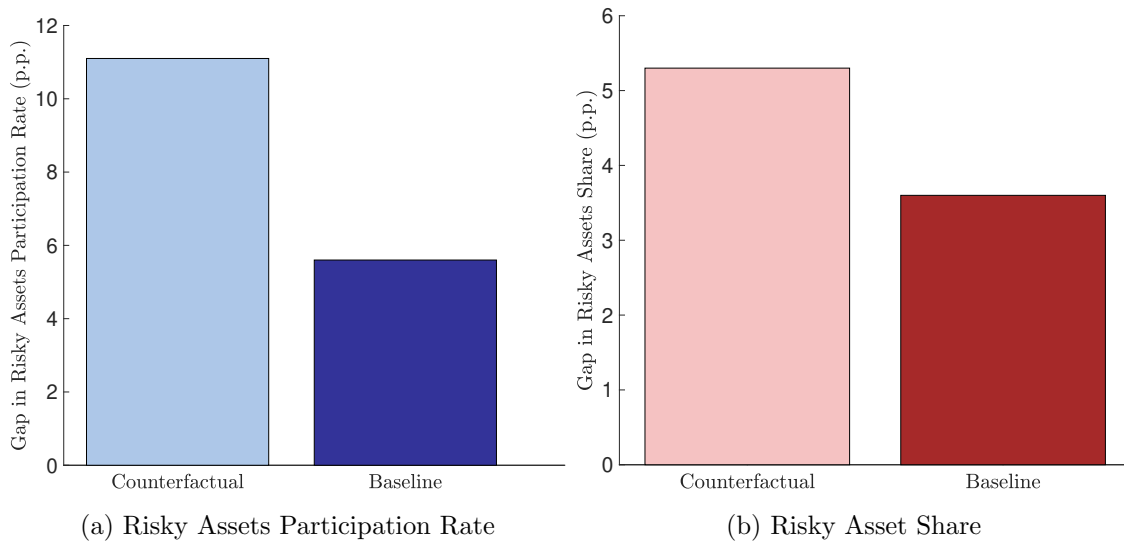
FIGURE 2.4 Property Regime Gap in Risky Investment: Baseline vs Counterfactual 1



This figure plots the property regime gap in the participation and portfolio share in risky financial assets in the counterfactual scenario and the baseline economy. The gap is computed as the difference between separate-property and community-property households' outcomes.

Income levels. We explore how income differences between spouses affect the property regime gaps in risky financial investments. To do so, we simulate a counterfactual scenario where we calibrate the spouses' permanent income process to match the average gender wage gap of male-headed couples (i.e. $\frac{\bar{y}^h}{\bar{y}^w} = 1.91$).¹⁴ Figure 2.5 shows that the gap in risky investment increases as the wife's permanent income decreases relative to their husband's. Notice that although all married women would experience a higher drop in consumption compared to the baseline economy as they earn lower permanent income on average, divorce becomes riskier for those under community property as it is more costly.

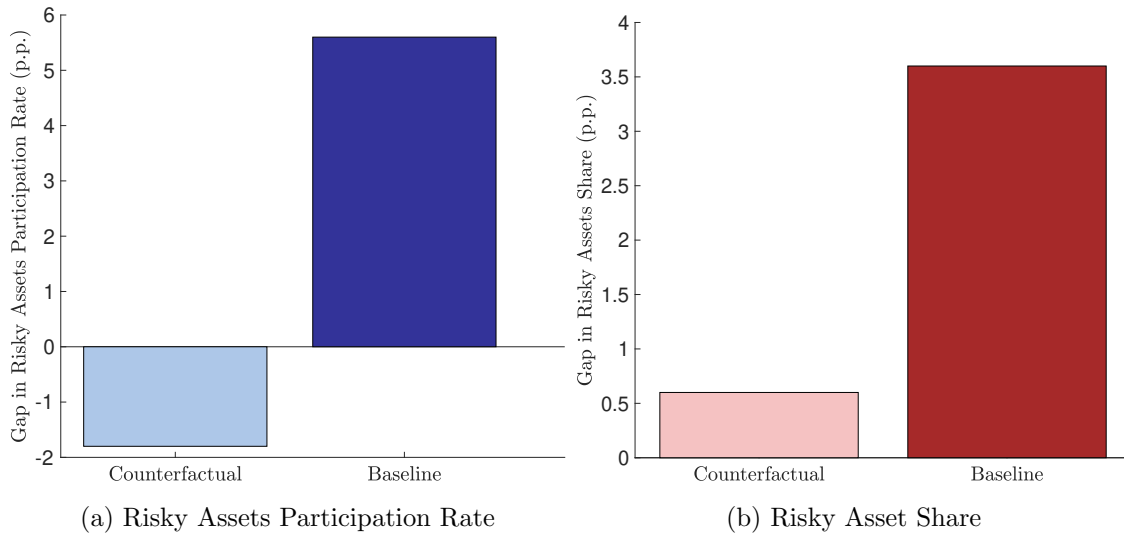
FIGURE 2.5 Property Regime Gap in Risky Investment: Baseline vs Counterfactual 2



This figure plots the property regime gap in the participation and portfolio share in risky financial assets in the counterfactual scenario and the baseline economy. The gap is computed as the difference between separate-property and community-property households' outcomes.

Income risk. Finally, we investigate how income risk shapes the marital property regime gap in risky financial investments. We do so by assigning wives the stochastic part of their husbands' labor income process (variance and persistence), lowering their exposure to income fluctuations. Figure 2.6 shows that the gap in risky investment gets significantly reduced both at the extensive and intensive margin, becoming slightly negative for the participation rate. Compared to the baseline, divorce becomes a less financially risky outcome for community property wives who increase their demand for risky assets. This reduces the average differences in risky asset holdings between the two types of couples.

¹⁴We also change the calibration for the husband's savings as we assume that spouses' distribution of household savings during the marriage is proportional to the wage gap

FIGURE 2.6 Property Regime Gap in Risky Investment: Baseline vs Counterfactual 3

This figure plots the property regime gap in the participation and portfolio share in risky financial assets in the counterfactual scenario and the baseline economy. The gap is computed as the difference between separate-property and community-property households' outcomes.

Figures A2.4-A2.6 present the results for the gap in total savings-to-income ratio for each of the counterfactual scenarios. As can be inspected, total savings increase with the dissolution costs of marriage and income risk. However, we obtain a smaller gap in total savings for larger gender income differentials within the couple.

2.9 Further Results

2.9.1 Disentangling the role of the dissolution cost and the asset division rules

In the model, marital property regimes introduce differences in (i) the allocation rule of marital savings between spouses and (ii) the dissolution costs of marriage. More precisely, separate-property spouses retain ownership of their individual portfolio in the event of divorce while community-property spouses pool their savings together and each of them retains 50% of the total household portfolio. In addition, we assume that community-property couples pay a dissolution cost of marriage while separate-property couples face no cost.

We conduct two counterfactual exercises to isolate the contribution of each of these two factors (i.e. asset allocation vs dissolution costs) on the estimated marital property regime gap. In the first scenario, we simulate the model assuming that both types of couples face the same dissolution cost of marriage (i.e. $\kappa = 5\%$). In the second scenario, we assume those married under separate property pool the assets

upon divorce and divide them in half without paying any dissolution cost. Table 2.5 presents the difference in the participation rate, the share of risky assets, and the savings-to-income ratio in these two counterfactual economies with respect to the baseline economy for separate-property couples.

TABLE 2.5 Disentangling the role of dissolution costs vs asset allocation rule

	(1)	(2)
	The role of dissolution cost	The role of pooling assets
Risky assets participation rates	-10.31 p.p	-4.78 p.p
Risky assets share	-4.52 p.p	-3.03 p.p
Total savings-to-income ratio	1.51 p.p	3.98 p.p

Notes: Columns (1) and (2) present the percentage points difference between the model outcomes in each of the two counterfactual scenarios and the baseline for separate-property couples. In the first column, we assume that separate property couples also pay the dissolution cost, κ . In the second column, we assume that separate property couples also pool the assets and divide them by half in case of divorce.

Column (1) in Table 2.5 shows that when separate-property wives bear the same dissolution cost as community-property wives, they save more but demand less risky assets. Higher dissolution costs make divorce riskier, as a fraction of permanent income is destroyed in the event of divorce, which encourages higher precautionary savings in the form of safe assets to smooth consumption. Column (2) in Table 2.5 shows that when separate-property couples pool the assets and divide them fifty-fifty in the event of a divorce, they would also save more and demand less risky assets. The fact that assets are split equally between spouses independently on the intra-household distribution of savings during marriage also incentives precautionary savings in the form of safe assets for the spouse with lower income. Quantitatively, the dissolution costs of marriage seem to be more important for explaining the property regime gap in risky investment at the extensive and intensive margin.

2.9.2 Model validation

The empirical findings presented in Section 2.4 suggest that separate-property couples hold significantly riskier portfolios than community-property ones *only* when wives take a more prominent role in managing household finances. We validate our theoretical results by solving the model when the husband is the one making portfolio choices taking as given her wife's saving decisions.

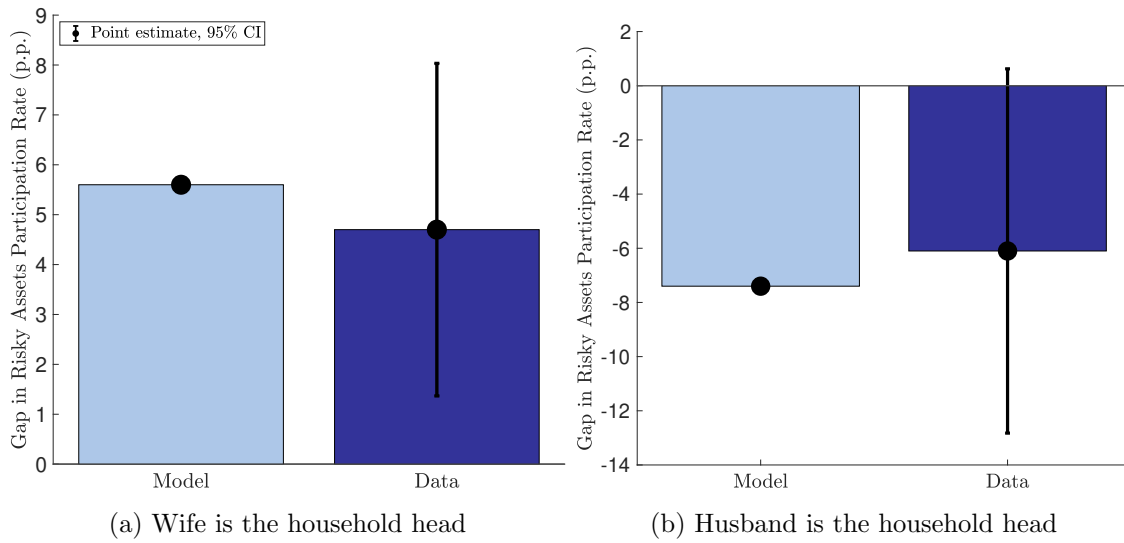
Table 2.6 presents the relevant parameters modified for this exercise and their corresponding values. Relative to the baseline economy, we change both spouses' income parameters to match the income profiles of male-headed households in the EFF data from 2002-2020. In particular, we change the permanent income components to match the average gender wage gap for male-headed households and estimate the variance and persistence of the stochastic component of both spouses' income for these couples. Finally, we also obtain the wife's total savings and share in risky assets following the procedure explained in Section 2.6.1.¹⁵ It is noteworthy that relative to the baseline economy, husbands leading household finances have a higher level of permanent income but a lower variance of the income shock compared to wives leading household finances. Conversely, the spouse in this case - the wife - maintains lower savings levels and a relatively smaller portfolio of risky assets.

Figure 2.7 compares the alternative model outcome with the estimated gap in the sample of households led by husbands. When calibrated to match the income profiles of male-headed households, the model is able to replicate the estimated empirical gaps for these couples fairly well. Appendix Figure A2.7 shows that the model is also able to replicate the estimated gaps in the risky asset share and total savings. These results highlight the importance of income profile heterogeneity in explaining differences in portfolio investments for couples with the same property division rules.

TABLE 2.6 Parameters when the husband is the household head

Parameter	Value	Source
$\frac{\bar{y}^h}{\bar{y}^w}$	1.91	EFF
σ_h^2	0.349	EFF
ρ_h	0.514	EFF
σ_w^2	0.297	EFF
ρ_w^2	0.574	EFF
α_1	15.6%	EFF
α_2	3%	EFF

¹⁵Appendix Table A2.8 presents the parameter estimates of the income process of male-headed households, whereas Table A2.7 displays the values utilized for the wife's total savings and share in risky assets.

FIGURE 2.7 Model Validation

This figure plots the property regime gap in the risky assets participation rate when calibrating the model to match male-headed households' income profiles and compares it with the baseline economy (female-headed households). The gap is computed as the difference between separate-property and community-property households' outcomes. The darker blue bar refers to the 2SLS estimate of the gap and the corresponding 95% CI using EFF survey waves 2002-2020. The lighter blue bar refers to the model simulation outcome.

2.10 Conclusion

A vast literature in household finance emphasizes that women are less likely to take financial risks than men because of their psychological traits (less confidence and optimism, more risk aversion) or because of the social norms they have been raised in (financial matters are considered the domain of men). This paper uncovers a critical yet unexplored determinant of financial investment when women are in charge of household finances: the marital property regime.

We use rich household-level data and exploit the regional variation in default marital property regimes in Spain to provide causal evidence on the effects of property division rules on couples' risky financial investment. We find that couples married under separate property are more likely to hold wealth in risky assets than their counterparts married under community property when women are in charge of household finances. Not only do these couples participate more in risky assets, but also they hold a more diversified portfolio of risky assets. In particular, separate-property households are up to 9% more likely to take financial risks than those married under community property. On average, they also hold a share in risky asset classes up to 5 percentage points higher. To understand better the mechanisms at play, we develop a two-period financial portfolio choice model where wives decide how to allocate savings and couples differ in their property division rule.

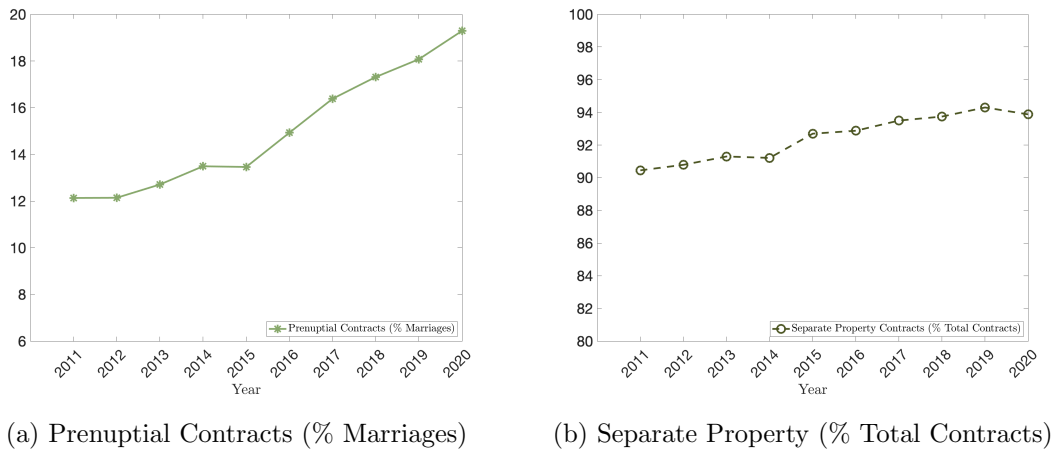
Couples consist of two individuals born married and face an exogenous probability of divorce in the second period. In the model, property division rules determine the sharing rule of marital savings upon divorce and the associated dissolution costs of marital assets. In the event of divorce, separate-property spouses take their individual assets and face no dissolution of marital assets while community-property couples must pay the costs of dissolving the common pool of assets equally between spouses. We calibrate the model to match key moments of Spanish female-headed couples and show that divorce risk and gender differences in labor income profiles are key determinants in shaping the financial portfolio choices of married couples under different property division rules.

In all, our results suggest that property division rules in marriage seem to be an essential factor influencing the portfolio choices of couples in the face of divorce risk. An exciting extension of this work would be to analyze the wealth accumulation outcomes of divorced women under these two regimes and their implications for explaining the gender wealth gap later in life. We leave this for future research.

A2 Appendix to Chapter 2

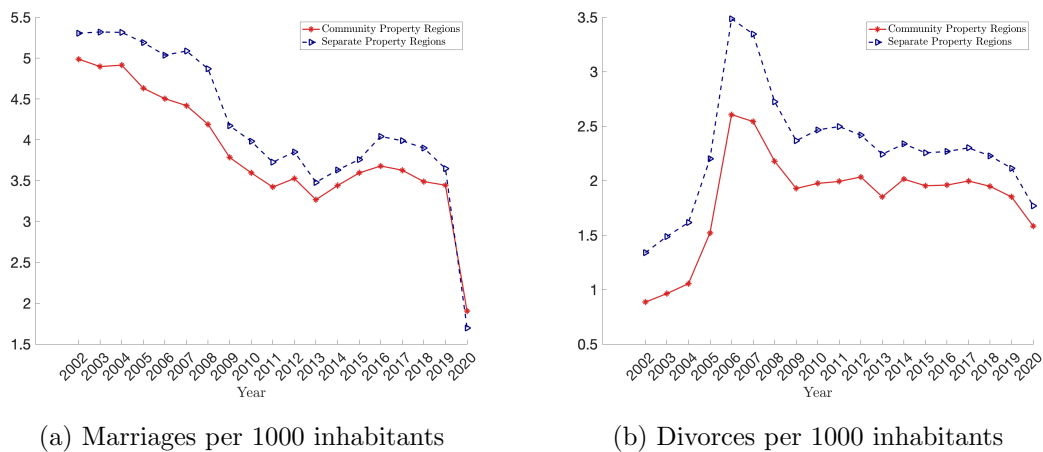
A2.1 Institutional background

FIGURE A2.1 Prenuptial Contracts



The figure plots the evolution of prenuptial contracts (% total marriages) and prenuptial contracts for separate property (% total prenuptial contracts) between 2011-2020. The data has been obtained from Statistics of the General Council of Notaries

FIGURE A2.2 Marriages and Divorces in Spanish Regions by Default Regime



Notes: The figure plots the evolution of marriages and divorces per 1000 inhabitants across Spanish regions depending on their default property regime for the period 2002-2020. Separate-property regions (blue triangle line) are Catalonia and the Balearic Islands (and Valencian Community for the period 2009-2015). Community-property regions (red star line) are the rest of the Spanish regions (and Valencian Community for the period 2002-2008, 2016-2017).

A2.2 Household Data

TABLE A2.1 Household Summary Statistics - Wife is household head

	Mean	St. dev.	Separate	Community
Panel A. Socioeconomic characteristics				
<i>Household head</i>				
Separate property	0.25	0.43		
Age	44	7.98	44	44
Education				
Less than high school	0.24	0.43	0.19	0.26
High School	0.35	0.48	0.31	0.36
College	0.40	0.49	0.50	0.37
Occupation in financial sector	0.05	0.23	0.08	0.05
<i>Comparative ratios bw spouses</i>				
Education ratio bw spouses	1.24	0.56	1.20	1.26
Age ratio bw spouses	0.98	0.09	0.98	0.97
Wage ratio bw spouses	0.83	0.65	0.89	0.81
<i>Other controls</i>				
Home-ownership				
Rent	0.11	0.29	0.13	0.11
Ownership	0.84	0.33	0.82	0.85
Other	0.04	0.18	0.05	0.04
Household size	3.55	0.99	3.52	3.56
Income (thousands eur)	55.12	46.98	67.52	51.08
Net wealth (thousands eur)	306.46	614.22	464.76	254.90
Panel B. Financial Variables				
<i>Financial Variables</i>				
Participation risky assets	0.22	0.41	0.33	0.18
Risky asset classes (%Total asset classes)	0.11	0.21	0.17	0.09
Risky assets share	0.10	0.24	0.16	0.08

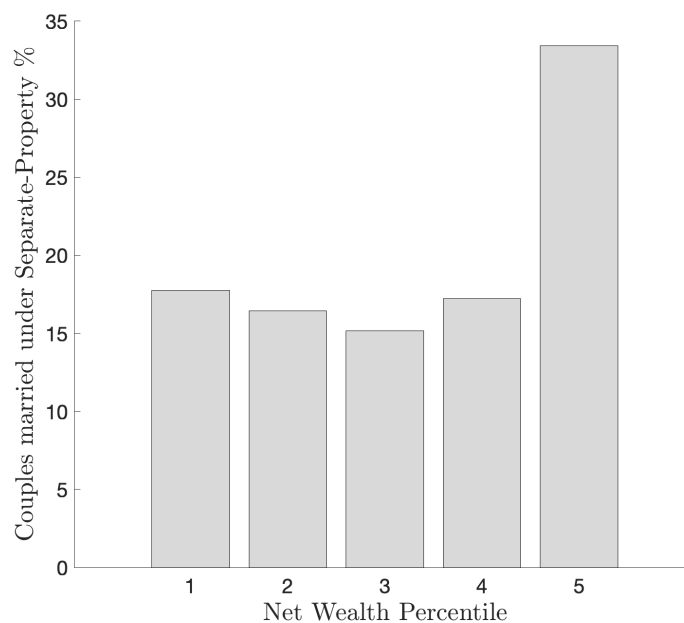
Notes: This table shows summary statistics for two-spouse households characteristics and by marital property regime of the household head. The sample includes information from 2002-2020 waves of the Spanish Survey of Household Finances and is restricted to two-spouse households aged above 25 years old who are employed. Self-employed households are excluded from the sample. Observations: 1681 (1652 for the education ratio, 1633 for the risky asset classes share, and 1626 for the risky assets share)

TABLE A2.2 Household Summary Statistics - Husband is the household head

	Mean	St. dev.	Separate	Community
Panel A. Socioeconomic characteristics				
<i>Household head</i>				
Separate property	0.27	0.44		
Age	47	8.88	47	47
Education				
Less than high school	0.23	0.42	0.15	0.26
High School	0.33	0.47	0.31	0.34
College	0.34	0.50	0.54	0.40
Occupation in financial sector	0.05	0.22	0.09	0.04
<i>Comparative ratios bw spouses</i>				
Education ratio bw spouses	1.04	0.41	1.05	1.03
Age ratio bw spouses	1.06	0.09	1.06	1.06
Wage ratio bw spouses	1.98	2.09	2.14	1.92
<i>Other controls</i>				
Home-ownership				
Rent	0.08	0.27	0.08	0.08
Ownership	0.89	0.32	0.87	0.89
Other	0.03	0.17	0.04	0.03
Household size	3.50	1.00	3.45	3.51
Income (thousands eur)	73.17	109.00	101.28	62.92
Net wealth (thousands eur)	679.90	4186.65	1438.94	403.04
Panel B. Financial Variables				
<i>Financial Variables</i>				
Participation risky assets	0.35	0.48	0.41	0.32
Risky asset classes (%Total asset classes)	0.18	0.25	0.21	0.16
Risky assets share	0.18	0.31	0.23	0.16

Notes: This table shows summary statistics for two-spouse households characteristics and by marital property regime of the household head. The sample includes information from 2002-2020 waves of the Spanish Survey of Household Finances and is restricted to two-spouse households aged above 25 years old who are employed. Self-employed households are excluded from the sample. Observations: 3229 (3148 for the education ratio, 3158 for the risky asset classes share and, 3148 for the risky assets share)

FIGURE A2.3 Married Couples under Separate Property in Community-Property Regions



Notes: The figure shows the proportion of married couples that opt out of community property by net wealth percentile as a share of total married couples opting out. Data are from the 2002-2020 waves of the Spanish Survey of Household Finances. The sample is restricted to two-earner households aged above 25. Self-employed households are excluded.

A2.3 Empirical Results

TABLE A2.3 Robustness Checks - Participation in risky financial assets

	(1) Risky Financial Assets	(2) Risky Financial Assets	(3) Risky Financial Assets
Separate Property	-0.060 (0.036)	-0.086* (0.044)	-0.061 (0.040)
Female	-0.056*** (0.016)	-0.096*** (0.015)	-0.074*** (0.015)
Female \times Sep. Property	0.084*** (0.022)	0.151*** (0.022)	0.095*** (0.023)
Risk Attitudes	✓		
Online Banking		✓	
Managed Fin. Accounts		✓	
Mother Housewife			✓
Households Characteristics	Yes	Yes	Yes
Survey Year FE	Yes	Yes	Yes
Observations	4262	3087	4216

Notes: The sample includes all two-earner married households in 2002-2020. This table reports 2SLS estimates from a model where the dependent variable is a binary variable that equals 1 if households hold wealth in risky assets. *Separate property* is instrumented using a dummy for residence in Catalonia or the Balearic Islands. *Female* is a dummy variable that equals 1 if the headship of the household is female and 0 otherwise. *Risk attitudes* is a categorical variable that measures attitudes towards risk from a lower to a higher degree of risk tolerance. *Online banking* is a dummy variable for online banking usage. *Managed Fin Accounts* is a dummy variable for ownership of managed financial accounts by professional financial institutions. *Mother Housewife* is a dummy variable that equals 1 if the mother of the household head is/was a housewife. We exclude from the sample couples living in Valencian Community as this region changed its default regime during the time period considered. Standard errors (in parenthesis) are robust and clustered at the regional level.

TABLE A2.4 Robustness Checks - Portfolio share in risky asset classes

	(1) Risky Financial Assets	(2) Risky Financial Assets	(3) Risky Financial Assets
Separate Property	-0.038* (0.023)	-0.044* (0.026)	-0.038 (0.025)
Female	-0.028*** (0.007)	-0.049*** (0.008)	-0.038*** (0.010)
Female × Sep. Property	0.047*** (0.012)	0.078*** (0.016)	0.052*** (0.016)
Risk Attitudes	✓		
Online Banking		✓	
Managed Fin. Accounts		✓	
Mother Housewife			✓
Households Characteristics	Yes	Yes	Yes
Survey Year FE	Yes	Yes	Yes
Observations	4156	3012	4113

Notes: The sample includes all two-earner married households in 2002-2020. This table reports 2SLS estimates from a model where the dependent variable is a binary variable that equals 1 if households hold wealth in risky assets - mutual funds, listed shares and unlisted shares. *Separate property* is instrumented using a dummy for residence in Catalonia or the Balearic Islands. *Female* is a dummy variable that equals 1 if the headship of the household is female and 0 otherwise. *Risk attitudes* is a categorical variable that measures attitudes towards risk from a lower to a higher degree of risk tolerance. *Online banking* is a dummy variable for online banking usage. *Managed Fin Accounts* is a dummy variable for ownership of managed financial accounts by professional financial institutions. *Mother Housewife* is a dummy variable that equals 1 if the mother of the household head is/was a housewife. We exclude from the sample couples living in Valencian Community as this region changed its default regime during the time period considered. Standard errors (in parenthesis) are robust and clustered at the regional level.

TABLE A2.5 Empirical Gaps

	(1) % Risky Financial Assets Assets	(2) Risky Financial Assets	(3) Savings-to-Income Ratio
	Wife household head	Wife household head	Wife household head
Separate Property	0.023 (0.017)	0.047** (0.022)	-0.043* (0.020)
Households Characteristics	Yes	Yes	Yes
Survey Year FE	Yes	Yes	Yes
Observations	1461	1461	1461

Notes: The sample includes all two-earner married households in 2002-2020 where the household head is the wife. This table reports 2SLS estimates from a model where the dependent variable is the share in risky financial assets in the household portfolio (column (1)), a binary variable that equals 1 if households hold wealth in risky assets (column (2)) and the ratio between savings and total household income (column (3)). *Separate property* is instrumented using a dummy for residence in Catalonia or the Balearic Islands. We exclude from the sample couples living in Valencian Community as this region changed its default regime during the time period considered. Standard errors (in parenthesis) are robust and clustered at the regional level.

A2.4 Model Calibration and Theoretical Results

TABLE A2.6 Husband savings calibration

Parameter	Data Source	
	Married Couples Wife is the household head	
Household savings-to-income ratio	0.357	EFF
Husband savings-to-income ratio	0.209	
Household share in risky assets	0.10	EFF
Husband share in risky assets	0.06	

The average household savings-to-income ratio and share in risky assets have been computed using EFF survey data from 2002-2020. The sample has been restricted to two-earner married couples above 25 years old, for which the wife is the most knowledgeable about household finances. The gender wage gap is 1.25 for these couples. Survey weights are applied to give consistent averages for the Spanish population

TABLE A2.7 Wife savings calibration

Parameter	Data Source	
	Married Couples Husband is the household head	
Household savings-to-income ratio	0.456	EFF
Wife savings-to-income ratio	0.156	
Household share in risky assets	0.10	EFF
Wife share in risky assets	0.03	

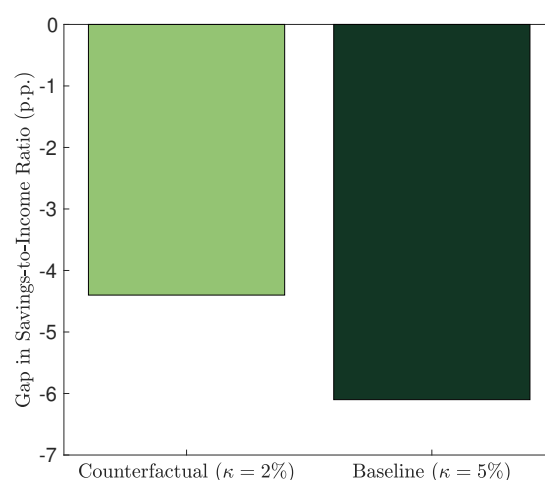
The average household savings-to-income ratio and share in risky assets have been computed using EFF survey data from 2002-2020. The sample has been restricted to two-earner married couples above 25 years old for which the husband is the most knowledgeable about household finances. The gender wage gap is 1.91 for these couples. Survey weights are applied to give consistent averages for the Spanish population

TABLE A2.8 Estimation results - Stochastic Income Process

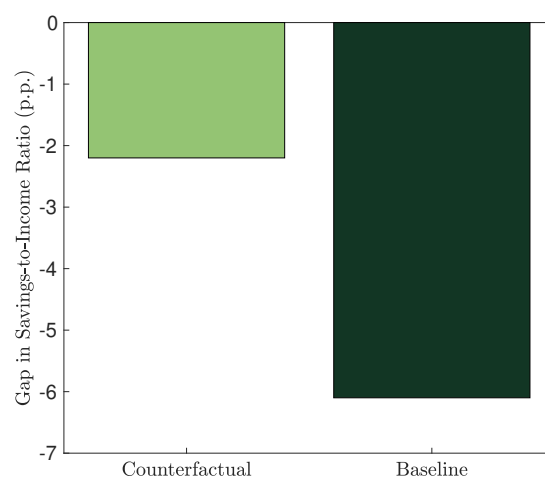
Parameter	Married Couples
Husband is the household head	
σ_h^2	0.349
ρ_h	0.514
σ_w^2	0.297
ρ_w^2	0.574

TABLE A2.9 Counterfactual - Divorce risk

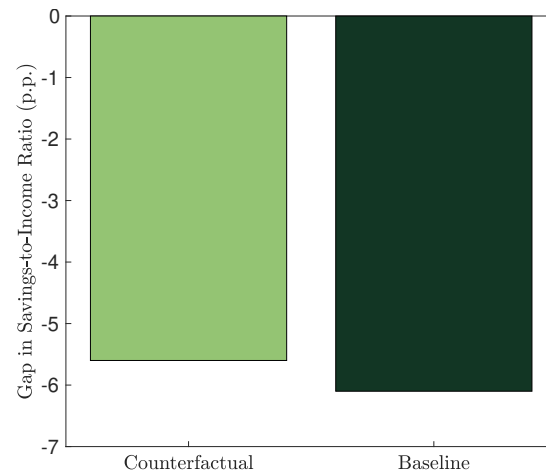
	(1) Baseline	(2) Counterfactual	(3) Data
Gap in	$\delta = 0.24$	$\delta = 0$	
Risky assets share	2.1 p.p	0 p.p	2.3 p.p
Risky assets participation rates	5.1 p.p	0 p.p	4.7 p.p
Total savings-to-income ratio	-7.4 p.p	0 p.p	-4.3 p.p

FIGURE A2.4 Gap in Savings-to-income Ratio - Baseline vs Counterfactual 1

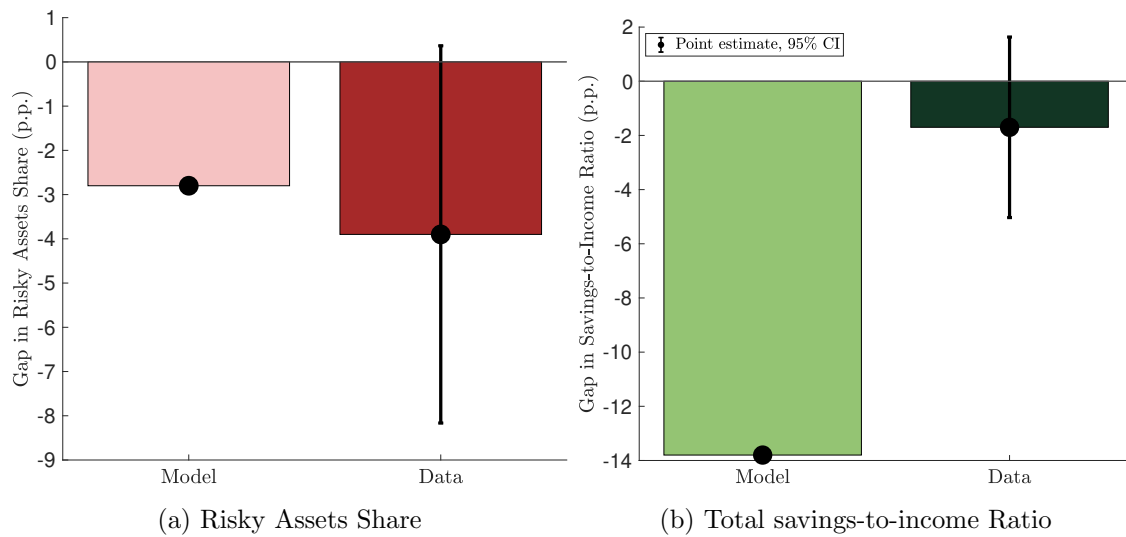
This figure plots the property regime gap in the total savings-to-income ratio generated by the model in the baseline economy and counterfactual scenario. The gap is computed as the difference between separate-property and community-property households' outcomes.

FIGURE A2.5 Gap in Savings-to-income Ratio - Baseline vs Counterfactual 2

This figure plots the property regime gap in the total savings-to-income ratio generated by the model in the baseline economy and counterfactual scenario. The gap is computed as the difference between separate-property and community-property households' outcomes.

FIGURE A2.6 Gap in Savings-to-income Ratio - Baseline vs Counterfactual 3

This figure plots the property regime gap in the total savings-to-income ratio generated by the model in the baseline economy and counterfactual scenario. The gap is computed as the difference between separate-property and community-property households' outcomes.

FIGURE A2.7 Model Validation - Property Regime Gaps for Male-headed Households

This figure plots the property regime gap in the portfolio share in risky financial assets and the total savings-to-income ratio generated by the model, and the one estimated in the data. The gap is computed as the difference between separate-property and community-property households' outcomes. The darker bar refers to the 2SLS estimate of the gap and the corresponding 95% CI using EFF survey waves 2002-2020. The lighter bar refers to the model simulation outcome.

Chapter 3

The sentimental propagation of lottery winnings: Evidence from the Spanish Christmas Lottery

3.1 Introduction

In the classical quote of Chapter 12 of *General Theory*, Keynes (1936) mentions: “A characteristic of human nature is...that a large proportion of our positive activities depend on spontaneous optimism rather than on a mathematical expectation.” Many studies have resuscitated this idea to show that expectations shape economic behavior. Early studies like the ones of Blanchard (1993) and Hall (1993) associate the 1990-1991 recession with an exogenous shift in pessimism. Similarly, Akerlof and Shiller (2010) argued that “declining animal spirits” were the main reason for the Great Recession. Cochrane (1994) rationalized the positive relation between sentiment and economic activity by arguing that sentiment reflects news about future economic conditions. Many years later Beaudry and Portier (2006) brought this link to the center of macroeconomic research and later Barsky and Sims (2012) established that confidence innovations relate to news about the business cycle but also that animal spirits could also matter.

Most of those studies provided indirect evidence of the effects of autonomous changes in sentiments on economic activity. Exceptions are the work of Lagerborg et al. (2022) who show that sentiments are an important driver of cyclical fluctuations using mass shootings as an instrument for autonomous changes in sentiments that are unrelated to fundamentals, and the work of Gillitzer and Prasad (2018), Benhabib and Spiegel (2019) and Mian et al. (2021) who use variation in consumer sentiment associated with political preferences to investigate whether innovations to consumer sentiment have a causal effect on consumption. This paper uses the exceptional nature of the Spanish Christmas lottery to estimate jointly the individual

and aggregate effects of lottery wins that are shared among many people living in the same province and accentuates the role of consumer confidence for the transmission of these shocks¹. We show that lottery shocks impact significantly consumers' sentiment and this brings demand effects that improve macroeconomic conditions in the winning regions.

The Spanish Lottery has three characteristics that are different from other lotteries: (i) Large size and quantity of prizes each year, (ii) Clustering of prizes to individuals living in the same Spanish province, and (iii) High level of participation. Each winner of the first prize, known as *El Gordo* (the fatty), receives around €20,000 per euro played, and the standard ticket costs €20. Moreover, winners of the second and third top prizes receive €6,250 and €2,500 per euro played, respectively. Importantly for our experiment, winners tend to be geographically clustered. Instead of awarding one big prize to a few individuals, as is the case of most lottery schemes, the top prizes are awarded to several thousand individuals sharing the same ticket number. Usually, one lottery outlay sells most (if not all) of the series of a single number in the lottery. The winning provinces receive an income shock equivalent, on average, to 0.2 percent of their GDP. For the provinces that receive the maximum lottery prize per capita, the income shock represents, on average, around 3.4 percent of provincial GDP.² Finally, because sharing Christmas lottery tickets is a social tradition, the lottery has an extremely high participation rate that is reflected in the high prizes for the winners.

We employ data from the monthly consumer sentiment survey conducted by the Center of Sociological Research (CIS). Each month around 1,000-1,500 nationally representative households across Spain are asked questions related to their past and intended consumption behavior and their current views and expectations about their own personal finances, as well as about their employment status considering the evolution of the Spanish labor market and the overall economic outlook of Spain. Following the University of Michigan Survey, we construct regional indices of confidence for the current (ICC) and expected macroeconomic conditions (ICE) and show using local projections (See, e.g., Jordà (2005)) that confidence reacts positively and significantly on impact to lottery wins at the regional level. To explore in depth the sentimental propagation of lottery wins, we use binary choice and ordinal regression models to study the effects of the lottery win on individual sentiment

¹The response of consumption and hours to lottery income for lottery winners has been studied extensively. (See, e.g., Imbens et al. (2001) for evidence using a lottery in Massachusetts in the mid-1980s, Fagereng et al. (2018) using Norwegian data, Lindqvist et al. (2020), using Swedish data, Oswald and Winkelmann (2019) using German data, Kuhn et al. (2011) using lottery winnings of Dutch Postcode Lottery and Picchio et al. (2018) using Dutch State Lottery prizes. Here, we do not wish to analyze the effects of the income shock for those households that receive money transfers. Instead, we want to analyze the effects of the positive news of the lottery arrival on sentiment in the region.

²The average lottery prize as a share of GDP has been computed using data from 2005-2017. Unfortunately, there is no available GDP data at the province level since 2018.

and consumption behavior using the same survey data. Lottery wins change significantly consumer sentiment at the individual level. Households become temporarily more optimistic about their current and future income and employment and tend to update upwards their expectations about the evolution of the Spanish economy if they live in a province that won the lottery. In line with the results found in the existing literature (see, e.g., Kuhn et al. (2011) and Attanasio et al. (2020)), we also find that households in winning provinces increase significantly their consumption of durable goods, in particular, the consumption of furniture and vehicles - relative to household residing out of these provinces - the first six months after the lottery win.

The increase in sentiment can be attributed to both news about future economic fundamentals and animal spirits. We try to disentangle the two channels using all available data and provide convincing evidence that lottery wins satisfy the exclusion restriction of having no direct effect on spending intentions. First, given that the probability of being a prize receiver in a winning province is only 0.015%, the lottery win is most likely unrelated to both current and future individual income. Second, surveyed households do not report a significant increase in their ability to pay bills after a lottery win, indicating that the lottery win does not increase the individual income of the respondents.

The Spanish Christmas lottery and in particular its top prize, *El Gordo*, has a long history in Spain, and people probably understand that if a town in their region wins the lottery, this will probably stimulate the regional economy. In order to discard such an interpretation, we first notice that sentiment increases significantly for questions related to the evolution of the Spanish economy as a whole. If winning the lottery carries news about a possible expansion in the region, rational agents should not expect this expansion to affect the rest of Spain. Hence, the positive reaction of expectations about the Spanish economy can only be attributed to increased optimism rather than news about regional fundamentals. This is further confirmed when we look at regions with active secessionist movements, like Catalonia and the Basque Country where people can clearly distinguish between national and regional conditions. In these regions, although agents are in general pessimistic about the future of the Spanish economy relative to other regions, the change in sentiment they experience is not different than the change in sentiment observed in other regions after a lottery win. Finally, we show that business sentiment does not react significantly to the lottery shock.

To see if the beliefs captured in sentiment surveys affect consumption, we match individual consumers' expectations of future economic conditions from the consumer sentiment survey to their intended durable consumption spending. We find that consumers who have a more positive economic outlook for their future employment based on their assessment of the Spanish labor market and a more positive outlook for the future economic conditions in Spain report more positive spending intentions.

We also show that lottery wins affect more significantly the sentiment and intended consumption of young, less educated, unemployed, and low-income households and that the effect of lottery wins on sentiment is stronger during recessions.

Next, we examine the dynamic effects of the Spanish lottery shock on macroeconomic conditions using monthly Spanish province-level data. We find that lottery wins have significant and economically important stimulative effects at the provincial level. On average, after a province wins a lottery of 1000 euros per capita the unemployment rate falls sluggishly reaching its maximum fall (-0.3 percentage points) after a year and it remains significantly low 20 months after the initial impact. The significant drop in unemployment cannot be attributed to a reduction in participation induced by the wealth effect of the lottery win. We show that the number of short and long-run contracts signed by individuals registered as unemployed in the National Employment Agency and labor market tightness (defined as the ratio of total contracts per number of unemployed) rise significantly and persistently after the lottery prize shock. Furthermore, the price level in the winning province increases persistently reaching its maximum 17 months after the shock, and exhibits a slow mean reversion, returning to its pre-shock value after approximately two years. We also explore whether the lottery shocks have effects on the housing market and find that neither rental prices nor mortgages are significantly affected by the shock in the winning provinces.

We are not the first to use the data from the Spanish Christmas Lottery to address economic issues. Bagues and Esteve-Volart (2016) use lottery prizes to identify random increases in provincial income and study how it affects electoral outcomes. They also report significant expansionary effects of lottery wins using annual data and show that the incumbent party tends to obtain relatively more votes in those provinces that won the prize in election years. Bermejo et al. (2021) also use annual data and find that firm and job creation rises significantly in winning provinces, suggesting that the money windfalls induce supply-side effects, especially in recessions and for firms that are financially constrained. Relative to these studies, we use more granular and monthly data and bring evidence on the effects of lotteries on sentiment apart from their macroeconomic consequences. Moreover, our results support that the short-run expansion in the winning provinces is demand-driven and operates through sentiment. Kent and Martinez (2020) also investigate how lottery wins impact local economic activity. By means of historical annual data since 1900, they find that consumption increases in those towns that won the lottery, which is consistent with our results. However, they find evidence supporting that lottery wins lead to a slowdown in economic activity and deter new migration to towns that won the big prizes in recent decades. By contrast, we rather focus on the short-run effects of lottery prizes on demand and consumer sentiment by using more recent monthly data.

The remainder of the paper is structured as follows. Section 2 describes the data.

Section 3 introduces the methodology and presents the results on the effects of lottery wins on sentiments at the aggregate and the individual level. Section 4 presents the effects of lottery wins on consumption at the individual level. Section 5 presents the aggregate effects of lottery wins and Section 6 describes various robustness checks. Section 7 concludes. An Online Appendix gathers further results discussed in the main text, as well as the outputs of several robustness checks.

3.2 Data

3.2.1 Spanish Christmas Lottery

The Spanish Christmas Lottery (*Lotería de Navidad*) is a national lottery scheme that is held every Christmas since 1812, and is considered one of the biggest lottery events worldwide. The draw takes place on December 22nd of each year and it is organized by the National Lottery and Gambling Agency (*Loterías y Apuestas del Estado*).

Christmas Lottery tickets have five-digit numbers and are available at a cost of €200. The amount of numbers played between 2005 and 2010 was 85,000 and has increased to up to 100,000 numbers since 2011. Each number is printed multiple times in so-called *series* (an average of 170 series per number were printed every year since 2005). Because the €200 tickets may be too expensive for many purchasers, each of the tickets is split into 10 identical sub-tickets (or fractions) sold for €20. Each one of these fractions is known as *décimo* (1/10 of the value of the total ticket). It is very common to buy a share of a *decimo*, called a *participación* (participation in English), through local associations, workplaces, sports teams, etc. These shares usually cost between €1 and €5.

Lottery tickets are sold in official lottery outlays located throughout the country.³ Out of the total lottery emission, 70% is distributed as prizes while the remaining 30% is devoted to commissions paid to outlets, internal revenue, and administration costs. There are three main prizes: the top prize, popularly known as *El Gordo*, which awards to each fraction holder of the winning number €20,000 per euro played, and the second and third prizes which reward winners with €6,250 and €2,500 per euro played, respectively. This means that all holders of a *decimo* of the top prize winning number would win €400,000. The individuals holding a *decimo* of the second or third prize winning number would win €125,000 and €50,000, respectively. The top prizes represent around half of the total payout assigned to prizes. There are also several smaller prizes ranging from €300 to €1 per euro played. Usually, one lottery outlay sells most (if not all) of the series of a single number. The Spanish

³Since 2015 lottery prizes can also be purchased online. However, the lottery online sales only represent about 1% of the total sales.

Christmas Lottery constitutes a collective game, meaning that Spaniards like to share *decimos* with relatives, friends, and co-workers. This implies not only that most of the winners of a lottery number usually live in the same area (province or village) but also that the main top prizes end up being distributed as smaller prizes to several individuals living in the same location.

Data on prizes and expenditure on Christmas Lottery by province were assembled using information from the National Lottery and Gambling Agency (*Sociedad Estatal Loterías y Apuestas del Estado*) and the dataset constructed by Bagues and Esteve-Volart (2016). Although holders of winning tickets can cash out the corresponding lottery prize on the same day of the draw (December 22nd), we impute reception of lottery prizes to next January as it usually takes time to actually receive the money transfer (bank transaction costs, bank holidays, etc.) For that reason, we use observations regarding the gross income distributed by the three main top prizes in each province, ranging from January 2006 to 2020. We do not observe the remaining several smaller prizes that are also awarded in the Christmas Lottery. However, given the random nature of the event, it can be assumed that their geographical distribution is proportional to the lottery expenditure by province (see also, Bagues and Esteve-Volart (2016)). We compute the after-tax revenue derived from the top lottery prizes and obtain a measure of net lottery-prize revenue per capita. We also observe the expenditure on the Christmas lottery per capita at the province level over the same time period.

Panel A of Table 3.1 presents descriptive statistics for the Christmas lottery at the province level. The average individual pays out 58 Euros to the lottery and receives on average 19.9 Euros and their probability of winning is 0.007%. These numbers reveal that the choice to participate in the lottery is more sentimental than rational to start with. Panel B summarizes the Christmas lottery expenditure and top prizes per capita in the winning provinces. The average expenditure per capita in those Spanish provinces is around €61, while the average lottery prize is around €42 per capita and the probability of being a winner in a winning province is 0.015%.

TABLE 3.1 Summary Statistics - Christmas Lottery data at the province level

	Mean	St. dev.	Min.	Max.	N
	(1)	(2)	(3)	(4)	(5)
A Christmas Lottery: <i>All provinces</i>					
Top prizes pc (in euros)	19.96	168.18	0.00	3414.72	750
Number awarded tickets (in 1000 pers.)	0.07	0.37	0.00	4.61	750
Top prizes (% of GDP)	0.08	0.76	0.00	14.81	650
Expenditure pc (in euros)	58.37	29.04	17.17	222.19	750
B Christmas Lottery: <i>Winning provinces</i>					
Top prizes pc (in euros)	41.47	240.74	0.02	3414.72	361
Number awarded tickets (in 1000 pers.)	0.15	0.53	0.00	4.61	361
Top prizes (% GDP)	0.20	1.16	0.00	14.81	278
Expenditure pc (in euros)	60.72	28.36	20.80	222.19	361
C Christmas Lottery: <i>Winning provinces with max prize pc</i>					
Top prizes pc (in euros)	722.49	966.83	70.74	3414.72	15
Number awarded tickets (in 1000 pers.)	1.66	1.45	0.09	4.61	15
Top prizes (% GDP)	3.35	4.41	0.22	14.81	13
Expenditures pc (in euros)	70.43	29.42	36.85	128.51	15

Top prizes and expenditures per capita are computed using data from May 2005 - Jan 2021. Top prizes (% of GDP) are computed using data from 2005 to 2018

Panel C of Table 3.1 reports summary statistics for those provinces that were awarded the maximum prize per capita in each year of our sample period. In these winning provinces, the average top lottery prize represents around 3.4% of provincial GDP and about €722 in per capita terms. The expenditures per capita reflect the high participation of Spaniards in the lottery while the variation in the rewards per capita suggests that in some cases the monetary transfers received by the winners are substantial. The numbers in this last table might justify the Spaniards' choice to participate in the lottery. Conditional on living in a province that won the maximum prize per capita, the probability of having a winning ticket varies between 0.009% and 0.461%. Hence, as often argued by Spanish people, participation in the lottery is justified by the fact that in case you do not participate you feel more like a loser. What we want to point out for the sake of our analysis is that the fraction of households within a “winning” province that actually won the lottery is really very small. We will return to this observation later in the following subsections.

3.2.2 Sentiment and Consumption Data

We collect individual-level data on Spanish confidence and consumption attitudes from monthly surveys conducted by the Center of Sociological Research, which follows closely the methodology adopted by the University of Michigan's Survey of Consumer Confidence, (*Centro de Investigaciones Sociológicas-CIS*) from April 2013 to January 2020 for which individual unit responses, as well as a full range of individual characteristics, are available. We start our sample in April 2013 because survey respondents were not reporting their household income before that date. Each month around 1,000-1,500 nationally representative households across Spain are asked questions related to their consumption of durable goods and own per-

sonal finances and employment status as well as about the economic situation of the Spanish economy.

The questions that concern consumers' assessment of their current and expected own financial and employment status and the state of the Spanish economy are summarized below:

1. **Q1S (Q1F)** Would you say that your household economic conditions are better off, worse off, or just about the same compared to six months ago (*in six months from now?*)?
2. **Q2S (Q2F)** Would you say that the current economic situation of Spain would allow you to improve your employment status, would worsen your employment status, would have no impact on your employment status compared to six months ago (*in six months from now?*)?
3. **Q3S (Q3F)** Would you say the current state of the Spanish economy is better, worse, or about the same compared to six months ago (*in six months from now?*)?

For each of these six questions, the surveyed households can either give a positive, neutral or negative answer. We code the answers in ascending order in the regressions.

Surveyed individuals are also asked whether they have purchased any durable goods during the past six months or whether they intend to buy durables in the next six months. We construct the following indices to measure the responses of durable consumption:

1. **(DC)** denotes durable consumption and equals 1 if the household has purchased at least one durable good in the past six months.
2. **(FDC)** denotes future durable consumption and takes values from 1 to 3 if the household expects their consumption of any durable good to decrease, remain the same, or increase in one year from now.

Moreover, households are asked to specify what type of durable goods they have purchased. To take advantage of this information we construct indices for the following durable goods categories: (i) car and motorbikes (**DCcar**); (ii) furniture (**DCfurn**); (iii) large home appliances (**DCLargeApp**) and (iv) small appliances (**DCSmallApp**). For each of these categories, the index takes the value 1 if the household has purchased at least one of these items.

We additionally retrieve socio-economic information on each interviewed household—such as age, gender, marital status, employment status, income quantile, and education level. For the sake of brevity, we provide details on the individual characteristics

data and also present tables describing the percentage of positive, neutral, and negative answers by households' socio-economic characteristics and durable consumption and consumer sentiment questions, in the Online Appendix (Section A3.3 and A3.3, respectively). Younger, highly educated, and high-income households are more likely to have purchased a vehicle, furniture, and small and large home appliances in the near past. The opposite holds for older, less-educated, and lower-income households. As regards consumer sentiment, highly-educated, not-married, employed households tend to be more optimistic regarding their current household income. In contrast, less-educated, poorer and older households tend to give, on average, more negative answers when asked about their current and future economic and financial conditions and about the actual and future evolution of the Spanish economy.

3.2.3 Macroeconomic Data

Data on unemployment and labor contracts by province is obtained at monthly frequency from the National Employment Agency (*Servicio Público Estatal de Empleo*). Provincial and national CPI, number of mortgages, and population are obtained from the Spanish Statistical Office (*Instituto Nacional de Estadística*). We obtain also monthly data on employment by province from Social Security Statistics (*Seguridad Social Estadísticas, SSE*). According to Spanish law, any employer must register their employees with the Spanish Social Security authorities. We use the data available by SSE to recover employment dynamics at the province level. We construct a series for the unemployment rate coming from the two distinct data sources. According to the constructed data, the average weighted unemployment rate at the province level is 20.7 percent, while at the national level, this number equals 17.5 percent for the period under consideration. We believe that this divergence is due to measurement errors in the data on employment provided by the SSE and, for that reason, we also use the ratio of unemployed over province population as an alternative measure for tracking down the dynamics of the labor market and present results for the responses of logged unemployment. For the aggregate unemployment rate series at monthly frequency for Spain we retrieve data from the OECD indicators database. The data has been seasonally adjusted using the Seasonal and Trend decomposition provided by Loess (STL decomposition). See the Online Appendix A3.2 for more complete data definitions and sources.

3.3 Effects of Lottery Wins on Sentiment

3.3.1 Effects of Lottery Wins on Regional Sentiment

We start by investigating whether the lottery prize arrival in a region affects aggregate regional sentiment. To this end, following the methodology of the University

of Michigan Survey, we aggregate the answers to the confidence questions across respondents and across questions at the province level to produce two broad indices: the Index of Current Economic Conditions (ICC) and the Index of Consumer Expectations (ICE). The ICC relates to current sentiment and is based on answers to the questions concerning consumers' assessment of their own current financial and economic situation as well as the current state of the Spanish economy (i.e., Q1S-Q3S). The ICE summarizes answers to questions about consumers' expectations for their future household finances, their employment status given the Spanish labor market conditions, and the evolution of the Spanish economy as a whole (i.e., Q1F-Q3F).

The Spanish consumer confidence survey is designed to be representative at the national level, but the CIS does not guarantee that the sample will be representative of the population within each separate province during each month. In order to mitigate measurement error in our data set due to sampling variation within the survey at the province level we average over two-month responses following Aguiar et al. (2013). Also, to keep the representativeness of the consumer sentiment indices at the province level, we keep in our sample those monthly observations for which the provincial ICC and ICE are constructed with at least 25 respondents. A representativeness threshold of 25 respondents implies that we have at least 25 survey answers for each of the three questions included in the computation of ICE and ICC, respectively. The details about the construction of these aggregates are referred to in the Online Appendix A3.3 for the economy of space.

To control for potentially confounding events, other than lottery wins, that may affect consumer sentiment in the winning provinces and to provide a more causal interpretation of the results, we follow Jordà (2005) and adopt local projections (LP) for the longest possible sample we have available, that is, 2011M11 - 2020M1. For each variable and each horizon $h \geq 0$ we run the following linear LP model:

$$S_{j,t+h} = \alpha_{j,h} + \beta_h \text{LotteryPrize}_{j,t} + \delta_h \text{LotteryExp}_{j,t-1} + \sum_{k=1}^{12} \psi_{k,h} X_{t-k} + \sum_{s=1}^{12} \lambda_s M_s + \varepsilon_{j,t+h}$$

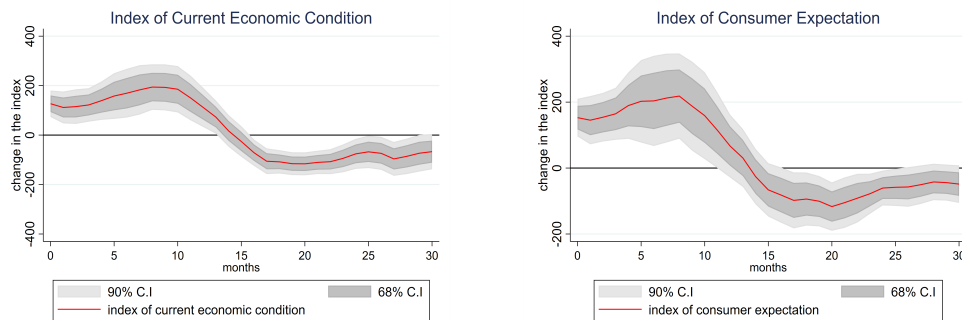
where $S_{j,t+h}$ is the variable of interest for province j at time $t+h$, $\text{LotteryPrize}_{j,t}$ is after-tax Christmas Lottery prize per capita (in 1000 euros) in province j at time t and $\text{LotteryExp}_{j,t}$ is the corresponding Christmas Lottery expenditure per capita in province j at time $t-1$.

We include Christmas Lottery expenditures in our regression since this variable might affect the probability of winning the lottery *in a specific province* and also to identify correctly the treatment effect and make our results comparable to those in previous studies (See Bagues and Esteve-Volart (2016) and Bermejo et al. (2021)). The Christmas Lottery event is random and, thus, the coefficient β_h would identify the causal effect of the lottery shock at time t in province j on consumer sentiment at time $t+h$ in province j . To make sure our results are not driven by local or aggregate shocks that correlate spuriously with the regional money windfalls, the

vector $X_{j,t}$ includes lags of provincial and aggregate unemployment rate and CPI inflation. To also control for any potential pre-trend in consumer sentiments, we add to our specification four lags of sentiment indices and add province-fixed effects α_j and a set of monthly dummies M_s in equation (3.3.1). All variables are detrended using a fourth-order polynomial.⁴ Standard errors are robust and clustered at the province level.

Figure G3.6 documents that winning the lottery rewards strongly affects aggregate sentiment. After a lottery shock, both sentiment indices for current and future economic conditions significantly increase for up to one year. Since the indices range between 0 and 200, their response implies that winning a lottery prize can change on average the households' sentiment in a province from being completely pessimistic about the economic conditions to being completely optimistic⁵. One might worry that when we perform this exercise we do not control for the fact that lottery expenditure might be endogenous to sentiment. In Online Appendix A3.1 we investigate whether the two aggregate sentiment indices affect the per capita lottery expenditure. Results do not support any significant causal relationship between aggregate sentiment and lottery expenditures neither contemporaneously nor at any lags.

FIGURE 3.1 Effect of Christmas Lottery Prizes on the Index of Current Economic Condition and the Index of Consumer Expectation



Impulse responses to Christmas Lottery prizes. The left panel presents the responses in the linear LP model (3.3.1) for the index of consumer current condition, while the right panel presents the responses of the index of consumer expectation. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2011M11-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Table 3.2 reports the first-stage F-statistics for the null hypothesis that the lottery awards have no explanatory power for consumer confidence on impact and

⁴In the Online Appendix C3.1 we show that results are similar if we use growth rates or use the HP filter to detrend the data.

⁵Similar results hold for the lottery rewards net of expenditure for lottery tickets. See Figure C3.4 in the Online Appendix C3.1

one month after the shock, respectively. We report F-test statistics for both ICC and ICE in our sample for the null of standard conditional homoscedasticity and clustered standard errors. The standard F-statistic for ICC equals 42.7 on impact, and lowers to 23.6 one month after the shock. Lottery wins affect less significantly sentiment about future economic conditions on impact, although the F-statistics it is still relatively high and equals 10.8 and surges to 65 one month after the shock.

TABLE 3.2 F-statistics of the first-stage regression of Christmas Lottery prizes on consumer confidence. Sample 2011M11-2020M1

Horizon (months)	F statistics for ICC	F statistics for ICE
$h = 0$	42.7	10.8
$h = 1$	23.6	65

Hence, lottery wins stimulate average sentiment significantly in the short run. Bagues and Esteve-Volart (2016) find that the incumbent party tends to obtain relatively more votes in the provinces that won the lottery, attributing this effect to a temporary increase in happiness that is making voters more lenient toward the incumbent. Their intuition is consistent with our findings. Yet, these authors do not use the surveys we exploit in this study and reach this conclusion by rejecting some alternative hypotheses. We instead provide direct evidence of the effects of lottery awards on economic sentiment.

3.3.2 Effects of Lottery Wins on Individual Sentiment

The results from aggregating sentiment responses strongly suggest that sentiment is affected positively by lottery wins. Given the aggregation issues mentioned above, now we evaluate the credibility of our results about the impact of lottery wins on consumer confidence, by looking at individual-level survey responses mapped to Spanish regions.

Existing studies suggest that lottery wins are associated with high overall life satisfaction that persists for over a decade (See, e.g., Lindqvist et al. (2020)) and that winning the lottery brings happiness (See, e.g., Oswald and Winkelman (2019)). Although we do not have information about happiness or life satisfaction in our sample and we cannot detect the winners, we do observe consumers' sentiments about economic conditions. In this section, we analyze whether those households living in awarded provinces tend to be more optimistic about their current and future household finances and employment prospects and about the current and future evolution of the general economic conditions in Spain. In order to study the effects of lottery wins on economic sentiment we adopt the following ordered probit model:

$$c_{i,j,t,s} = \alpha + \beta \text{LotteryPrize}_{j,t,s} + \delta \text{LotteryExp}_{j,t,s} + \gamma X_{i,j,t,s} + \sum_{s,j} \lambda_{s,j} D_{s,j} + \epsilon_{i,j,t,s}$$

where $c_{i,j,t,s}$ denotes the survey responses of individual i in province j at year t and month s regarding economic sentiment, $\text{LotteryPrize}_{j,t,s}$ is a dummy variable that takes the value of 1 if Christmas Lottery income is awarded in the province j at year t and month s and $\text{LotteryExp}_{j,t,s}$ is the corresponding expenditure on the Lottery in per capita terms.

Although the Christmas Lottery event is genuinely random and, thus, the coefficients β would identify the causal effect the lottery win in the province on individual sentiment, individual characteristics, as well as economic conditions, are also relevant in determining sentiment and household consumption (see also Benhabib and Spiegel (2019); Mian et al. (2021)). To address concerns regarding the endogeneity of household consumption choices with respect to individual economic conditions we include as further controls a vector of individual characteristics ($X_{i,j,t,s}$). The vector of individual characteristics comprises age, gender, marital status, education level, employment status, and household income. Finally, we also add a set of month times province dummies ($D_{s,j}$) control for regional shocks affecting sentiment.

Table 3.3 presents the estimation results of Equation (3.4.3) for the answers related to current and future household income (first and second column), current and future employment prospects based on the evolution of the labor market in Spain (third and fourth column) and current and future economic conditions in the Spanish economy (last two columns). The estimates clearly suggest that lottery wins affect significantly and positively consumers' sentiment about current and future economic

conditions for all the variables they are questioned about.

TABLE 3.3 Survey evidence on the effects of Spanish Christmas Lottery on consumer sentiment

	(1)	(2)	(3)	(4)	(5)	(6)
	Household Income	Future Household Income	Employment Prospects	Future Employment Prospects	Spanish Economy	Future Spanish Economy
Lottery Prize Dummy	0.119*** (0.045)	0.131*** (0.037)	0.180*** (0.053)	0.099** (0.050)	0.113*** (0.040)	0.108** (0.043)
Lottery Expenditures	23.922*** (3.236)	14.205*** (2.966)	6.076** (2.385)	-18.748*** (2.819)	-5.767* (3.265)	-15.075*** (2.981)
Month \times Province Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	117476	112951	112047	106086	114776	109441
Pseudo R^2	0.051	0.041	0.025	0.014	0.022	0.014

Columns (1)-(6) provide results from an ordered probit where the dependent variable are questions Q1C-Q1F. *Lottery Prize Dummy* takes value 1 if awarded Christmas lottery tickets were distributed in that province. *Lottery Expenditures* are expressed in 1000 euros per capita. Robust standard errors clustered by province are reported in parentheses. The sample includes information from consumer confidence monthly surveys conducted by the Spanish CIS between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Following the analysis of the aggregate indices, we next examine the persistence of the sentiment responses to the lottery win. For that, we first redefine our treatment variable, $LotteryPrize_{j,t,s}$, to vary across provinces and months and interact it with monthly dummies $M_{s,t}$. Thus, our baseline empirical specification in Equation (3.4.3) is modified as follows:

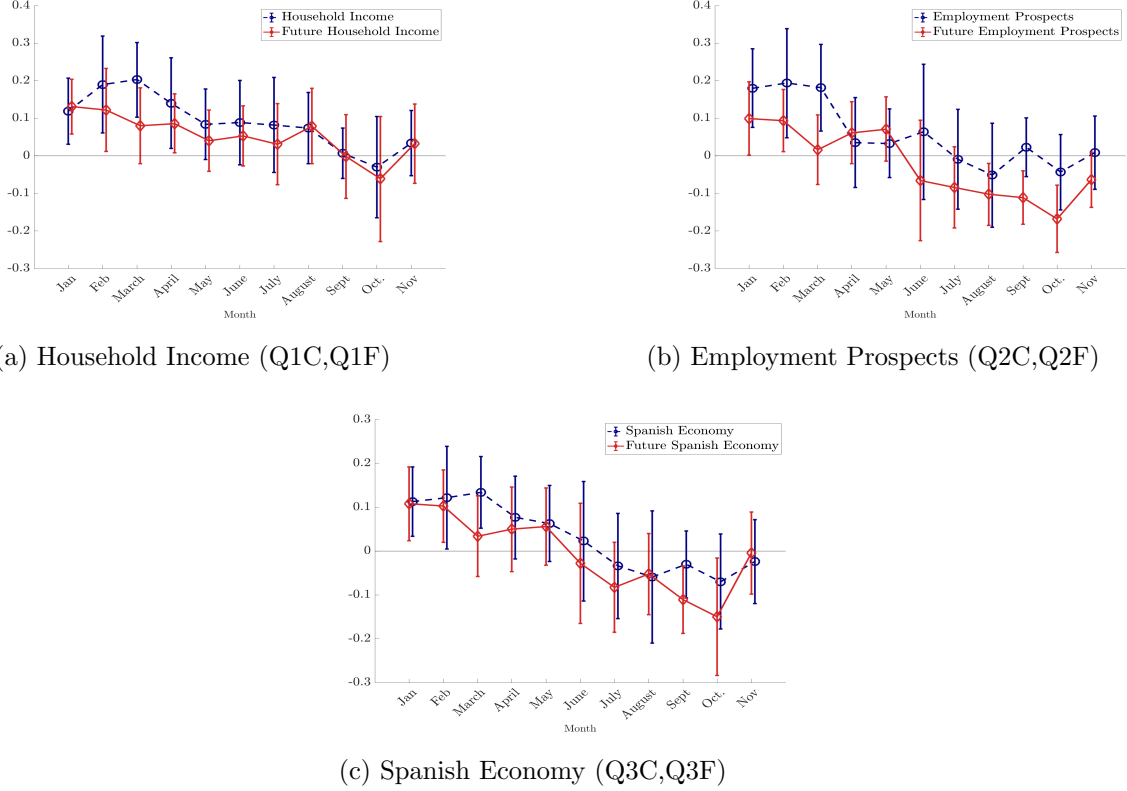
$$c_{i,j,t,s} = \alpha + \sum_{s=1}^{11} \beta_s (LotteryPrize_{j,t} \times M_{s,t}) + \delta LotteryExp_{j,t,s} + \gamma X_{i,j,t,s} + \sum_{j,s} \lambda_{s,j} D_{s,j} + \epsilon_{i,j,t,s}$$

The interaction term $\sum_{s=1}^{11} \beta_s (LotteryPrize_{j,t} \times M_{s,t})$ takes value 1 in those provinces awarded with the Christmas Lottery not only in January but also in the subsequent months after the lottery draw. This captures the dynamic effects of the lottery shock on sentiment for those households living in the winning regions compared to households residing in the non-winning regions.

Figure 3.2 plots the β_s coefficients and their 95% confidence intervals from estimating Equation (3.3.2) using an ordered probit model where the dependent variable is each of the six consumer sentiment questions. The positive effect on sentiment for those households living in the winning provinces is instantaneous and dies out after five (six) months for current (future) household income (see Panel 3.2a). Consumers become also more optimistic about their current and future employment perspectives, conditional on the labor market of Spain, while their sentiment about current labor conditions persists in their expectations about future employment subdue two

months after the lottery shock (See Panel 3.2b). Similarly, Panel 3.2c shows that household sentiment for the current and future state of the Spanish economy increases significantly on impact and one period after the lottery award and tones down in the subsequent months.

FIGURE 3.2 Dynamic effects of Christmas Lottery on consumer sentiment



The Figures plot the β_s coefficients and their 95% CI from estimating equation (3.3.2) using a ordered probit model. The dependent variables in Panel 3.2a Q1C (blue circled line) and Q1F (red diamond line). The dependent variables in Panel 3.2b are Q2C (blue circled line) and Q2F (red diamond line). The dependent variables in Panel 3.2c are Q3C (blue circled line) and Q3F (red diamond line) Standard errors are robust and clustered at the province level. We deliberately estimate the effects of lottery shocks on confidence up to November because the Christmas Lottery draw takes place every December in our sample.

3.4 Lottery wins, Consumer Sentiment and Durable Consumption

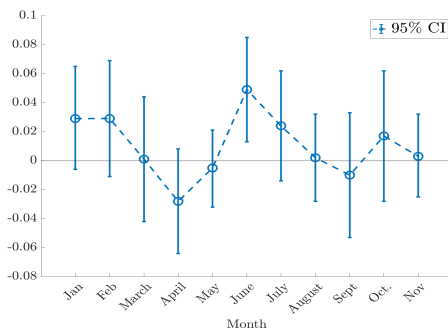
3.4.1 Effects of Lottery Wins on Durable Consumption

Changes in expectations about future economic conditions are considered to be an important source of variation in consumer spending (see, e.g., Blanchard (1993), Hall (1993), and Gillitzer and Prasad (2018)). In what follows we perform various

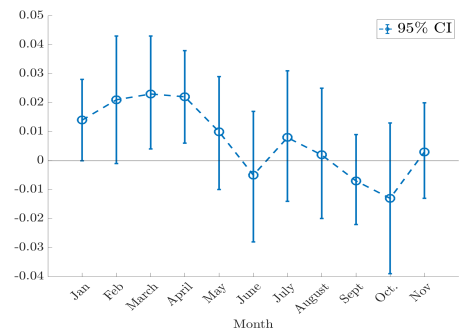
exercises to identify the link between consumer sentiment due to lottery wins and consumption behavior. We start by investigating whether the surveyed households living in winning provinces are more likely to report durable goods purchases during the subsequent months of the lottery wins. To do so, given that the survey question on durable consumption asks households about any durable goods purchases in the last six months, we adopt the same empirical specification as in Equation (3.3.2) and investigate how the responses about realized consumption for durables varies the months after the lottery wins. This strategy provides us with more flexibility in capturing the timing of household consumption choices after the lottery draw takes place.

Figure B3.1a plots the marginal effects associated with the β_s coefficients and their 95 percent confidence intervals from a probit model in Equation (3.3.2). The dependent variable is a dummy that takes the value of 1 when households give a positive answer to the question related to durable consumption in the last six months (DC). The evidence suggests that exogenous variations in local income affect significantly realized durable consumption. Households living in provinces awarded with Christmas lottery prizes are 5% more likely to report having purchased at least one durable good around six months after the win. It is worth highlighting that the surveyed households are asked about their durable consumption purchases in the last six months. This implies that the peak observed in Figure B3.1a after six months does not correspond to an increase in consumption after six months but rather that the maximal effect of the lottery on accumulated consumption shows six months after the shock.

FIGURE 3.3 Effects of Christmas Lottery on realized and intended household durable consumption



(a) Recent Durable Purchases



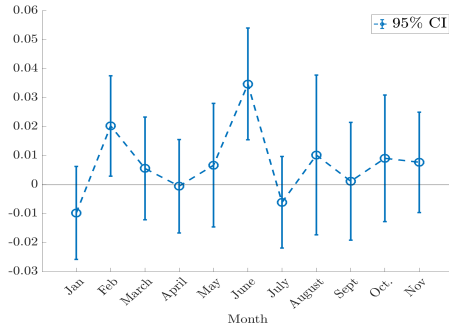
(b) Intended Durable Purchases

This figure plots the marginal effects associated to the β_s coefficients and their 95% CI from estimating Equation (3.3.2) using a probit model and an ordered probit model, respectively. The dependent variable in Panel B3.1a is DC. The dependent variable in Panel B3.1b is FDC. Standard errors are robust and clustered at the province level

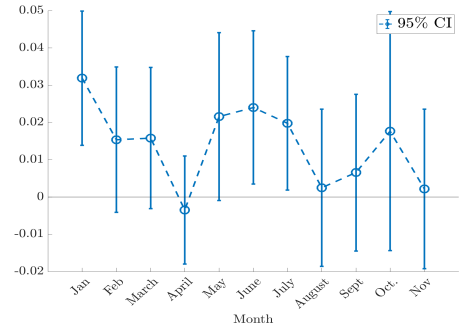
Luckily, the respondents, apart from being asked about the expectations about their personal finances and employment and the Spanish economy, they are also asked about their future durable consumption plans in the same survey (FDC question). Figure B3.1b plots the marginal effects associated with the β_s coefficients and their 95 percent confidence intervals from the ordered probit model when we use intended consumption as the dependent variable. To be precise, the dependent variable is a categorical variable that takes the values 1-3 if households plan to decrease/maintain/increase their durable consumption in the near future (one year from now). The estimated results suggest that living in provinces awarded with the Christmas lottery significantly increases the probability of households reporting an increase in future consumption by 2-3 percentage points in the next four months after the lottery win.

We continue by examining the responses of realized consumption for the different durable categories available in the survey. Figure 3.4 reveals that the significant increase in the probability of having purchased at least one durable good reported in Figure B3.1a is driven by household consumption of furniture and vehicles (see Panels 3.4a and 3.4b). In particular, households living in winning provinces are more likely to report having purchased a car or motorbike in the, two or six months following the win. They are also around 3% more likely to report having purchased furniture goods in January and around 2% more likely to have purchased furniture in a period between five to seven months after the win. In the month after the win households are also 2% more likely to have purchased a computer or a large house appliance. These results align well with a version of the life-cycle consumption model in which households adjust the timing of durables purchases to smooth consumption (See, e.g., Browning and Crossley (2009)). They are also very consistent with the results of Kuhn et al. (2011) that also report significant effects of lottery wins on car expenditures and other durable expenditures.

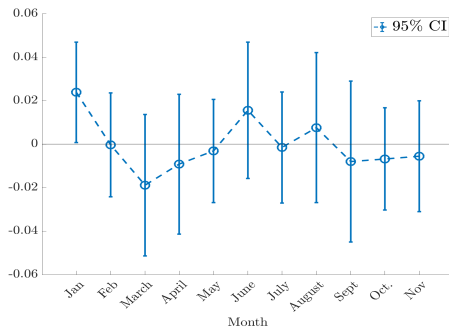
FIGURE 3.4 Effects of Christmas Lottery on realized household durable consumption by item



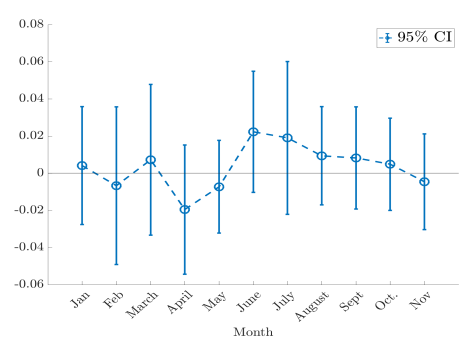
(a) Car or Motorbike



(b) Furniture



(c) Computer or Large Home Appliances



(d) Small Home Appliances

These figures plot the marginal effects associated to the β_s 's coefficients and their 95% CI from estimating Equation (3.3.2) using a probit model. The dependent variable DCCar (a), DCfurn (b), DCLargeApp (c), DCSmallApp (d) in the past six months. Standard errors are robust and clustered at the province level

3.4.2 The Joint Response of Sentiment and Consumption

So far, we have shown that lottery wins spur sentiment and consumption expenditures. However, we have not connected the responses of these two variables. We now study the joint responses on the intention to consume durable goods together with the responses on consumers' expectations. To be more specific, we use the FDC question in the survey to create a categorical variable that summarizes the joint response of the surveyed individuals' economic expectations and future durable consumption plans responses as follows: for each individual, we construct a categorical variable that takes values 1/2/3 if households respond that their economic expectations and future durable consumption is both lower/same/higher. We create three different categorical variables where we consider the joint responses to questions about intended durable consumption and economic expectations related to a) household income, b) employment prospects, and c) the Spanish economy. As in

the previous Section, we use an ordered probit to compute the joint responses of confidence and future durable consumption.

Table 3.4 collects the results of these regressions. The dependent variable in column (1) takes values 1/2/3 if households give jointly negative/neutral/positive answers in the questions relating to their future household income and intended durable consumption. Similarly, column (2) presents estimates for the index relating to future employment prospects and intended durable consumption, and finally column (3) relates expectations about the Spanish economy with answers about future durable consumption.

TABLE 3.4 Survey evidence on the effects of Spanish Christmas Lottery on consumer sentiment and future consumption

	(1)	(2)	(3)
	Future Durable & Consumption Household Income	Future Durable& Consumption Employment Prospects	Future Durable & Consumption Spanish Economy
Lottery Prize Dummy	0.152*** (0.044)	0.141** (0.057)	0.140*** (0.051)
Lottery Expenditures	16.978*** (3.584)	0.863 (4.066)	4.526 (3.897)
Month \times Province Dummies	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes
Observations	70571	43471	47609
Pseudo R^2	0.054	0.050	0.048

Columns (1)-(6) provide results from an ordered probit. The dependent variable in column (1) and (4) takes values 1 to 3 if households respond in ascending order to Q1F and FDC jointly. The dependent variable in column (2) and (5) takes values 1 to 3 if households respond in ascending order to Q2F and FDC jointly. The dependent variable in column (3) and (6) takes values 1 to 3 if households respond in ascending order to Q3F and FDC jointly. *Lottery Prize Dummy* equals 1 if awarded Christmas lottery tickets were distributed in that province. *Lottery Expenditures* are expressed in 1000 euros per capita. *Recession dummy* equals 1 if the unemployment rate in Spain is higher than 20%. Robust standard errors clustered by province in parentheses. The sample includes information from consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The estimates of Table 3.4 suggest that individuals tend to give positive answers to both questions about their expectations and their consumption plans after a lottery win, indicating that sentiment responses are related to the demand for durables at the individual level. Gillitzer and Prasad (2018) use US data to document a similar causal effect running from sentiment to consumption. The identification approach of Gillitzer and Prasad (2018) uses voting intention as an instrument for the economic sentiment. They show that supporters of the winning party after the US elections report higher spending intentions than supporters of the losing party. The evidence presented in Table 4 is indicative of the positive relation between sentiment and intended durable consumption. Still, it does not establish that changes in sentiment are the ones causing the positive consumption responses. In what follows we will show that lottery wins affect consumption only through sentiment and not

through economic fundamentals and we will use lottery wins as an instrument to identify the causal effect of sentiment innovations on consumption on Spanish data.

3.4.3 Lottery Wins and Economic Fundamentals

The evidence we have presented so far points to a positive relationship between sentiment and consumption after a lottery shock. Yet, the incremental predictive power of sentiment could reflect changes in other fundamental determinants of consumption that we have not accounted for, rather than any independent causal effect of changes in sentiment on spending. The mechanism we put forward in our analysis works through sentiment. However, lottery wins involve monetary transfers for some households and they might relate to news about regional economic fundamentals. In what follows we establish that lottery wins are unrelated to individual and regional fundamentals and identify the causal effect of sentiment on individual consumption using lottery wins as an instrument for consumer confidence.

Disentangling Income vs Sentiment Effects from Lottery Wins

Given that lottery wins involve monetary transfers for some households living in the winning province, it is in principle very difficult to disentangle whether the effects we report come from sentiment or from income increases for the lucky inhabitants. As mentioned earlier, the probability of being a winner of any of the top Christmas lottery prizes in a winning province is 0.015%, which is very low, implying that the surveyed households are very unlikely to be lottery winners. Fortunately, we have a more direct way to examine whether this is the case in our sample. The Spanish survey of consumer confidence includes a question that allows us to investigate whether the positive change in economic sentiment is related to changes in individual income. The CIS asks survey participants the following question about the households' ability to pay bills: *Which of the following assertions describes best the economic situation of your household with respect to your ability to pay bills?*. The answers vary between 1 and 5 with items from 1 “*Struggle to pay bills and have to take debt*” to 5 “*Get easily to the end of the month and manage to save a lot.*” Lottery wins should affect the respondents' answers to this question. In particular, one should expect survey respondents to improve significantly their current ability to pay bills if they happen to be one of the lottery winners in the region. Table 3.5 presents results for the baseline specification (3.4.3) when the dependent variable is the question about households' ability to cover monthly bills. Lottery wins do not alter significantly the ability to pay bills of the surveyed households, suggesting that the results we present for changes in sentiments do not derive from changes in the wealth of these households. That is, the surge in sentiment does not seem related to increases in the wealth of the interviewed households.

TABLE 3.5 Survey evidence on the effects of Spanish Christmas Lottery on households' current ability to pay bills

	(1) Current ability to pay bills
Lottery Prize Dummy	-0.009 (0.038)
Lottery Expenditures	15.609*** (2.420)
Month \times Province Dummies	Yes
Individual Characteristics	Yes
Observations	117244
Pseudo R^2	0.105

Columns (1) provide results from an ordered probit where the dependent variable is the ability-to-pay bills question. *Lottery Prize Dummy* equals 1 if awarded Christmas lottery tickets were distributed in that province. *Lottery Expenditures* are expressed in 1000 euros per capita. Robust standard errors clustered by province in parentheses. The sample includes information from consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

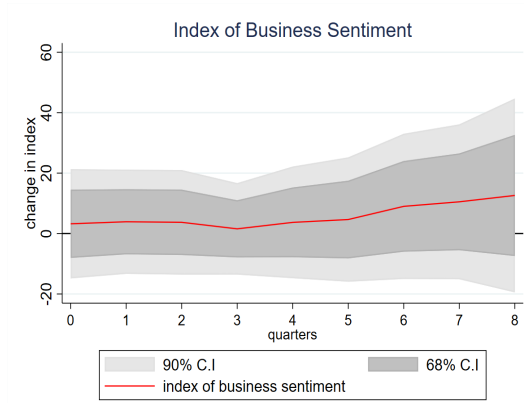
News About Fundamentals

Another major concern regarding the exogeneity of lottery wins to economic fundamentals is the fact that, although lottery wins do not imply monetary transfers for the majority of agents living in the province, they can still bring news about changes in economic fundamentals at the regional level. This implies that our results on the effects of lottery shocks on economic sentiment do not operate through a simple increase in optimism but rather through the news about improved regional economic fundamentals after the lottery win. The Spanish Christmas lottery is, after all, an event with a long tradition and agents in the winning provinces might expect an increase in the regional economic activity due to the increase in wealth of the winners, or precisely because they expect demand or supply conditions to improve. Obviously, this is a more difficult concern to tackle.

We start investigating this hypothesis by studying data on business confidence that are available at the quarterly frequency for different Spanish autonomous communities. Recall that we have performed our analysis so far using province-level monthly data. Luckily there are seven autonomous regions in Spain that have only one province (Asturias, Baleares, Cantabria, La Rioja, Madrid, Murcia, and Navarra). We use these provinces to investigate how business confidence reacts to lottery wins. In the Online Appendix (see Figure D3.1), we show that consumer confidence about the current and future economic conditions increases in response to the lottery wins significantly at quarterly frequency for these seven provinces.

We next examine how the Harmonised Business Confidence Index from the Span-

FIGURE 3.5 Effects of Christmas Lottery prizes on the Harmonised Business Confidence Index - Seven provinces



Impulse responses to Christmas Lottery prize in the linear LP model (3.3.1). Due to data availability, the sample period covered is 2013Q1-2019Q4 for the seven communities with a unique province. Standard errors are robust and clustered at the community level and response functions are smoothed by a centered moving average.

ish Statistical Office (*Instituto Nacional de Estadística*) reacts for those provinces that also constitute an autonomous community. The Business Confidence Indicators survey collects the opinions of the managers of the establishments regarding the progress of their business for the past quarter and their expectations for the coming quarter. Figure 3.5 presents the responses of the Harmonised Business Expectations Index in those communities to a lottery win. The responses of the business expectation index are flat, indicating that firms do not change their expectations after a lottery win. This could be because firms do not perceive a substantial increase in local economic fundamentals after a lottery win. It could also be due to the fact that businesses operate subject to the aggregate economic conditions in Spain and not with the local conditions and for that reason, their sentiment is less local.

The unresponsiveness of business sentiment to lottery wins is indicative of the fact that lottery wins do not affect significantly regional economic fundamentals. However, we have another way to evaluate whether it is sentiment rather than economic fundamentals that drive our results. We argue that even if lottery wins represent good news about economic stimulus at the local level, households should not get optimistic about the state of the Spanish economy. Yet, in the observed survey responses at the individual level, the unconditional probability of getting positive responses about the future Spanish labor market and the Spanish economy is 37% and 35%, respectively, while the respective probability of getting positive answers for future personal finances that should be more affected by local conditions is 25% in winning provinces.

To formalize better this argument, we next construct aggregate indices for the individual questions for the future personal finances Q1F, future employment out-

comes given the labor market conditions in Spain, Q2F and the future of the Spanish economy, Q3F and investigate how sentiment about those different aspects moves on average after a lottery win. Figure 3.6 depicts the aggregate responses for each question to a lottery win. All indices react significantly to the lottery win on impact with the sentiment about the future Spanish economic conditions reacting strongly to the lottery wins. If the lottery win was a signal about changes in local demand one should expect rational respondents when asked about the Spanish macroeconomic conditions to be less optimistic. Instead, the data suggests that survey respondents change radically their sentiment about the future Spanish economy after a lottery win. Hence, the evidence reported in Figure 3.6 weakens the hypothesis that agents become optimistic because they perceive changes in regional fundamentals after the lottery wins.

FIGURE 3.6 Effects of Christmas Lottery prizes on disaggregated consumer sentiment indices



Impulse responses to Christmas Lottery prizes in the linear LP model (3.3.1). To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months. The sample period covered is 2011M11-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Table 3.6 presents the first stage F-statistics for the different sentiment questions on impact and the first month after the lottery wins and reconfirms these results. Sentiment about the Spanish economy is significantly more responsive to lottery news relative to sentiment about personal finances and employment prospects. For example, the standard F-statistic for Q3F equals 12.8 on impact and 50.9 one month after the lottery win, while the same statistics for questions Q1F and Q2F are significantly lower.

TABLE 3.6 First-stage F-statistics for the null hypothesis that the lottery awards have no explanatory power for consumer confidence.

F-statistics			
horizon (months)	Question 1F	Question 2F	Question 3F
$h = 0$	1.9	4.9	12.8
$h = 1$	11.9	2.1	50.9

Our analysis so far suggests that the regional responses to lottery wins are driven by consumer sentiment. If they were driven by economic fundamentals, expectations of national economic conditions should rise by less in response to regional lottery winnings. One could argue, however, that the increased optimism about the prospects of the Spanish economy in the winning regions is driven by agents being unable to disentangle local from national demand shocks. To investigate this hypothesis, we exploit the presence of active secessionist movements in the provinces of Catalonia and the Basque Country and estimate the following regression:

$$c_{i,j,t,s} = \alpha + \beta \text{LotteryPrize}_{j,t,s} + \kappa \text{Nationalist}_j + \zeta (\text{Nationalist}_j \times \text{LotteryPrize}_{j,t,s}) \\ + \delta \text{LotteryExp}_{j,t,s} + \gamma X_{i,j,t,s} + \sum_{s,j} \lambda_{s,j} D_{s,j} + \epsilon_{i,j,t,s}$$

where the variable Nationalist_j equals 1 for Catalan and Basque Country provinces and 0 for the rest of Spanish regions. Political attitudes shape perceptions of national economic conditions (Duch et al., 2000; Evans and Andersen, 2006) and economic arguments have been playing a major role in the discourse of nationalist and secessionist movements (Rodríguez-Pose and Sandall, 2008; Muñoz and Tormos, 2015). Therefore, households living in Catalonia or the Basque Country should be able to disentangle news about regional from news about national fundamentals.

Table 3.7 presents the estimation results for this regression. Interestingly, households living in Catalonia and the Basque Country are more pessimistic on average with respect to the future of the Spanish economy. However, the sentimental effects of lottery winnings with respect to current and future national economic conditions are not significantly different from the rest of the Spanish regions.

TABLE 3.7 Survey evidence of the effects of Christmas Lottery prizes in provinces with active nationalist movements

	(1) Spanish Economy	(2) Future Spanish Economy
Lottery Prize Dummy	0.144*** (0.046)	0.118** (0.054)
Nationalist Provinces	-0.268 (0.233)	-1.048*** (0.221)
Lottery × Nationalist Provinces	-0.138 (0.110)	-0.039 (0.081)
Lottery Expenditures	-5.767* (3.265)	-15.075*** (2.982)
Month × Province Dummies	Yes	Yes
Individual Characteristics	Yes	Yes
Observations	114776	109441
Pseudo R^2	0.022	0.014

Columns (1)-(2) provide results from an ordered probit where the dependent variable is question Q3C and Q3F. *Lottery Prize Dummy* takes value 1 if awarded Christmas lottery tickets were distributed in that province. *Lottery Expenditures* are expressed in 1000 euros per capita. *Nationalist* takes value equal to 1 if households live in Catalonia or Basque Country and 0 if they live in any other Spanish province. Robust standard errors clustered by province in parentheses. The sample includes information from consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The evidence we have presented in this section illustrates that while lottery wins seem to be related to economic sentiment, they seem unrelated to changes in individual economic fundamentals or news about future regional fundamentals. With this evidence at hand, we next proceed to evaluate at the individual level the causal effect of changes in sentiment on individual consumption.

Instrumental Variable Regressions

We have already established that economic sentiment in the winning regions reacts positively to lottery wins and satisfies the exclusion restriction of having no direct effect on spending intentions. We now turn to examine the effects of consumer sentiment on durable consumption that work through the optimism boost stemming from the lottery winnings. To do so, we rely on an IV strategy where we use the lottery prize dummy variable as an instrument for changes in consumer sentiment.

The last column of Table 3.8 reports the F-statistics of the first stage regression for each consumer sentiment question. The F-statistics are high and above 10 for all the questions considering confidence about future economic conditions, indicating that lottery wins are strong instruments for confidence.

TABLE 3.8 Effects of consumer sentiment on recent and intended durable purchases - 2SLS estimates

	(1)	(2)	(3)	(4)	(5)	(6)	F-stat
	Recent Durable Purchases	Recent Durable Purchases	Recent Durable Purchases	Intended Durable Purchases	Intended Durable Purchases	Intended Durable Purchases	
Future Household Income	0.396 (0.243)			0.420*** (0.157)			25.22
Future Employment Prospects		0.408 (0.258)			0.598* (0.323)		27.39
Future Spanish Economy			0.387 (0.295)			0.445** (0.226)	11.69
Month \times Province Dummies	Yes	Yes	Yes	Yes	Yes	Yes	
Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	112269	105463	108784	110294	103803	106943	

This table presents the 2SLS estimates when each of the consumer sentiment questions is instrumented using the set of Christmas Lottery dummies. The dependent variable in columns (1)-(3) is a dummy variable that takes value of 1 if the household has purchased any durable good in the past six months. The dependent variable in columns (4)-(6) is a categorical variable that takes values 1-3 if the household intends to decrease/maintain/increase her consumption of durable goods in the near future. Robust standard errors clustered at the province level in parentheses. The sample includes information from consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Columns (1) to (3) present the 2SLS estimates of the effects of consumer sentiment on any recent durable purchases and columns (4) to (6) the ones for intended durable purchases. Changes in sentiment instrumented by lottery wins have no significant effects on the recent durable consumption purchases. However, the shifts in sentiment about future economic conditions affect significantly spending intentions. In particular, concentrating on the question about the future of the Spanish economy, a change in confidence about the Spanish economy instrumented by lottery wins increases significantly intended durable purchases at the 90% confidence level. Hence, the results in Table 3.8 suggest beyond any doubt that innovations to consumer sentiment have a causal effect on intended consumption.

3.4.4 Heterogeneous Effects

How individuals react to exogenous variations in income can depend on their characteristics. For example, it might be that some individual traits make individuals more sentimental per se and more susceptible to changes in sentiment. We investigate this hypothesis by allowing for an interaction effect between the lottery prize dummy and individual characteristics and looking at whether these interaction effects matter in explaining consumers' sentiment dynamics in response to the lottery prize shocks.

The results of these regressions for the questions related to future economic conditions are collected in Tables B3.2 to B3.4 in the Online Appendix B3.1. They suggest that lottery prizes have a positive effect on individuals' confidence, whereas

no evidence is found on heterogeneous effects of the lottery prizes on households' responses about future household income (see Table B3.2 in the Online Appendix B3.1). Although the lottery prizes do not seem to affect asymmetrically the different individual groups for future income, when asked about their future employment prospects given the labor market conditions in Spain, households with older, richer, more educated, and employed members appear to be significantly less optimistic (see Table B3.3)). The lottery shocks consistently drive the increases in younger individuals' sentiment about their future employment and the sentiment of female contestants. When forming expectations about the future of the Spanish economy, (see Table B3.4 in the Online Appendix B3.1), all individuals become more positive after a lottery win, but higher income and more educated households tend to be less optimistic about the future evolution of the Spanish economy.⁶

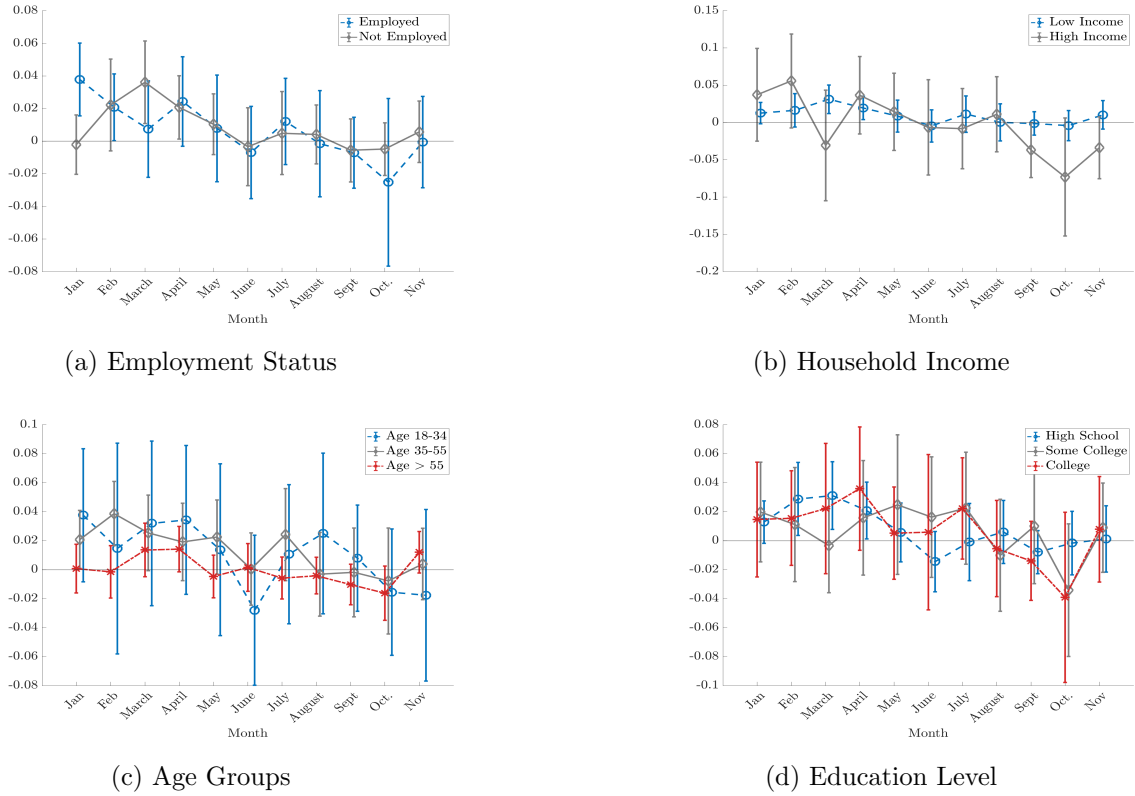
According to our results, young, less educated, and lower income groups are the groups that react more strongly to the lottery wins. A strong theme emerging from research investigating the relationship between social class and emotion is that lower-class individuals score more highly on measures of empathy and are more sentimental. A rationale for this behavior is the tendency for lower social class individuals to be more socially engaged and to have more interdependent social relationships. Kraus et al. (2010) provide results that support the latter hypothesis. In light of this evidence, it could be argued that individuals with such characteristics are more sensitive to positive news in their community, as observed in our empirical exercise.

The data also allows us to investigate whether the effects of lottery wins on household durable consumption depend on the socio-economic characteristics of the households. We can investigate this by examining both the responses of the different groups with respect to the question concerning purchases of durables in the last six months, DC, or the question concerning future consumption plans, FDC.

Figure 3.7 plots the estimated marginal effects of lottery shocks on household intended durable consumption for different demographic groups. Consistent with the sentiment responses, households that are not employed, that have low income, and have only a high school diploma change significantly their intended consumption responses after a lottery shock (see Panel 3.7a, Panel 3.7b and Panel 3.7d). When looking at different age groups, middle-aged households' intended consumption reacts significantly to the lottery win two and three months after the shock while very young and old individuals' intended consumption does not seem to be affected significantly by the shock.

⁶Lagerborg (2019) reports that female sentiment is also affected more significantly by shootings in US schools, while she observes that individuals with higher education and income become relatively more pessimistic as a result of these shootings. We definitely consider a very different shock type and our findings are not directly comparable to hers.

FIGURE 3.7 Heterogeneous effects of Christmas Lottery on intended household durable consumption



The figures plot the marginal effects associated to the β_s coefficients and their 95% CI from estimating Equation (3.3.2) using an ordered probit model. The dependent variable is a categorical variable that takes values 1-3 if the household plans to decrease/maintain/increase their durable consumption one year from now. Panel 3.7a restricts the sample to employed individuals (blue circled line) and unemployed or non-active individuals (gray diamond line). Panel 3.7b to households with monthly household income below or equal to 2700 euros (blue circled line) and above 2700 euros (gray diamond line). Panel 3.7c plots responses for individuals aged between 18-34 years old (blue circled line), aged between 35-55 years old (gray diamond line), and panel aged above 55 years old (red star line). Panel 3.7d plots responses for individuals with a high school degree or lower (blue circled line), with some college degree (gray diamond line), and with a college degree or higher (red star line). Standard errors are robust and clustered at the province level

3.4.5 Sentimental Effects of Lottery Wins in Expansions vs Recession Periods

We now explore how the effects of lottery shocks on consumer sentiment depend on the state of the economy. In particular, we study whether the effect of receiving random lottery wins on consumer confidence becomes stronger during recessions. To this end, we estimate our baseline specification in a subsample where the unemployment rate in Spain is higher than 20% and in another subsample where the unemployment rate in Spain is lower than that threshold.

Table 3.9 presents estimates of Equation 3.4.3 for the answers related to future household income, future employment given the economic situation of Spain, and future conditions in the Spanish economy when unemployment in Spain is high (columns (1)-(3)) and when it is low (columns (4)-(6)).

The positive effect of lottery wins on consumer confidence is significantly larger during periods of high unemployment. Households living in winning provinces become very confident about their future household income, employment prospects and the Spanish economy in times of high unemployment. By contrast, there is almost no evidence suggesting that receiving lottery shocks in the region affects positively households' sentiment about their future income during periods of low unemployment.

TABLE 3.9 Survey evidence on the effects of the Spanish Christmas Lottery on consumer sentiment: high vs low unemployment rate periods

	(1)	(2)	(3)	(4)	(5)	(6)
	High unemployment rate			Low unemployment rate		
	Future Household Income	Future Employment Prospects	Future Spanish Economy	Future Household Income	Future Employment Prospects	Future Spanish Economy
Lottery Prize Dummy	0.177*** (0.041)	0.254*** (0.058)	0.242*** (0.063)	0.081 (0.073)	0.134* (0.080)	0.108 (0.077)
Lottery Expenditures	78.861*** (8.407)	90.559*** (9.935)	94.475*** (8.948)	-5.940 (6.370)	-58.883*** (14.027)	-61.964*** (14.036)
Month \times Province Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	46873	44438	46042	66078	61648	63399
Pseudo R^2	0.039	0.022	0.022	0.049	0.019	0.020

Columns (1)-(6) provide results from an ordered probit where the dependent variable is question Q1F-Q3F. *Lottery Prize Dummy* equals 1 if awarded Christmas lottery tickets were distributed in that province. *Lottery Expenditures* are expressed in 1000 euros per capita. Robust standard errors clustered by province in parentheses. The sample includes information from consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020

Results are similar when we look at aggregate sentiment indices. In Section C3.1 of the Online appendix we show that when we distinguish between expansionary and recessionary periods, the responses of both ICC and ICE to lottery wins are strong and statistically significant the first few months after the win during recessions.

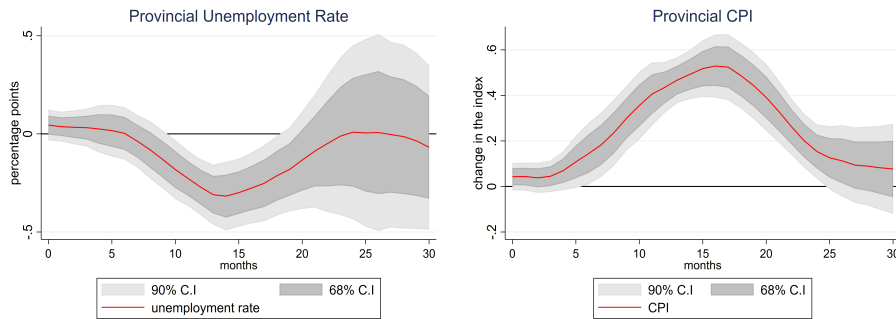
3.5 Regional Macroeconomic Effects of Lottery Wins

In the previous sections we have shown that lottery wins spur sentiment and durable consumption expenditures, we turn to investigate whether those sentimental effects propagate in the local economy. In this section, we analyze the dynamic effects of

lottery shocks on the economy of the provinces that won the Christmas Lottery. Following the specification for aggregate sentiment indices, 3.3.1, we identify the causal effect of an exogenous lottery win at time t in province j on different regional macroeconomic outcomes at time $t + h$ in province j for the longest possible sample we have available, that is, 2005M5 - 2020M1. All variables in the aggregate regressions are detrended using a fourth-order polynomial.⁷ Standard errors are robust and clustered at the province level.

Figure 3.8 presents the dynamic responses of the province-level unemployment rate and CPI movements to a thousand euros of per capita lottery rewards (rewards are expressed in constant prices to take into account possible changes in inflation), together with their respective 68 and 90 percent confidence bands.

FIGURE 3.8 Effect of Christmas Lottery prizes on the unemployment rate and CPI



Impulse responses to Christmas Lottery prizes. The left panel presents the responses in the linear LP model (3.3.1), while the right panel presents the responses in the state-dependent LP model, where the solid blue line is the response in high-unemployment states and the dotted red line are responses in low-unemployment states. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2005M5-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

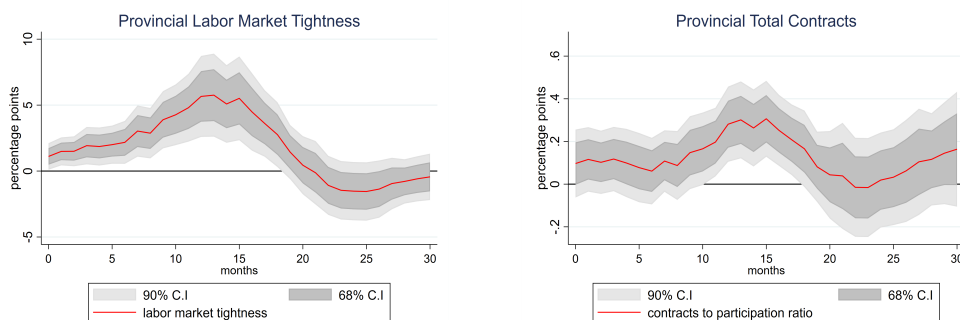
Lottery prizes do not affect the unemployment rate on impact. It takes approximately half a year for the unemployment rate to react to the shock. The impulse response function (IRF) decreases significantly after 10 months reaching its maximum fall of -0.3 percentage points 14 months after the lottery win, while it continues to be below its mean for approximately two years. Provincial CPI prices also respond sluggishly, lifting significantly seven months after the initial shock and remaining above the mean for almost two years after the winning. The maximum

⁷In the Online Appendix C3.1 we show that results are similar if we use growth rates or use the HP filter to detrend the data, and if we use relative unemployment and CPI prices in the baseline specification. Given the discrepancy of the unemployment rate data, we also present results of the same set of regressions for the log of the total number of unemployed population instead of the unemployment rate in Online Appendix C3.1. In accordance with our baseline, the number of unemployed significantly drops after six months and reaches its maximum 13 months after the lottery wins.

increase in the province CPI is around 0.54 units and it is quite persistent. Hence, lottery shocks have a significant short-run effect on the real economy that dissipates two years after the initial impact. In the Online Appendix C3.1 we show that the beneficial effect of the lottery win on unemployment is significantly larger and more persistent during the high-unemployment state, while CPI prices react similarly in the two states. Hence, lottery wins are more effective to lift the economy during recessions, generating moderate inflationary pressures in the local economy, while its effect on unemployment during expansions is short-lived.

The significant drop in the unemployment rate after lottery wins could be attributed to a fall in labor force participation induced by the positive wealth effect as a result of the lottery wins. Since the data for participation is not available at monthly frequency by province, we use the total number of short and long-run contracts signed by workers registered as unemployed in the National Employment Agency as a close proxy to changes in vacancies. Figure 3.9 shows that both labor market tightness, i.e. the share of total contracts over unemployment, and the share of total contracts over working population increase after the lottery shock, providing further evidence for the improvement in the labor market conditions.⁸ In the Online Appendix C3.1 we show that short-term contracts are the ones that increase significantly after a lottery shock. This is not surprising given the dual nature of the Spanish labor market (see Dolado et al. (2020)).

FIGURE 3.9 Effect of Christmas Lottery prizes on labor market tightness and labor contracts to participation ratio

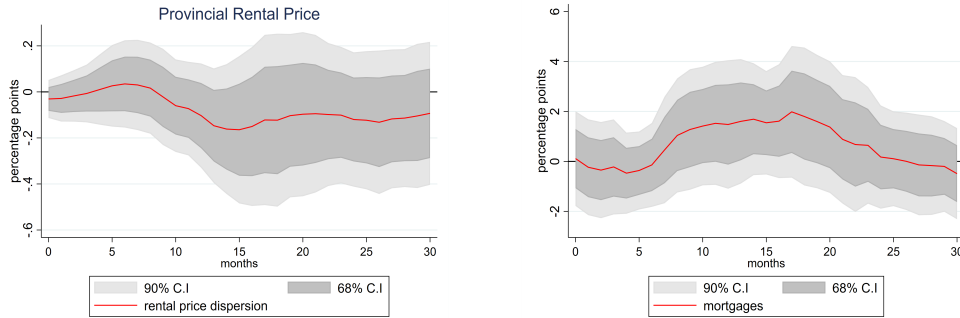


Impulse responses to Christmas Lottery prizes. The left panel presents the responses of labor market tightness to lottery wins, while the right panel presents those of total provincial labor contracts. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2005M5-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

⁸Labor market tightness during the full sample period is on average 49.3 percent with 30.2 s.d. The ratio of total contracts to the labor force is on average 9.3 percent with 4.7 s.d.

Next, following Bagues and Esteve-Volart (2016) and Kent and Martinez (2020), we investigate the effects of lottery wins on house prices. Bagues and Esteve-Volart (2016) report an insignificant increase in house prices at all horizons, while Kent and Martinez (2020) document a significant increase in rural land values and home sales per capita two years after the shock.

FIGURE 3.10 Effect of Christmas Lottery prizes on rental prices and the number of mortgages



Impulse responses to Christmas Lottery prizes. The left panel presents the responses of provincial rental prices to lottery wins, while the right panel presents those of provincial mortgages defined as the ratio of the number of provincial mortgages to the average number of mortgages in Spain. The sample period covered is 2005M5-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Since we do not have readily available monthly data on house and rental prices at the province level we impute monthly rental prices by using the rental housing price index used to compute monthly provincial CPI for all goods and services. We also have available monthly data on the number of mortgages constituted within a province from INE (*Instituto Nacional de Estadística*). Figure 3.10 displays the IRFs of the level of rental prices and the number of mortgages relative to the average number of mortgages in Spain to the lottery win. Contrary to Kent and Martinez (2020), we detect no effect of the shock on rental prices or mortgages at any short horizon.

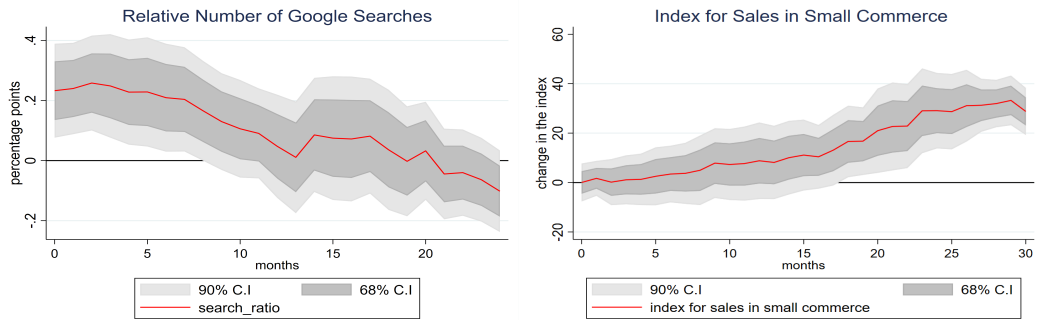
Due to limited data availability, we were able to examine the responses of durable consumption to the lottery shocks at the individual level. Data on non-durable consumption at the regional level are not publicly available. To investigate how lottery wins affect non-durable consumption we have used two proxies for a specific type of non-durable consumption: retail sales and restaurants.

First, we have collected data from Google searches for restaurants in Google Trends since 2011 at the Spanish regional level and investigated using the same specification as in Equation (3.3.1) how the winning of the lottery affects searches for restaurants in the winning provinces. The underlying assumption behind this exercise is that people that intend to go to restaurants search more for restaurants

online in the winning regions. Results are presented in Figure 3.11 where we plot the IRFs for the number of Google searches in the winning provinces relative to the total searches for restaurants in Spain. Restaurant searches increase by more than two percentage points on average on impact and significantly after the lottery rewards for seven months.

Next, the national statistical institute (INE) collects monthly data for the General Retail Trade Index at constant prices at the autonomous region level. We have investigated how this index changes after lottery wins for seven communities that have a unique province. The bottom panel of Figure 3.11 presents the estimated effect of lottery wins on the Retail Trade Index in those provinces.⁹ The retail trade index increases significantly after 17 months in the winning provinces.

FIGURE 3.11 Effects of Christmas Lottery prizes on the relative number of Google searches for restaurants and retail sales



The left panel presents the responses in the linear LP model (3.3.1) for the number of Google searches, while the right panel presents the response of the index for sales. The relative number of Google searches is defined as the ratio of the number of Google searches in each province to the total Google searches for restaurants in Spain for the sample period 2011M1-2020M1. The sample period for the retail trade index is 2005M5-2020M1 and the reported responses are based on seven communities with a unique province. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

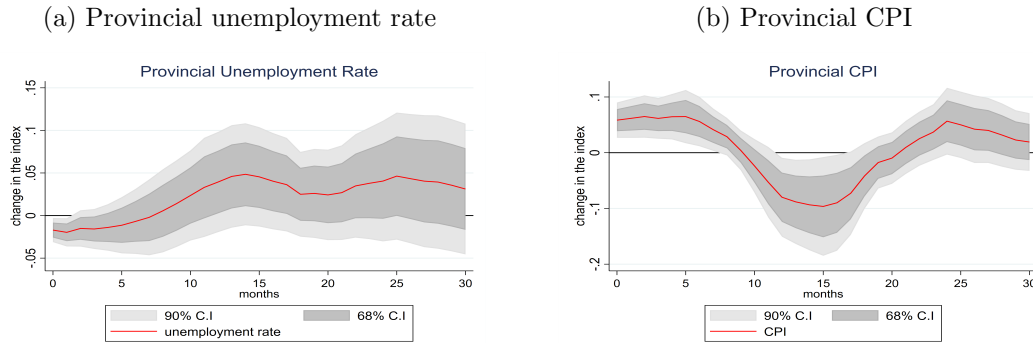
Our results in this section confirm partially and extend the results of previous studies that analyzed the macroeconomic effects of Christmas lottery wins in Spain. Bagues and Esteve-Volart (2016) using annual data have shown that lottery wins have a temporary marginally significant impact on unemployment and house prices. We report a more substantial drop in unemployment and no significant rise in house prices. Yet, we also find that labor demand and employment rise and that lottery wins also push upwards the provincial CPI level in the winning provinces, while they do not report any significant price effects. Bermejo et al. (2021) using also annual data report a higher firm creation in winning provinces and, in particular,

⁹Details about those communities and their response to lottery wins are provided in the next section.

during recessions. Although the macroeconomic results we present are compatible with theirs since higher firm creation could drive the increase in job vacancies and the fall in unemployment we report, the mechanism we put forward is different. The sentimental responses to the lottery win indicate that a demand effect is clearly operative.

Finally, given the reaction of confidence to lottery wins and the reported F-statistics in Table 3.2 and given the analysis that suggests that lottery wins are independent of economic fundamentals, one could use lottery wins as an instrument for autonomous changes in sentiment at the aggregate level. Figure 3.12 presents the unemployment and provincial CPI responses for the sample period 2011M11-2020M1 to a confidence shock identified using lottery wins as an instrument for autonomous changes in ICE. Consistently with Lagerborg et al. (2022), in response to confidence shocks identified through an IV that uses lottery wins as instrument unemployment falls significantly on impact and CPI prices increase the first month after the shock¹⁰. Relative to the last authors, we investigate a positive shock to sentiment (lottery wins versus mass shootings) and find that results on unemployment are short-lived. Yet, our results should be taken with caution given the short sample size and are not directly comparable since the latter authors investigate the dynamics of sentiment shocks in the US economy.

FIGURE 3.12 Effect of the Index of Consumer Expectation Instrumented by Lottery Rewards on the Provincial Unemployment Rate and CPI



Impulse responses to the Index of Consumer Expectation shocks instrumented by Lottery prizes. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months (see Online Appendix for details and robustness checks on the construction of the indices). Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2011M11-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

¹⁰Notice that we have few data available at the aggregate level (9 years) and drop many of the provinces from the analysis because of the lack of enough respondents in some provinces to make the response of the aggregate sentiment index representative. As a result, the explanatory power of the IV regressions at the aggregate level is weak.

3.6 Robustness Exercises

In this section, we examine the robustness of our results. For economy of space we present the outcomes of these exercises in the Online Appendix G3.1-G3.1.

We start by investigating whether including in the lottery prizes El Niño (The Kid) lottery affects our main results. El Niño is considered the second most popular lottery prize in Spain. The Niño lottery takes place every year on the 6th of January. The average lottery prize is around €9, which is lower than the average Christmas lottery prize per capita, €42. In the Online Appendix F3.1 we present summary statistics for this lottery. Given the proximity in time of these two lottery events, those provinces where the winning tickets are sold experience relatively large income shocks in a short time window between the end of each year and the beginning of the next one. It is precisely this proximity in time between these two lotteries, coupled with the common traits it shares with the Christmas lottery (syndicate game, popularity), that might cast some doubts on the results we present since the provinces we considered as the control group in our regressions might have been treated with monetary transfers coming from the El Niño lottery. For that reason, we have extended the original data of Bagues and Esteve-Volart (2016) and constructed a broader lottery rewards and expenditures per capita database that includes both the Christmas lottery data and the data from El Niño lottery. In the Online Appendix F3.1 we present results when repeating all the exercises presented above when replacing the original data for lotteries with the extended database. Our main results all survive besides the data extension.

Second, we examine the possible presence of spillover effects by replacing in the specification in Equation (3.3.1) data of the winning province with data of the autonomous community to which the province belongs. For example, instead of running regressions using Barcelona as the economic unit, we instead replace this with data for Catalonia. Figure G3.1 in the Online Appendix G3.1 plots the IRFs of the unemployment ratio at the community level for communities in which at least one of their provinces received the money windfalls (we exclude the seven communities with only one province). In accordance with the results of Bagues and Esteve-Volart (2016), the results do not support any significant spillover effects in neighboring provinces for the unemployment rate, while a moderate increase in CPI at the community level is observed.

We also aggregate data in quarters and show that results are robust (see Online Appendix G3.1). If we do not account for the size of the reward and just define a dummy for provinces that have won the lottery, the effect on unemployment and consumer sentiments remains statistically significant (see Online Appendix G3.1). One might worry that our results are driven by a few outliers that contaminate the effects of lottery prizes on consumption or sentiment and macroeconomic conditions. To alleviate such concerns, we have dropped all the rewards higher than 1000 euros

per capita and repeated our analysis. The aggregate effect on unemployment and sentiment indices, albeit smaller, remains significant. We repeat a similar exercise also at the individual level in order to examine the sensitivity of our results with respect to the effects of the lottery shocks on durable consumption and confidence. Our results survive this robustness check as well and are presented in the Online Appendix G3.1.

In our baseline individual-level analysis experiment, we used dummies for lottery prizes in regions where lottery wins per capita were higher than zero. The idea behind our specification is that large lottery wins affect significantly sentiment independently of the amount of money redistributed per capita from the lottery win. Notice that our hypothesis implies that the news about lottery wins in the region spurs sentiment independently of the magnitude of the money transfers actually received in the region. To confirm this intuition we repeat our analysis by regressing sentiment to total lottery awards when controlling for population and total lottery expenditures in the region. Results of these regressions are presented in Online Appendix B3.1 and G3.1. Our results are robust to this change¹¹.

An alternative explanation of our findings is that the lottery prizes do not spur sentiment but they rather represent a redistribution mechanism from rich to poor provinces in Spain. We examine this hypothesis both at the aggregate and the individual level analysis in the Online Appendix E3.1. To examine whether our main results are driven by poorer provinces receiving huge transfers from rich regions we interact lottery rewards with a dummy variable for poorer provinces for the aggregate regressions and also by adding two extra variables to the baseline specification in Equation (3.4.3): a dummy variable that takes the value of 1 if the GDP per capita in province j at year t is lower than average GDP per capita across provinces for the whole sample ($\text{Poor}_{j,s}$) and an interaction term between the lottery prize dummy and a poor dummy for the individual regressions. Both the analyses at the aggregate and the individual level suggest that the nature of the experiment we are considering talks more about changes in sentiment due to positive news and less about redistribution.

In a recent paper Canova (2020) highlights the problems that the application of cross-sectional methods involves when computing macroeconomic objects in spatial settings. He argues that when dynamic heterogeneity is present, it is best to estimate the effect of a policy change or shock in time, unit by unit, and then compute a cross-sectional average. Following his suggestion, we compute dynamic responses

¹¹Given that our mechanism does not work through the money transfer but rather through the good news about large money drops in the region, it is not surprising that if we would run regressions where we would consider lottery rewards per capita as a continuous variable in the individual regressions, we would get small and insignificant coefficients. Those regressions would capture how much a marginal change in lottery awards per capita changes consumer sentiment. Instead, we are interested in studying how the fact that a province won the lottery affects consumer sentiment and not the amount of per capita lottery prize transfers per se.

to lottery shocks unit by unit. Our results are robust to adopting the proposed methodology (see Online Appendix G3.1).

3.7 Conclusions

We show that Spanish Christmas lottery wins stimulate economic activity in the winning regions and their propagation works through sentiment. Lottery winnings spur economic sentiment and induce significant demand effects that lead to a reduction in unemployment, a rise in job vacancies, and moderate increases in CPI prices at the province level and they are more expansionary during recessions. We uncover the sentimental propagation of lottery wins using individual survey data. Households living in provinces awarded by the lottery, although they do not directly receive wins and do not perceive any change in the regional fundamentals, become more optimistic about the future economic conditions in Spain on impact and increase their intended consumption responses, while they increase their durable consumption expenditure (for cars and furniture) significantly six months after the lottery draw.

Our findings square well with the theory developed in Pappa et al. (2023) on sentiment-driven cycles. They show that the countercyclicality of earnings' risk induces sensitivity to expectational shocks including news about future fundamentals, noise shocks, and stochastic sunspots. The evidence we report gives further support to the presence of countercyclical earning risk especially for young, low educated, low-income, and unemployed individuals.

A3 Appendix to Chapter 3

A3.1 Correlation between Consumer Sentiment and Lottery Expenditure

To check if lottery expenditures in each province are influenced by aggregate economic sentiment, we adopt the specification in Equation 3.3.1 and regress the per capita regional lottery expenditures on the two aggregate sentiment indices. The estimates in Table A3.1 suggest that current and lagged consumer sentiment indices do not explain lottery expenditures at the province level.

TABLE A3.1 Testing for Endogeneity of the Lottery Expenditures

	(1) LotteryExp _t	(2) LotteryExp _t	(3) LotteryExp _t	(4) LotteryExp _t
ICC _t	2.44e-06 (2.41e-06)		1.78e-06 (2.82e-06)	
ICE _t		5.53e-07 (2.25e-06)		3.61e-06 (2.99e-06)
ICC _{t-1}			-2.37e-06 (3.30e-06)	
ICC _{t-2}			5.70e-06 (3.74e-06)	
ICC _{t-3}			2.54e-06 (3.13e-06)	
ICE _{t-1}				-7.08e-06 (4.41e-06)
ICE _{t-2}				5.38e-06 (3.79e-06)
ICE _{t-3}				-2.16e-07 (2.82e-06)
LotteryExp _{t-1}	0.985*** (0.015)	0.985*** (0.015)	0.985*** (0.015)	0.985*** (0.015)
Provincial Controls	Yes	Yes	Yes	Yes
Aggregate Controls	Yes	Yes	Yes	Yes
Observations	972	972	972	972

LotteryExp_t denotes per capita expenditure on lottery tickets, ICC is the aggregate index for current economic condition, and ICE is the aggregate index of consumer expectation. Robust standard errors clustered at the province level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

A3.2 Number of times each province won the Spanish Christmas lottery 2005-2019

The table below reports the number of times each Spanish province has won any of the top prizes between 2005 and 2019.

TABLE A3.2 Number of times each province was awarded with any of the Spanish Christmas Lottery main prizes between May 2005 - Jan 2020.

Province	Number of times won any of the top lottery prizes	Province	Number of times won any of the top lottery prizes
Álava	5	La Rioja	3
Albacete	7	Lugo	8
Alicante	11	Madrid	14
Almería	9	Málaga	8
Ávila	4	Murcia	8
Badajoz	7	Navarra	7
Baleares, Islas	5	Ourense	4
Barcelona	13	Asturias	9
Burgos	7	Palencia	4
Cáceres	7	Las Palmas	7
Cádiz	7	Pontevedra	8
Castellón	8	Salamanca	7
Ciudad Real	6	Santa Cruz de Tenerife	11
Córdoba	7	Cantabria	7
Coruña, A	9	Segovia	4
Cuenca	3	Sevilla	10
Girona	6	Soria	7
Granada	9	Tarragona	6
Guadalajara	3	Teruel	2
Guipúzcoa	10	Toledo	7
Huelva	7	Valencia	11
Huesca	6	Valladolid	4
Jaén	8	Vizcaya	11
León	5	Zamora	4
Lleida	10	Zaragoza	11

A3.3 Consumer Sentiment and Durable Consumption Data

Individual Characteristics

Variable	Description
Age	1: Less than 25 years
	2: Between 25 and 34 years
	3: Between 35 and 44 years
	4: Between 45 and 54 years
	6: More than 55 years
Gender	0: Male
	1: Female
Marital Status	1: Married
	2: Single
	3: Widow
	4: Separated
	5: Divorced
Education	1: Less than 5 years of schooling
	2: Primary education
	3: Less than high-school
	4: Some high-school
	5: Vocational training I
	6: High-school
	7: Vocational training II
	8: Some college
	9: College
	10: Master/ PhD degree
Employment Status	0: Other
	1: Employed
Household Income	1: Less than 1100 euros
	2: Between 110 and 1800 euros
	3: Between 1801 and 2700 euros
	4: Between 2701 and 3900 euros
	5: More than 3900 euros

TABLE A3.3 Percentage of answers by question and individual characteristics

	(1) Household Income			(2) Employment Prospects			(3) Spanish Economy		
<i>Answer:</i>	Positive	Neutral	Negative	Positive	Neutral	Negative	Positive	Neutral	Negative
Age									
16-24	22%	9%	9%	16%	8%	10%	14%	7%	9%
25-34	27%	14%	15%	18%	16%	16%	17%	16%	16%
35-44	24%	20%	20%	21%	22%	20%	21%	22%	21%
45-55	15%	18%	20%	16%	20%	19%	17%	20%	19%
> 55	12%	39%	36%	29%	34%	35%	31%	35%	35%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Gender									
<i>Female</i>	46%	51%	53%	44%	52%	53%	42%	53%	52%
<i>Male</i>	54%	49%	47%	56%	48%	47%	58%	47%	48%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Marital Status									
<i>Married</i>	40%	55%	53%	50%	55%	52%	51%	55%	52%
<i>Not Married</i>	60%	45%	47%	50%	45%	48%	49%	45%	48%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Education									
<i>Less High School</i>	38%	44%	52%	40%	41%	51%	39%	43%	50%
<i>High School</i>	18%	16%	16%	18%	16%	16%	19%	15%	16%
<i>Some College</i>	19%	18%	17%	17%	19%	17%	18%	19%	17%
<i>College</i>	20%	18%	13%	20%	20%	13%	20%	19%	14%
<i>Master/PhD</i>	5%	4%	3%	4%	4%	3%	4%	4%	3%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Employment Status									
<i>Employed</i>	66%	49%	38%	52%	53%	43%	51%	53%	45%
<i>Not Employed</i>	34%	51%	62%	48%	47%	57%	49%	47%	55%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Household Income									
< €1100	16%	24%	42%	19%	24%	35%	20%	24%	35%
€1100 - €1800	33%	34%	35%	33%	35%	35%	32%	35%	35%
€1801 - €2700	26%	23%	16%	25%	23%	18%	25%	23%	18%
€2701 - €3900	15%	12%	6%	15%	12%	8%	14%	12%	8%
> €3900	10%	7%	2%	8%	6%	4%	9%	6%	4%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Observations	32,504	69,508	15,464	49,160	47,156	25,918	47,824	40,903	26,049

Education has been simplified to a categorical value that takes values 1 to 5 in ascending order from lower to higher degree of education attained. Marital status has also been simplified to a categorical value that takes value 1 if married and 0 otherwise

TABLE A3.4 Percentage of answers by question and individual characteristics

	(4) Future Household Income			(5) Future Employment Prospects			(6) Future Spanish Economy		
<i>Answer:</i>	Positive	Neutral	Negative	Positive	Neutral	Negative	Positive	Neutral	Negative
Age									
16-24	19%	7%	6%	14%	7%	8%	14%	7%	8%
25-34	26%	13%	14%	19%	15%	16%	18%	16%	16%
35-44	26%	19%	21%	21%	22%	22%	22%	22%	21%
45-55	17%	19%	21%	17%	21%	20%	17%	20%	20%
> 55	13%	42%	38%	29%	35%	34%	29%	35%	35%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Gender									
<i>Female</i>	46%	51%	51%	47%	53%	50%	46%	53%	50%
<i>Male</i>	54%	49%	49%	53%	47%	50%	54%	47%	50%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Marital Status									
<i>Married</i>	41%	57%	56%	50%	55%	54%	50%	55%	54%
<i>Not Married</i>	59%	43%	44%	50%	45%	46%	50%	45%	46%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Education									
<i>Less High School</i>	41%	44%	51%	43%	42%	47%	43%	44%	46%
<i>High School</i>	19%	15%	15%	18%	15%	16%	18%	15%	16%
<i>Some College</i>	19%	18%	17%	18%	19%	19%	18%	19%	18%
<i>College</i>	17%	19%	14%	19%	19%	6%	17%	18%	16%
<i>Master/PhD</i>	4%	4%	3%	4%	4%	3%	4%	4%	4%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Employment Status									
<i>Employed</i>	44%	51%	57%	50%	47%	51%	49%	53%	48%
<i>Not Employed</i>	56%	49%	43%	50%	53%	49%	51%	47%	52%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Household Income									
< €1100	24%	24%	40%	24%	24%	31%	24%	25%	31%
€1100 - €1800	34%	34%	34%	34%	35%	35%	34%	35%	35%
€1801 - €2700	23%	23%	17%	23%	23%	20%	23%	23%	20%
€2701 - €3900	13%	12%	7%	12 %	12%	12%	12%	12%	9%
> €3900	7%	3%	3%	7%	6%	5%	7%	5%	5%
	100%	100%	100%	100%	100%	100%	100%	100%	100%
Observations	22,125	63,712	27,114	39,975	25,629	40,482	39,686	30,387	39,368

Education has been simplified to a categorical value that takes values 1 to 5 in ascending order from lower to higher degree of education attained. Marital status has also been simplified to a categorical value that takes value 1 if married and 0 otherwise

TABLE A3.5 Percentage of answers by question and individual characteristics

	(1) Durable Consumption		(2) Durable Consumption Vehicle		(3) Durable Consumption Furniture		(4) Durable Consumption Large Appliance		(5) Durable Consumption Small Appliance	
<i>Answer:</i>	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Age										
16-24	12%	7%	15%	9%	13%	9%	13%	9%	12%	9%
25-34	19%	13%	23%	15%	23%	15%	18%	15%	19%	15%
34-44	23%	19%	23%	21%	25%	20%	22%	21%	24%	20%
44-55	20%	18%	19%	19%	18%	19%	20%	18%	20%	19%
>55	26%	42%	21%	36%	21%	37%	26%	37%	25%	37%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Gender										
<i>Female</i>	47%	54%	43%	51%	45%	51%	46%	52%	46%	52%
<i>Male</i>	53%	46%	57%	49%	55%	49%	54%	48%	54%	48%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Marital Status										
<i>Married</i>	53%	53%	51%	53%	51%	53%	46%	52%	53%	53%
<i>Not Married</i>	47%	47%	49%	47%	49%	47%	54%	48%	47%	47%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Education										
<i>Less High School</i>	36%	54%	38%	46%	30%	48%	35%	49%	34%	49%
<i>High School</i>	17%	15%	18%	16%	17%	16%	18%	16%	17%	16%
<i>Some college</i>	20%	16%	20%	18%	21%	17%	20%	17%	21%	17%
<i>College</i>	21%	13%	20%	17%	25%	16%	22%	16%	23%	15%
<i>Master/PhD</i>	45%	3%	5%	4%	7%	3%	5%	3%	5%	3%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Employment										
<i>Employed</i>	57%	41%	62%	48%	63%	47%	57%	46%	58%	46%
<i>Not Employed</i>	43%	59%	38%	52%	37%	53%	43%	54%	42%	54%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Household Income										
< €1100	17%	38%	15%	29%	13%	30%	16%	31%	17%	31%
€1100 - €1800	33%	35%	32%	34%	30%	35%	32%	35%	33%	35%
€1801 - €2700	26%	17%	27%	21%	28%	20%	26%	20%	25%	20%
€2701 - €3900	15%	7%	16%	10%	18%	10%	16%	9%	15%	9%
>3900	9%	3%	10%	5%	12%	5%	10%	5%	9%	6%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Observations	29,406	87,964	10,445	107,353	17,215	100,489	27,446	90,282	29,406	87,964

Education has been simplified to a categorical value that takes values 1 to 5 in ascending order from lower to higher degree of education attained. Marital status has also been simplified to a categorical variable that equals 1 if married and 0 otherwise

Consumer Confidence Questions

To assess how lottery wins shocks affect consumer sentiment in the winning provinces, we aggregate the answers to the confidence questions across respondents and across questions at the province level to produce two broad indices: the Index of Current Economic Conditions (ICC) and the Index of Consumer Expectations (ICE). The ICC is based on answers to the questions that concern consumers' assessment of their own current financial and economic situation as well as the current state of the Spanish economy. In particular, the ICC focuses on the following three questions:

1. (Q1S) Would you say that your household economic conditions are better off, worse off, or just about the same compared to 6 months ago?
2. (Q2S) Would you say that the current economic situation of Spain would allow you to improve your employment status, would help worsen your employment status, would have no impact on your employment status compared to 6 months ago?
3. (Q3S) Would you say the current state of the Spanish economy is better, worse, or about the same compared to 6 months ago?

Analogously, the ICE summarizes answers to questions about consumers' expectations about their future household finances, employment status, and about the evolution of the Spanish economy. Specifically, the ICE is computed by gathering answers to the following three questions:

1. (Q1F) Would you say that your household economic conditions will be better off, worse off, or just about the same 6 months from now?
2. (Q2F) Would you say that the economic situation of Spain will allow you to improve your employment status, will help worsen your employment status, will have no impact on your employment status in 6 months from now?
3. (Q3F) Would you say the state of the Spanish economy will be better, worse, or about the same 6 months from now?

Aggregate Consumer Sentiment Indices

We follow the methodology adopted by the University of Michigan's Survey of Consumer Confidence and construct two broad consumer sentiment indices for each province j : Index of Current Economic Conditions (ICC) and Index of Consumer Expectation (ICE)

$$ICC_{j,t} = \frac{Q_{1S,j,t} + Q_{2S,j,t} + Q_{3S,j,t}}{3}$$

$$ICE_{j,t} = \frac{Q_{1F,j,t} + Q_{2F,j,t} + Q_{3F,j,t}}{3}$$

where

$$Q_{i,j,t} = \%Better_{j,t} - \%Worse_{j,t} + 100 \quad i \in \{1S, 2S, 3S, 1F, 2F, 3F\}$$

The Spanish consumer confidence survey is designed to be representative at the national level, but the CIS does not guarantee that the sample will be representative of the population within each separate province during each month. Following Aguiar et al. (2013), we average over two months of responses in order to mitigate

measurement error in our data set due to sampling variation within the survey at the province level. Also, to keep the representativeness of the consumer sentiment indices at the province level, we keep in our sample those monthly observations for which the provincial ICC and ICE are constructed with at least 25 respondents. A representativeness threshold of 25 respondents implies that we have at least 25 survey answers for each of the three questions included in the computation of ICE and ICC, respectively. Table A3.6 summarizes the number of observations in the representative sample.

TABLE A3.6 Representativeness of Provincial ICC and ICE - Consumer sentiment indices at the province level have been constructed using monthly information between November 2011 and January 2020 for 50 Spanish provinces.

Representativeness of Provincial ICC and ICE			
Threshold	Number of observations	Provinces remaining in the sample	Provinces remaining in the sample at least 50 monthly obs.
≥ 25 survey respondents per question	1,692	29	17

Provincial and aggregate consumer confidence indices are strongly correlated (the average correlation coefficient between the national and all provincial ICC and ICE is 0.88 and 0.82, respectively)¹².

¹²The reported values for the average unconditional correlations between the national and all provincial ICC and ICE have been computed after keeping those monthly observations for which there are at least 25 respondents answering the survey questions. If we relax the threshold for representativeness to 5 respondents, these average unconditional correlations take value 0.80 and 0.71, respectively.

A3.4 Macroeconomic variables

TABLE A3.7 Summary Statistics - Macroeconomic data at the province and national level for the period May 2005- Jan 2020

	Mean	St. dev.	Min.	Max.	N
	(1)	(2)	(3)	(4)	(5)
Population (in thousands)	920.28	1136.82	89.50	6600	8850
Total Unemployment level (in thousands)	70.66	83.258	2.067	564.24	8850
Total Unemployment Level in Spain (in thousands)	3554.78	930.72	1959.34	4960.22	8850
Unemployment Rate (%)	20.74 ^a	8.44	5.34	47.42	8850
Unemployment Rate in Spain (%)	17.48	5.85	7.87	26.34	8850
Unemployment Ratio (Population %)	7.52	2.73	1.96	17.06	8850
Long-term Labor Contracts (% Labor Force)	0.72	0.31	0.16	3.82	8850
Short-term Labor Contracts (% Labor Force)	8.63	4.66	2.75	77.31	8850
Total Contracts (% Labor Force)	9.34	4.69	3.07	77.93	8850
Labor Market Tightness (%)	49.32	30.28	9.19	285.09	8850
Regional CPI (% Spanish CPI)	100.27	0.83	96.32	105.09	8850
CPI	97.1	5.82	80.22	106.17	8850
CPI (Spain)	96.8	5.91	83.29	104.87	8850

^aAverage unemployment rate is weighted by provincial labor force participation.

TABLE A3.8 Summary Statistics - Macroeconomic data for Asturias, Cantabria, Islas Baleares, Madrid, Murcia, Navarra, and La Rioja for the period May 2005- Jan 2020

	Mean	St. dev.	Min.	Max.	N
	(1)	(2)	(3)	(4)	(5)
Population (in thousands)	875.58	442.35	495	1900	1062
Total Unemployment level (in thousands)	77.45	47.01	19.58	229.84	1062
Unemployment Rate (%)	27.24 ^a	8.82	7.12	42.20	1062
Unemployment Ratio (Population %)	8.86	2.74	2.77	14.11	1062
Long-term Labor Contracts (% Labor Force)	0.68	0.33	0.18	2.04	1062
Short-term Labor Contracts (% Labor Force)	10.23	4.80	3.14	28.14	1062
Total Contracts (% Labor Force)	10.90	4.75	3.87	28.50	1062
Labor Market Tightness (%)	44.21	22.51	10.08	141.96	1062
Regional CPI (% Spanish CPI)	100.47	0.79	98.42	102.82	1062
CPI	97.25	5.75	82.16	105.64	1062

^aAverage unemployment rate is weighted by provincial labor force participation.

Variable	Description	Source
Total unemployment	Number of unemployed individuals registered in the National Employment Agency	SEPE
Total employment	Number of employed individuals affiliated with the Social Security System	Estadísticas Seguridad Social
Total labor contracts	Number of labor contracts signed by individuals who were registered as unemployed in the National Employment Agency	SEPE
Short-term labor contracts	Number of short-term labor contracts signed by individuals who were registered as unemployed in the National Employment Agency	SEPE
Long-term labor contracts	Number of long-term labor contracts signed by individuals who were registered as unemployed in the National Employment Agency	SEPE
Unemployment rate	Harmonized Unemployment Rate: All Persons for Spain	OECD
Provincial and National CPI	Consumer Price Index: all goods. Base 2016	INE
Provincial and National Rental Price Index	Rental prices subgroup of Consumer Price Index. Base 2016	INE
Mortgages	Number of mortgages. All types of real state property	INE
Population	Total population with Spanish residence	INE

B3 Appendix B to Chapter 3

B3.1 Individual-level Regressions

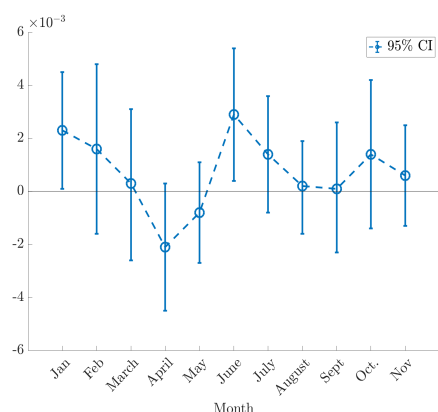
Alternative Definition of the Lottery Prize Variable

The hypothesis we test is whether winning the lottery in the province affects sentiment, independently of the amount received of lottery per capita. For that reason, we estimate again our baseline regression for consumer sentiment at the individual level by specifying the lottery variable in total 1000 euros instead of per capita terms. Table B3.1 and Figure B3.1 show that our results are robust to this alternative definition of the treatment variable.

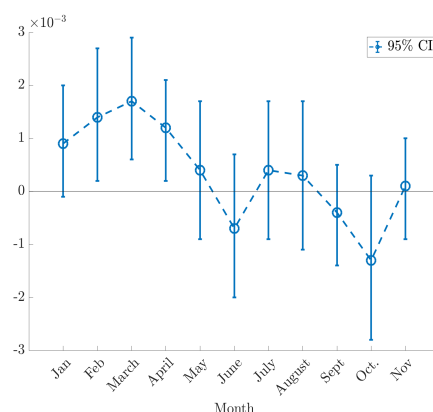
TABLE B3.1 Survey evidence on the effects of Spanish Christmas Lottery on consumer sentiment - Total lottery prizes

	(1) Household Income	(2) Future Household Income	(3) Employment Prospects	(4) Future Employment Prospects	(5) Spanish Economy	(6) Future Spanish Economy
Lottery Prize (log)	0.008** (0.003)	0.009*** (0.003)	0.009*** (0.004)	0.006 (0.004)	0.005* (0.003)	0.007** (0.003)
Lottery Expenditures (log)	1.301*** (0.184)	0.824*** (0.124)	0.389*** (0.124)	-0.888*** (0.188)	-0.180 (0.164)	-0.671*** (0.168)
Population (log)	-0.721 (1.269)	-0.127 (0.891)	-1.977* (1.171)	-2.013*** (0.671)	-2.533*** (0.903)	-1.999*** (0.697)
Month × Province Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	117476	112951	112047	106086	114776	109441
Pseudo R^2	0.049	0.039	0.023	0.011	0.021	0.012

Columns (1)-(6) provide results from an ordered probit where the dependent variable is Q1C-Q3F. *Lottery Prize log* refers to the logarithm of total Christmas lottery prizes in 1000 euros. *Lottery expenditures log* refers to the logarithm of total Christmas lottery expenditures in 1000 euros. We use the approximation of $\ln(x + 0.001) \approx \ln(x)$ as lottery prizes and expenditures are 0 in other months different from January and December, respectively. Robust standard errors clustered by province in parentheses. The sample includes information from consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

FIGURE B3.1 Effects of Christmas Lottery on realized and intended household durable consumption

(a) Recent Durable Purchases



(b) Intended Durable Purchases

This figure plots the marginal effects associated with the β_s coefficients and their 95% CI from estimating Equation (3.3.2) using a probit model and an ordered probit model, respectively. The dependent variable in Panel B3.1a is DC while the dependent variable in Panel B3.1b is FDC. The treatment variable is total rewards in logs. The specification includes population and total lottery expenditures as controls. Standard errors are robust and clustered at the province level.

Heterogeneous Effects

This section presents estimates of the effects of lottery wins on individual sentiment about current and expected individual and aggregate conditions when we control for individual characteristics by interacting the lottery prize with age, gender, education, income, and employment (see Tables B3.2-B3.4).

TABLE B3.2 Heterogeneous effects of Spanish Christmas Lottery on consumer sentiment - future household income

	(1) Future Household Income	(2) Future Household Income	(3) Future Household Income	(4) Future Household Income	(5) Future Household Income
Lottery Prize Dummy	0.157*** (0.052)	0.148*** (0.039)	0.162*** (0.053)	0.150*** (0.051)	0.126*** (0.042)
Lottery Expenditures	14.201*** (2.966)	14.204*** (2.966)	14.200*** (2.965)	14.196*** (2.965)	14.210*** (2.967)
Age× Lottery	-0.007 (0.009)				
Gender×Lottery		-0.034* (0.021)			
Education×Lottery			-0.005 (0.006)		
Household Income×Lottery				-0.008 (0.012)	
Employment×Lottery					0.010 (0.030)
Month × Province Dummies	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes
Observations	112951	112951	112951	112951	112951
Pseudo R^2	0.041	0.041	0.041	0.041	0.041

Columns (1)-(5) provide results from an ordered probit. Robust standard errors clustered by province in parentheses. The sample includes information consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE B3.3 Heterogeneous effects of Spanish Christmas Lottery on consumer sentiment
- future employment prospects

	(1) Future Employment Prospects	(2) Future Employment Prospects	(3) Future Employment Prospects	(4) Future Employment Prospects	(5) Future Employment Prospects
Lottery Prize Dummy	0.195*** (0.048)	0.077 (0.049)	0.213*** (0.068)	0.177*** (0.060)	0.121** (0.054)
Lottery Expenditures	-18.756*** (2.819)	-18.746*** (2.819)	-18.765*** (2.817)	-18.790*** (2.818)	-18.774*** (2.816)
Age×Lottery	-0.027** (0.013)				
Gender×Lottery		0.047* (0.026)			
Education×Lottery			-0.019*** (0.005)		
Household Income×Lottery				-0.033*** (0.012)	
Employment×Lottery					-0.043* (0.023)
Month × Province Dummies	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes
Observations	106086	106086	106086	106086	106086
Pseudo R^2	0.011	0.011	0.011	0.011	0.011

Columns (1)-(5) provide results from an ordered probit. Robust standard errors clustered by province in parentheses. The sample includes information consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE B3.4 Heterogeneous effects of Spanish Christmas Lottery on consumer sentiment - future Spanish economy

	(1) Future Spanish Economy	(2) Future Spanish Economy	(3) Future Spanish Economy	(4) Future Spanish Economy	(5) Future Spanish Economy
Lottery Prize Dummy	0.151** (0.059)	0.095** (0.043)	0.220*** (0.049)	0.198*** (0.047)	0.110** (0.044)
Lottery Expenditures	-15.080*** (2.983)	-15.075*** (2.981)	-15.094*** (2.978)	-15.125*** (2.980)	-15.077*** (2.978)
Age×Lottery	-0.012 (0.012)				
Gender×Lottery		0.027 (0.025)			
Education×Lottery			-0.019*** (0.004)		
Household Income×Lottery				-0.038*** (0.010)	
Employment×Lottery					-0.004 (0.024)
Month × Province Dummies	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes
Observations	109441	109441	109441	109441	109441
Pseudo R^2	0.014	0.014	0.014	0.014	0.014

Columns (1)-(5) provide results from an ordered probit. Robust standard errors clustered by province in parentheses. The sample includes information consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C3 Appendix C to Chapter 3

C3.1 Province-level Regressions

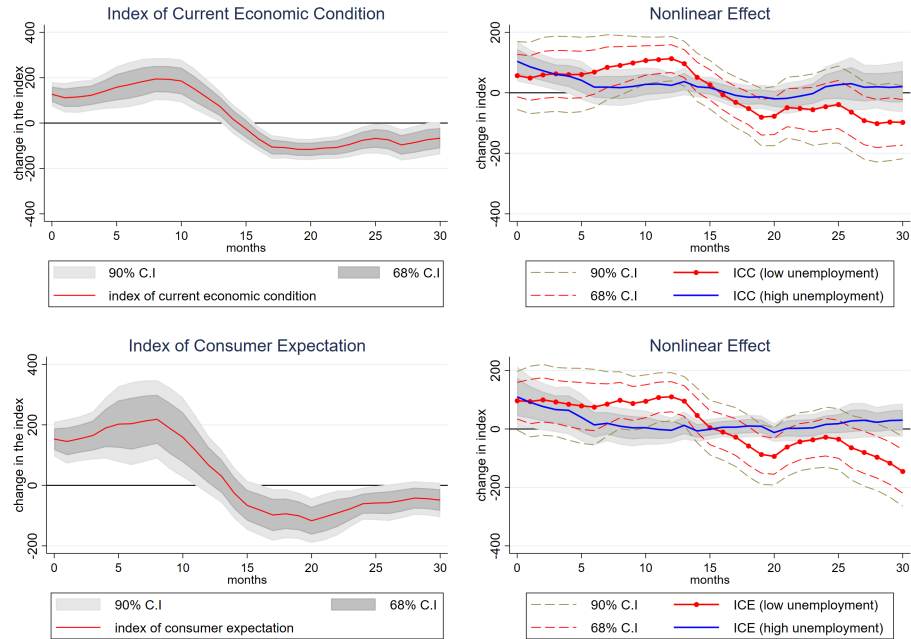
State-dependent Response of the Aggregate Variables

As mentioned in the main text, after a lottery shock, both sentiment indices for current and future economic conditions significantly increase for up to one year. In what follows we adapt the empirical model to account for possible state-dependency of the transitory shocks by allowing for time-varying coefficients according to the state of the business cycle. In particular, we use the following state-dependent LP specification for any $h \geq 0$:

$$S_{j,t+h} = I_{t-1} [\alpha_{A,j,h} + \beta_{A,h} \text{LotteryPrize}_{j,t} + \psi_{A,h}(L)X_{j,t}] \\ + (1 - I_{t-1}) [\alpha_{B,j,h} + \beta_{B,h} \text{LotteryPrize}_{j,t} + \psi_{B,h}(L)X_{j,t}] + \varepsilon_{j,t+h}$$

where $X_{j,t}$ is all control variables included in the linear specification in Equation (3.3.1) (i.e. provincial lottery expenditures, unemployment rate, and CPI prices, as well as the overall unemployment rate and CPI for Spain), $\psi(L)$ is the lag operator and I_t is an indicator variable of the state of the economy when the lottery shock hits. This dummy variable equals 1 (i.e. $I_t = 1$) whenever the economy enters a state in which the unemployment rate in Spain exceeds 20% which roughly corresponds to recessionary periods. When we distinguish between expansionary and recessionary periods, the responses of both ICC and ICE to lottery wins are strong and statistically significant the first few months after the win during recessions. During expansions, the ICC reaction which measures sentiment about economic current conditions does not respond significantly on impact but improves significantly with a lag, along with the improvements in the real economy, while expectations about future conditions, measured by the ICE, increase significantly on impact and remain uplifted up to one year after the win.

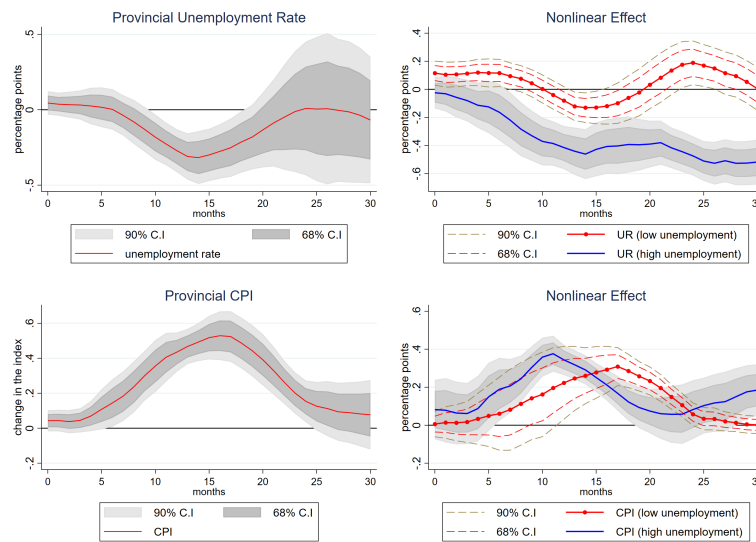
FIGURE C3.1 Effect of Christmas Lottery Prizes on the Index of Current Economic Condition and the Index of Consumer Expectation



Impulse responses to Christmas Lottery prizes. The left panel presents the responses in the linear LP model (3.3.1), while the right panel presents the responses in the state-dependent LP model. The solid blue line are responses in high-unemployment state and the dotted red line are responses in low-unemployment state. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2011M11-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

On the right-hand side of Figure C3.2 we plot the IRFs to lottery shocks in periods of high unemployment (continuous blue lines) and low unemployment (circled red lines). The beneficial effect of the lottery win on unemployment is significantly larger and more persistent during recessions, while CPI prices react similarly in the two states.

FIGURE C3.2 Effect of Christmas Lottery prizes on the unemployment rate and CPI



Impulse responses to Christmas Lottery prizes. The left panel presents the responses in the linear LP model (3.3.1), while the right panel presents the responses in the state-dependent LP model, where the solid blue line refers to the response in high-unemployment states and the dotted red line refers to those responses in low-unemployment states. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2005M5-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Testing for Differences in the Effect of Lottery Prizes across States

The table below presents Wald test statistics for the equality of responses of the unemployment rate, the relative CPI, the ICC and the ICE in recessions versus expansions.

TABLE C3.1 Wald Test Statistics Results

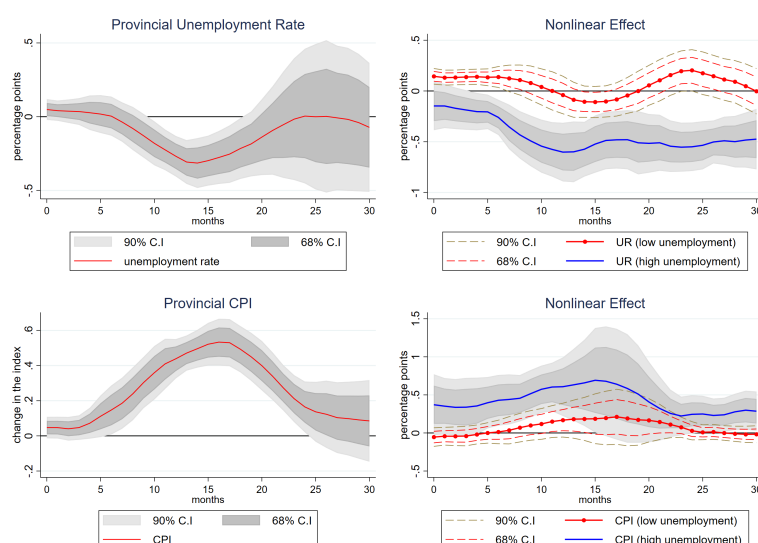
Wald Test Results				
Horizon (months)	Statistics for UR	Statistics for CPI	Statistics for ICC	Statistics for ICE
$h = 0$	5.7 (0.01)	15.6 (0.00)	1.8 (0.3)	5.68 (0.02)
$h = 1$	12.3 (0.00)	0.47 (0.5)	0.0 (0.9)	0.4 (0.53)
$h = 3$	0.23 (0.63)	0.14 (0.71)	1.85 (0.18)	0.0 (0.9)
$h = 6$	9 (0.00)	0.00 (0.9)	1.07 (0.31)	0.52 (0.47)
$h = 12$	11.7 (0.00)	3.1 (0.07)	2.45 (0.02)	1.6 (0.2)
$h = 24$	22.2 (0.00)	0.49 (0.48)	0.15 (0.7)	0.3 (0.6)

Wald test statistics for the null hypothesis that lottery wins have the same effect in high-unemployment and low-unemployment periods for different horizons (Equation ??). The first column shows the results for the unemployment rate (UR), the second column for the relative prices (CPI), the third column for the Index of Current Economic Condition (ICC) and the forth one for the Index of Consumer Expectation Index (ICE). Numbers in parenthesis show the corresponding p-value for each test.

Effects of Lottery Shocks Net of Lottery Expenditures on Unemployment Rate, Prices, and Consumer Confidence Indices

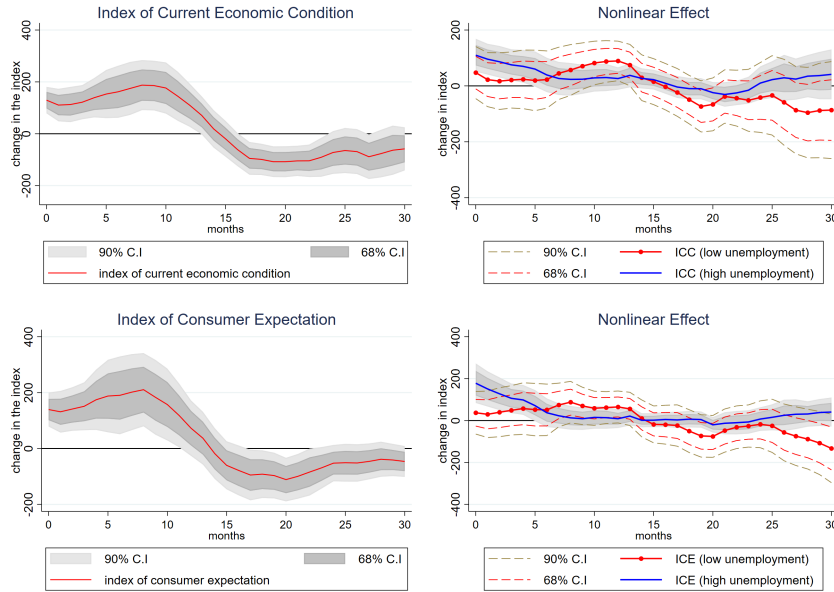
In this section we investigate whether our results are sensitive to the treatment effect considered. In the main text, we report results where the treatment effect is lottery wins after taxes. Here the treatment effect is the lottery wins net of lottery expenditures.

FIGURE C3.3 Effects of Christmas Lottery Prizes (net of lottery expenditures) on Unemployment Rate and CPI



Impulse responses to Christmas Lottery prizes (net of lottery expenditures). The left panel presents responses in the linear LP model (3.3.1), while the right panel presents responses in the state-dependent LP model, where the solid blue line are responses in high-unemployment state and the dotted red line are responses in low-unemployment state. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2005M5 - 2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

FIGURE C3.4 Effect of Christmas Lottery Prizes (net of lottery expenditures) on Index of Current Economic Condition and Index of Consumer Expectation

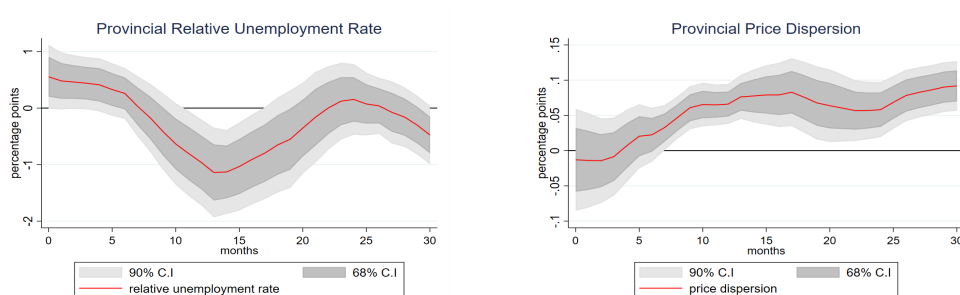


Impulse responses to Christmas Lottery prizes (net of lottery expenditures). The left panel presents responses in the linear LP model (3.3.1), while the right panel presents responses in the state-dependent LP model, where the solid blue line refers to the responses in high-unemployment states and the dotted red line refers to the ones in the low-unemployment state. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and we use responses for two consecutive months (see Online Appendix for details and robustness checks on the construction of the indices). Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2011M11-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Effects of Lottery Shocks on Relative Unemployment and CPI

In the baseline regressions we control for the aggregate unemployment and CPI in Spain in order to evaluate the effects of the shocks on unemployment and CPI at the province level. Here we present results when instead we regress relative unemployment, i.e., province unemployment/average unemployment in Spain and relative CPI, defined similarly on the lottery wins

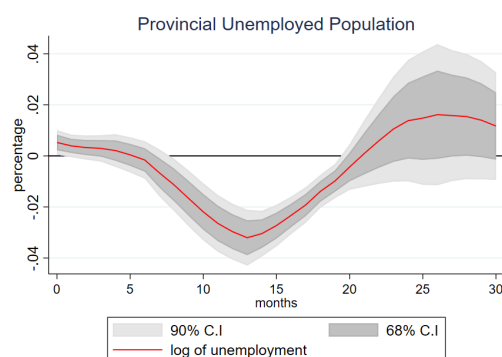
FIGURE C3.5 Effects of Christmas Lottery Prizes on Relative Unemployment Rate and Relative CPI



Impulse responses to Christmas Lottery prizes. The graph shows responses in the linear LP model (3.3.1). Relative unemployment is defined as provincial unemployment over total unemployment. Similarly, relative CPI is defined as the ratio of provincial CPI over Spain's CPI. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2005M5 - 2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Given the discrepancy of the unemployment rate data, we present here the results of the same set of regressions as in Equation (3.3.1) for the log of the total number of unemployed population instead of the unemployment rate.

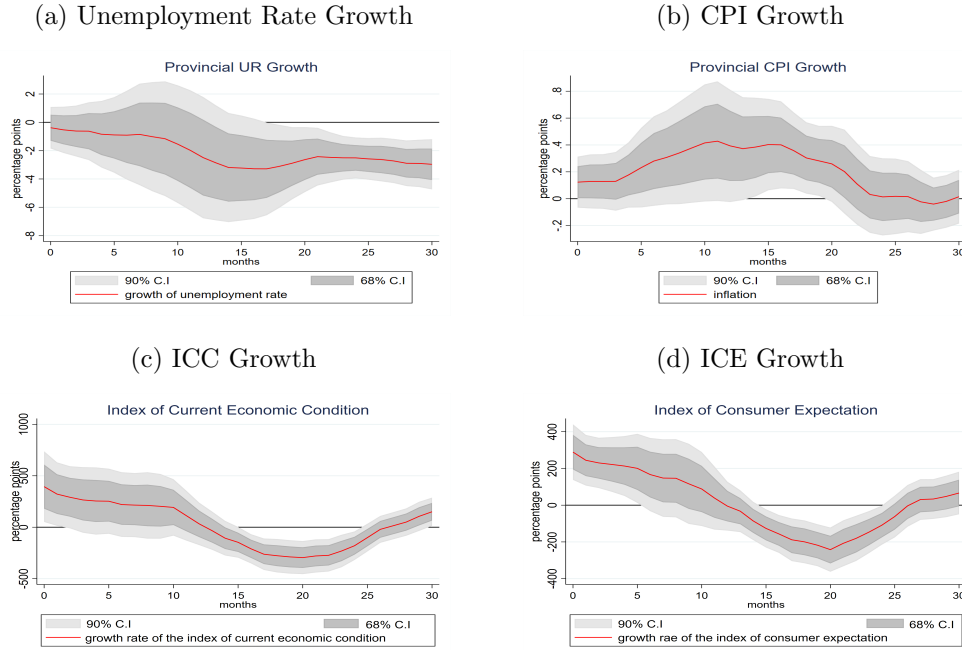
FIGURE C3.6 Effect of Christmas Lottery Prizes on Log of Total Unemployment



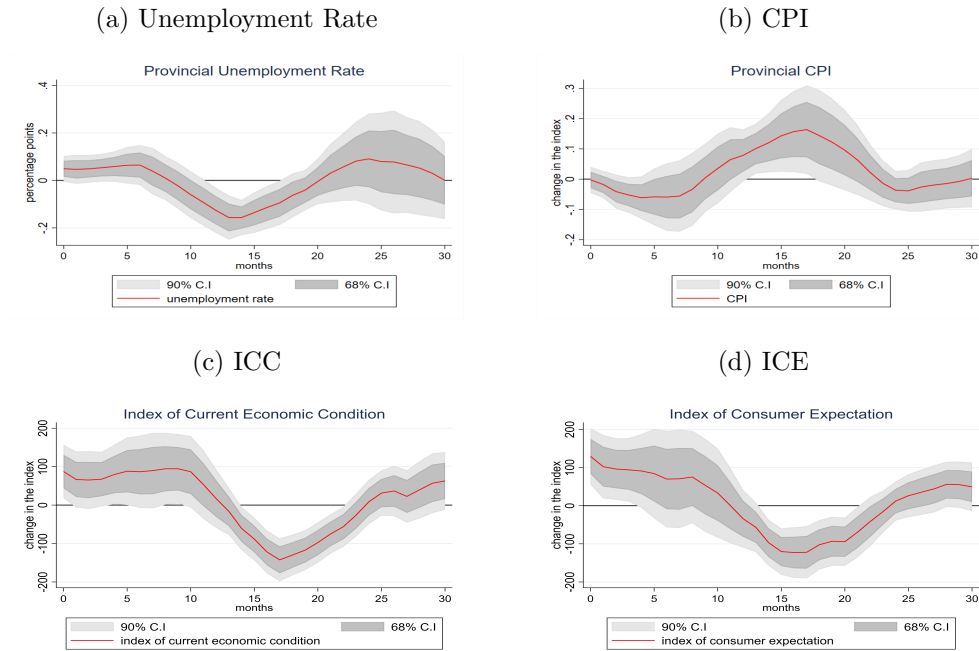
Impulse responses to Christmas Lottery prizes the linear LP model (3.3.1). Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2005M1-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Alternative Detrending Methods: growth rates and HP filtered series

FIGURE C3.7 Effects of Christmas Lottery Prizes on the Growth Rate of Unemployment Rate, CPI, and Consumer Sentiment Indices

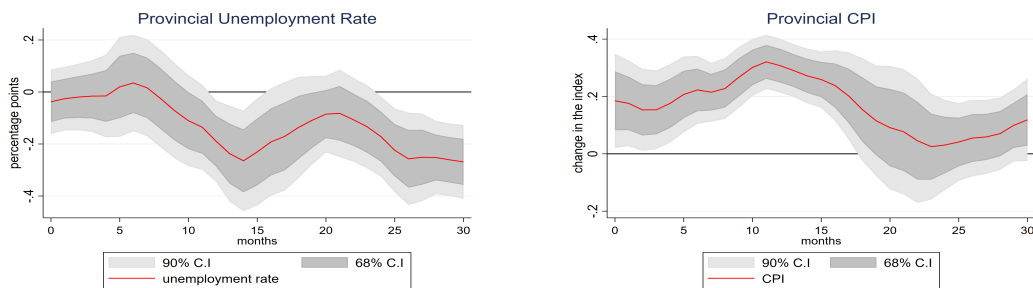


Impulse responses to Christmas Lottery prizes. The graph shows the responses in the linear LP model (3.3.1). Data are in growth rate instead of a fourth-order polynomial. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2005M5 - 2020M1 for UR and CPI and 2011M11 - 2020M1 for the sentiment indices. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and we use responses for two consecutive months. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

FIGURE C3.8 Effects of Christmas Lottery Prizes on Unemployment Rate, CPI, and the Sentiment Indices - Alternative Detrending

Impulse responses to Christmas Lottery prizes. The graph shows the responses in the linear LP model (3.3.1). Data has been detrended using Hodric Prescott filter instead of a fourth order polynomial. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2005M5 - 2020M1 for UR and CPI and 2011M11 - 2020M1 for the sentiment indices. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and we use responses for two consecutive months. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

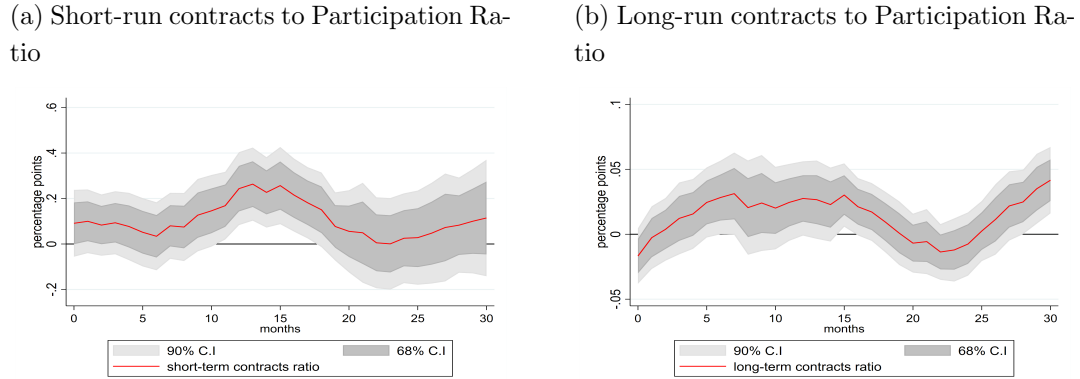
Effects of Lottery Shocks in Sub-sample 2011-2020

FIGURE C3.9 Effects of Christmas Lottery Prizes on Unemployment Rate and CPI - Sub-sample 2011-2020

Impulse responses to Christmas Lottery prizes. The graph shows the responses in the linear LP model (3.3.1). Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2011M1 - 2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Effects of Lottery Shocks on Long vs Short Run Contracts

FIGURE C3.10 Effects of Christmas Lottery Prizes on Labor Contracts by Contract Duration



Impulse responses to Christmas Lottery prizes. The graph shows the responses in the linear LP model (3.3.1). Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2005M5 - 2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

D3 Appendix D to Chapter 3

D3.1 News About Fundamentals

Business confidence

We study data on business confidence that are available at the quarterly frequency for different Spanish autonomous communities. Recall that we have performed our analysis so far using province level monthly data. Luckily there are seven autonomous regions in Spain that have only one province. We use these provinces to investigate how business confidence reacts to lottery wins.

Business Confidence Index

We use the Harmonised Business Confidence Index from Spanish Statistical Office (*Instituto Nacional de Estadística*) for those provinces that are also constituted as autonomous communities. These are: Asturias, Cantabria, Islas Baleares, Madrid, Murcia, Navarra and La Rioja. This index measures the confidence of a representative sample of firms operating in all sectors of the economy. It is constructed as the geometric average of two other indices: Situation Index and Expectations Index. The Situation and Expectations Indices for region j are constructed as follows:

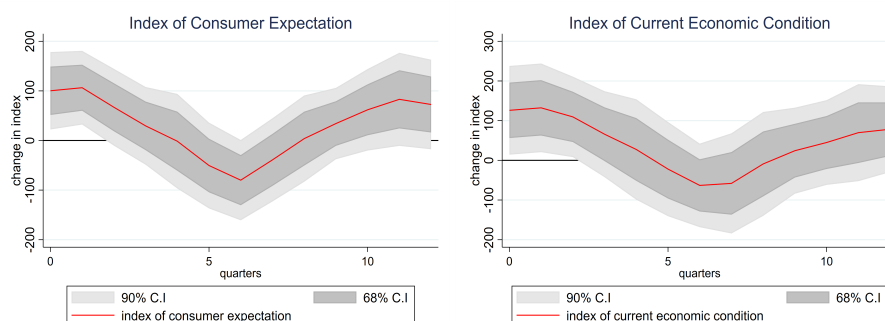
$$Q_{j,t} = \%Better_{j,t} - \%Worse_{j,t} + 100$$

The index reference quarter are 2013Q1.

Effects of Lottery Shocks on Consumer Sentiment Indices

Figure D3.1 shows the effect of winning the lottery on consumer sentiment in autonomous communities with one province using quarterly indicators for consumer sentiment. Our baseline results still hold for these provinces. That is, consumer confidence about the current and future economic conditions increases in response to the lottery wins significantly.

FIGURE D3.1 Effect of Christmas Lottery Prizes on the Index of Current Economic Condition and the Index of Consumer Expectation- Seven provinces



Impulse responses to Christmas Lottery prizes in the linear LP model (3.3.1). Sentiment indices are normalized to 100 for the first quarter of 2013, to be comparable to the business sentiment index. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2013Q1-2019Q4 and includes data for Asturias, Cantabria, Islas Baleares, Madrid, Murcia, Navarra and La Rioja. Standard errors are robust and clustered at the community level and response functions are smoothed by a centered moving average.

E3 Appendix E to Chapter 3

E3.1 Spanish Christmas Lottery as a Redistribution Mechanism

To examine whether our main results are driven by poorer provinces receiving huge transfers from rich regions we interact lottery rewards with a dummy variable for poorer provinces and estimate the following linear LP model for our variables of interest for any $h \geq 0$:

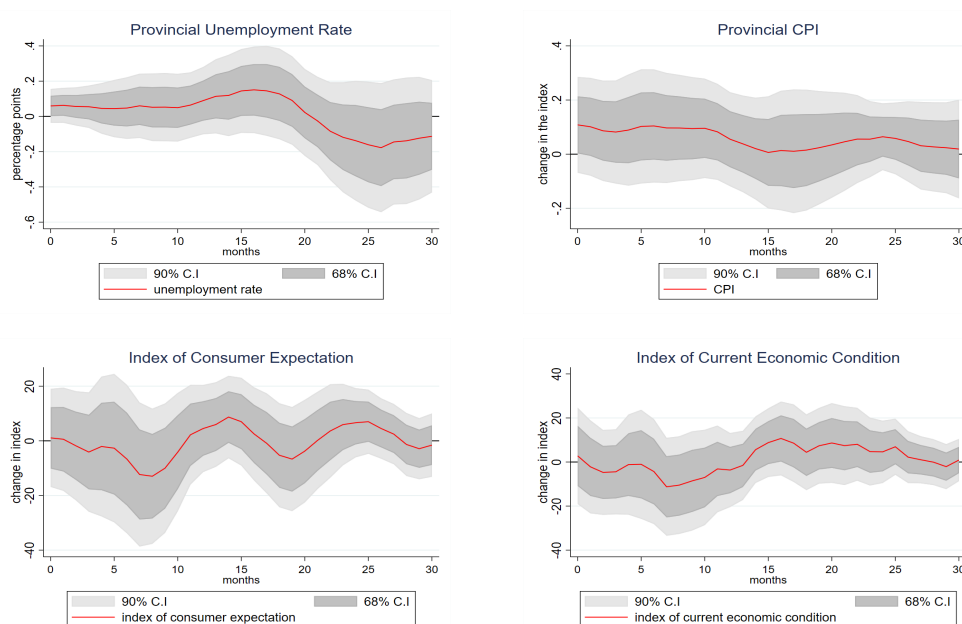
$$S_{j,t+h} = \alpha_{j,h} + \beta_h \text{LotteryPrize}_{j,t} + \delta_h \text{LotteryExp}_{j,t-1} + \zeta_h (\text{LotteryPrize}_{j,t} \times \text{Poor}_j) + \sum_{k=1}^{12} \psi_{k,h} X_{j,t-k} + \sum_{s=1}^{12} \lambda_s M_s + \varepsilon_{j,t+h}$$

where Poor_j is a dummy variable that takes the value of 1 if the average per capita GDP for a province during the sample period is less than the average per capita GDP for all Spanish provinces. Parameter ζ_h captures whether the effect of lottery rewards differs across provinces depending on their GDP per capita level. Figure E3.1 presents the estimation of ζ for economic variables and consumer sentiment indices, respectively. In all regressions, ζ is not significantly different from zero, showing that the effect of lottery shocks on the unemployment rate and consumer sentiments is not significantly different by differences between poor and richer provinces. The effect of CPI is slightly weaker for poor provinces. A similar result holds by interacting the lottery rewards with the GDP per capita of each province (see Figure E3.2).

FIGURE E3.1 Effects of Christmas Lottery Prizes on the Unemployment Rate, CPI and Consumer Sentiment Indices in High vs Low-GDP per capita Provinces



Impulse responses to Christmas Lottery prizes in provinces with low GDP per capita. The graph shows the responses in the LP model (E3.1) for the coefficient of the interaction term between a dummy variable for poor provinces and lottery prizes. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

FIGURE E3.2 Effects of Christmas Lottery Prizes Unemployment rate, CPI and Consumer Sentiment Indices - Redistribution

Impulse responses to Christmas Lottery prizes conditional on their GDP per capita. The graph shows the responses in the LP model (E3.1) for the coefficient of the interaction term between average GDP per capita and lottery prizes. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months. Christmas Lottery prizes are net of taxes and measured in 1000 euros per capita. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

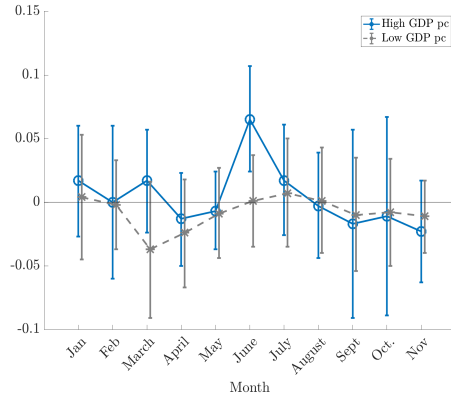
We investigate further whether lottery wins affect consumer confidence and durable consumption differently when households live in poor vs rich provinces by looking directly at individuals' survey responses. Table E3.1 reports the results of this regression for the set of consumer sentiment questions about the future and shows that sentiment about future household income seems to react stronger in low-income regions. Figure E3.3 presents the results of estimating Equation 3.3.2 from the main text in two different samples, one for provinces whose GDP per capita is below the sample average GDP per capita and another one for those provinces whose GDP per capita is above. As can be inspected, realized durable consumption effects are not stronger in the poorer Spanish region. However, the effect of lottery wins on intended durable purchases seems to pick up earlier in the poorer provinces.

TABLE E3.1 Survey evidence on the effects of Spanish Christmas Lottery on consumer sentiment in provinces with different living standards

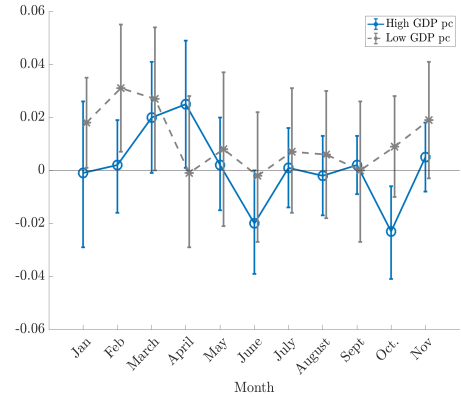
	(1) Future Household Income	(2) Future Employment Prospects	(3) Future Spanish Economy
Lottery Prize Dummy	0.033 (0.047)	0.189*** (0.056)	0.137*** (0.050)
Lottery Expenditures	18.213*** (3.677)	-1.893 (2.771)	2.008 (3.370)
Poor Dummy	-0.156*** (0.023)	-0.069*** (0.023)	-0.092*** (0.026)
Lottery \times Poor	0.120* (0.061)	0.013 (0.056)	0.080 (0.063)
Month \times Province Dummies	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes
Observations	90224	85892	88432
Pseudo R^2	0.042	0.016	0.017

Columns (1)-(6) provide results from an ordered probit where the dependent variable is Q1F-Q3F. *Lottery prize dummy* equals 1 if awarded Christmas lottery tickets were distributed in that province. *Lottery expenditures* are expressed in per capita terms. *Poor dummy* takes value 1 if the GDP per capita in the province is lower than the average GDP per capita across provinces. Robust standard errors clustered by province in parentheses. The sample includes information from consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and December 2018. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

FIGURE E3.3 Effects of Christmas Lottery on Household Durable Consumption - High-Income vs Low-Income Provinces



(a) Recent Durable Purchases



(b) Intended Durable Purchases

This figure plots the marginal effects associated with the β_s 's coefficients and their 90% CI from estimating Equation (3.3.2) in the main text using a probit model and ordered probit model respectively. The gray star line refers to provinces with GDP per capita above the sample average GDP per capita while the blue circle line refers to provinces with GDP per capita below the sample average GDP per capita. The dependent variable in Panel E3.3a is DC while in Panel E3.3b is FDC. Standard errors are robust and clustered at the province level.

F3 Appendix F to Chapter 3

F3.1 Extending the Spanish Lottery Data: El Niño Lottery

The *El Niño* lottery (*Sorteo de 'El Niño'*) is the second most popular national lottery game held in Spain. This lottery event was institutionalized in 1877 for the first time by the king of Spain Alfonso XII, given its popularity among Spaniards. The draw takes place on the 6th of January¹³ just 15 days after the Christmas Lottery event, and is also organized by the National Lottery and Gambling Agency (*Sociedad Estatal de Loterías y Apuestas del Estado*). El Niño tickets have also five-digit numbers and are available at a cost of €200. Each of the tickets is split into 10 identical sub-tickets (or fractions), known as decimos, sold for €20 each. Similar to what occurs with the Christmas lottery, it is also very common to buy a share of a decimo, through local associations, workplaces, sports teams, etc.

Lottery tickets are sold in official lottery outlays located throughout the country. Out of the total revenues, 70% of the ticket sales are distributed as prizes while the remaining 30% is devoted to commissions paid to outlets, internal revenue, and administration costs. There are three main prizes: the top prize, also popularly known as *El Gordo de El Niño*, which awards to each fraction holder of the winning number €10,000 per euro played, and the second and third prize which reward winners with €3,750 and €1,250 per euro played, respectively. This means that all holders of a decimo of the top prize winning number would win €200,000. The individuals holding a decimo of the second or third prize winning number would win €75,000 or €25,000, respectively. The top prizes represent around half of the total payout assigned to prizes. There are also several smaller prizes ranging from €60 to €1 per euro played. Usually, one lottery outlay sells most (if not all) of the series of a single number. The El Niño lottery constitutes a collective game in the same way the Christmas lottery does: Spaniards like to share decimos with family, friends and co-workers, especially if they were not lucky enough to win any Christmas lottery prize. Again, this implies not only that the winners of a lottery number usually live in the same area (province or village) but that the main top prizes end up being distributed as smaller prizes to several individuals living in the same location.

Descriptive statistics

Data on El Niño lottery gross rewards and expenditures by province has been provided by the National Lottery and Gambling Agency (*Sociedad Estatal de Loterías y Apuestas del Estado*) for the time period January 2006-January 2020. Differently from the Christmas Lottery event, we input El Niño lottery prizes in January, that

¹³Before 1999 the draw used to take place on the 5th of January and it was moved to the 6th of January in 2000

is, the very same month in which the gambling event takes place, as the draw is held at the beginning of the month (6th of January). Expenditures on El Niño Lottery are in turn inputted in December¹⁴. As in the Christmas Lottery case, we do not observe the remaining several smaller prizes that are also awarded in El Niño Lottery. We also compute the after-tax revenue derived from the top lottery prizes and obtain a measure of net lottery-prize revenue per capita. Table F3.1 presents descriptive statistics for El Niño Lottery at the province level. Panel B summarizes the El Niño lottery expenditure and top prizes per capita in the winning provinces. The average expenditure per capita in those Spanish provinces is around €15, which is substantially lower than the €61 that on average Spaniards spent on Christmas Lottery during the same period.

TABLE F3.1 Summary Statistics - El Niño Lottery data at the province level. Top prizes and expenditures per capita are computed using data from May 2005 - Jan 2020. Top prizes (% of GDP) are computed using data from 2005 to 2018

	Mean	St. dev.	Min.	Max.	N
	(1)	(2)	(3)	(4)	(5)
A: El Niño Lottery: <i>all provinces</i>					
Top prizes pc (in euros)	2.92	32.53	0.00	832.47	750
Top prizes (% of GDP)	0.01	0.16	0.00	3.84	650
Expenditure pc (in euros)	16.96	7.25	5.05	53.25	750
B: El Niño Lottery: <i>winning provinces</i>					
Top prizes pc (in euros)	8.85	56.29	0.02	832.47	247
Top prizes (% GDP)	0.05	0.29	0.00	3.84	194
Expenditure pc (in euros)	15.48	5.16	5.05	47.16	247
C: El Niño Lottery: <i>winning provinces with maximum prize pc</i>					
Top prizes pc (in euros)	108.88	208.21	10.03	832.47	15
Top prizes (% GDP)	0.54	1.03	0.03	3.84	13
Expenditures pc (in euros)	23.20	11.83	9.28	53.07	15

The average lottery prize is around €9, which is also lower than the average Christmas lottery prize per capita, €42. Panel C of Table 30 reports summary statistics for those provinces that were awarded the maximum prize per capita for our sample period. In these winning provinces, the average top lottery prize per capita on El Niño lottery goes up to €109 with a standard deviation of €208.

If the Christmas lottery constitutes the most popular lottery event in the country, El Niño lottery should be considered the second most popular one. Given the proximity in time of these two lottery events (only 15 days between the two draws), those provinces where the winning tickets are sold experience relatively large lottery shocks in a short time window between the end of each year and the beginning

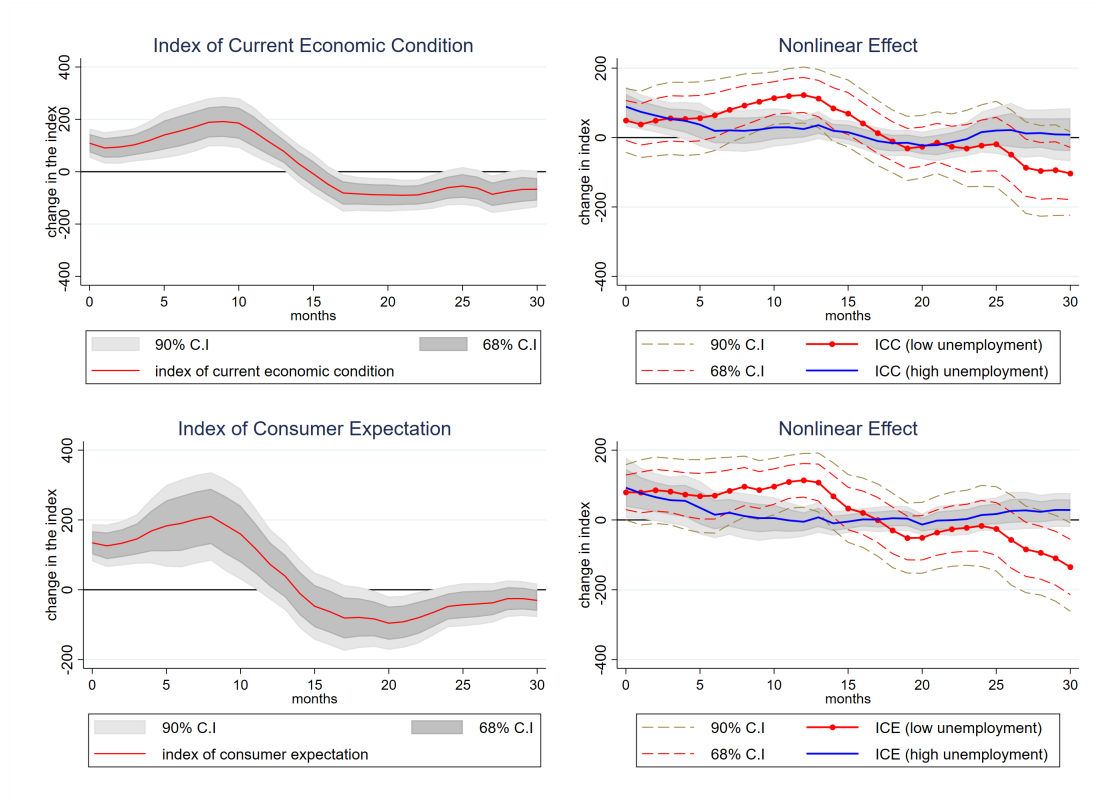
¹⁴We have inputted El Niño lottery expenditures in December for computational purposes although we have also considered the case in which these expenditures are inputted in January and results remain unaltered. This is somewhat intuitive since what matters for the identification of the causal effect of lottery prizes on consumer sentiment and macroeconomic outcomes is to control for the amount of lottery expenditures at the province level (high provincial lottery expenditures increase the odds of winning the lottery for that province)

of the next one. It is precisely this proximity in time between these two lottery events coupled with the common traits it shares with the Christmas lottery (syndicate game, popularity), that has motivated us to construct broader lottery rewards and expenditures per capita variables and check whether our results are robust to include El Niño lottery data in our sample. We now consider the lottery prize and expenditures variable as the sum of the main prizes of both the Christmas and El Niño lottery and the sum of their corresponding expenditures, respectively, for the time period December 2005 - January 2020. As a result, we are able to compare the effects of windfall gains coming from these two lottery events on consumer sentiment and macroeconomic outcomes in the winning provinces versus non-winning provinces in the cleanest possible way¹⁵. Tables F3.2 to F3.5 and Figure F3.2 show the individual-level main results when the lottery wins and expenditures variable compound the Christmas and El Niño lottery events. Results remain unaltered except for Table F3.2 where the coefficients for the lottery prize dummy on consumer sentiment about their current household income and about the current and future evolution of the Spanish economy are no longer significant. Figures F3.3 and F3.1 replicate the provincial-level results and show that results are robust to considering both lottery events.

¹⁵For example, in some years of the sample El Niño lottery randomly allocates income to some Spanish provinces that the Christmas lottery does not and viceversa. Although El Niño lottery tends to distribute a lower amount of income per capita in form of awards to the lucky provinces, still this could drive relevant effects in terms of consumer sentiment, prices, and labor market outcomes

Effects on Regional Consumer Sentiment Indices

FIGURE F3.1 Effect of Christmas Lottery and El Niño Prizes on Regional Consumer Sentiment Indices



The left panel presents responses in the linear LP model (3.3.1), while the right panel presents responses in the state-dependent LP model, where the solid blue line are responses in high-unemployment state and the dotted red line are responses in the low-unemployment state. We focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months (see Online Appendix for details and robustness checks on the construction of the indices). Christmas Lottery and El Niño prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2011M11-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Effects on Consumer Sentiment and Durable Consumption

TABLE F3.2 Survey evidence on the effects of Spanish Christmas Lottery and El Niño Lottery on consumer sentiment

	(1) Future Household Income	(2) Future Employment Prospects	(3) Future Spanish Economy
Lottery Prize Dummy	0.112** (0.051)	0.024 (0.063)	0.099* (0.058)
Lottery Expenditures	13.397*** (2.603)	-14.421*** (2.214)	-11.382*** (2.358)
Month \times Province Dummies	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	
Observations	112951	106086	109441
Pseudo R^2	0.041	0.014	0.014

Columns (1)-(6) provide results from an ordered probit where the dependent variable is Q1F-Q3F. *Lottery prize dummy* takes value 1 if awarded Christmas and El Niño tickets were distributed in that province. *Lottery expenditures* are expressed in 1000 euros per capita. Robust standard errors clustered by province in parentheses. The sample includes information from consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE F3.3 Heterogeneous effects of Spanish Christmas Lottery and El Niño Lottery on consumer sentiment - future household income

	(1) Future Household Income	(2) Future Household Income	(3) Future Household Income	(4) Future Household Income	(5) Future Household Income
Lottery Prize Dummy	0.129** (0.064)	0.125** (0.053)	0.143** (0.059)	0.123** (0.059)	0.108** (0.053)
Lottery Expenditures	13.395*** (2.603)	13.397*** (2.604)	13.392*** (2.602)	13.392*** (2.603)	13.401*** (2.604)
Age×Lottery	-0.005 (0.009)				
Gender×Lottery		-0.025 (0.021)			
Education×Lottery			-0.005 (0.005)		
Household Income×Lottery				-0.005 (0.011)	
Employment×Lottery					0.008 (0.028)
Month × Province Dummies	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes
Observations	112951	112951	112951	112951	112951
Pseudo R^2	0.041	0.041	0.041	0.041	0.041

Columns (1)-(5) provide results from an ordered probit. Robust standard errors clustered by province in parentheses. The sample includes information consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE F3.4 Heterogeneous effects of Spanish Christmas Lottery and El Niño Lottery on consumer sentiment - future employment prospects

	(1) Future Employment Prospects	(2) Future Employment Prospects	(3) Future Employment Prospects	(4) Future Employment Prospects	(5) Future Employment Prospects
Lottery Prize Dummy	0.115 (0.073)	0.006 (0.064)	0.118* (0.070)	0.085 (0.065)	0.044 (0.066)
Lottery Expenditures	-14.424*** (2.215)	-14.420*** (2.214)	-14.435*** (2.212)	-14.453*** (2.212)	-14.440*** (2.211)
Age×Lottery	-0.026** (0.011)				
Gender×Lottery		0.037 (0.024)			
Education×Lottery			-0.016*** (0.005)		
Household Income×Lottery				-0.026** (0.011)	
Employment×Lottery					-0.038*
Month × Province Dummies	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes
Observations	106086	106086	106086	106086	106086
Pseudo R^2	0.014	0.014	0.014	0.014	0.014

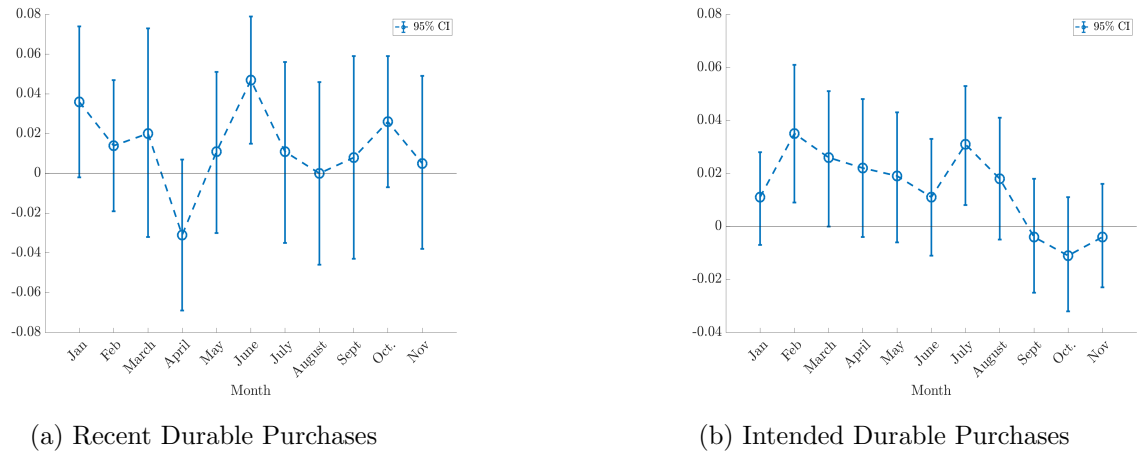
Columns (1)-(5) provide results from an ordered probit. Robust standard errors clustered by province in parentheses. The sample includes information consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE F3.5 Heterogeneous effects of Spanish Christmas Lottery and El Niño Lottery on consumer sentiment - future Spanish economy

	(1) Future Spanish Economy	(2) Future Spanish Economy	(3) Future Spanish Economy	(4) Future Spanish Economy	(5) Future Spanish Economy
Lottery Prize Dummy	0.138** (0.068)	0.091 (0.059)	0.192*** (0.061)	0.168*** (0.060)	0.103* (0.059)
Lottery Expenditures	-11.384*** (2.359)	-11.382*** (2.358)	-11.397*** (2.356)	-11.417*** (2.357)	-11.385*** (2.354)
Age×Lottery	-0.011 (0.010)				
Gender×Lottery		0.015 (0.025)			
Education×Lottery			-0.016*** (0.004)		
Household Income×Lottery				-0.030*** (0.011)	
Employment×Lottery					-0.007 (0.024)
Month × Province Dummies	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes
Observations	109441	109441	109441	109441	109441
Pseudo R^2	0.014	0.014	0.014	0.014	0.014

Columns (1)-(5) provide results from an ordered probit. Robust standard errors clustered by province in parentheses. The sample includes information consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

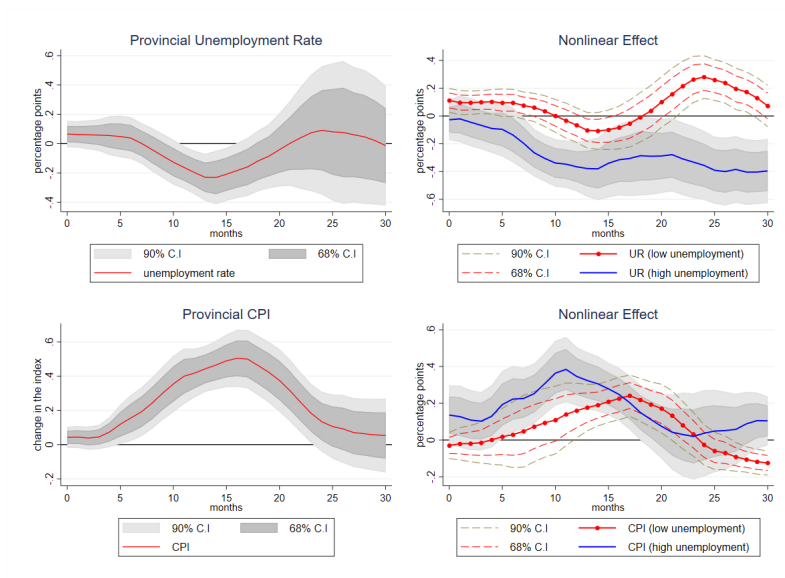
FIGURE F3.2 Effects of Christmas and El Niño Lottery on Household Durable Consumption



This figure plot the marginal effects associated with the β_s 's coefficients and their 95% CI from estimating Equation (3.3.2) in the main text using a probit model and ordered probit model, respectively. The dependent variable in Panel F3.2a is DC while in Panel F3.2b is FDC. Standard errors are robust and clustered at the province level

Effects on Regional Unemployment and CPI

FIGURE F3.3 Effects of Christmas Lottery and El Niño Lottery Prizes on Unemployment Rate and CPI



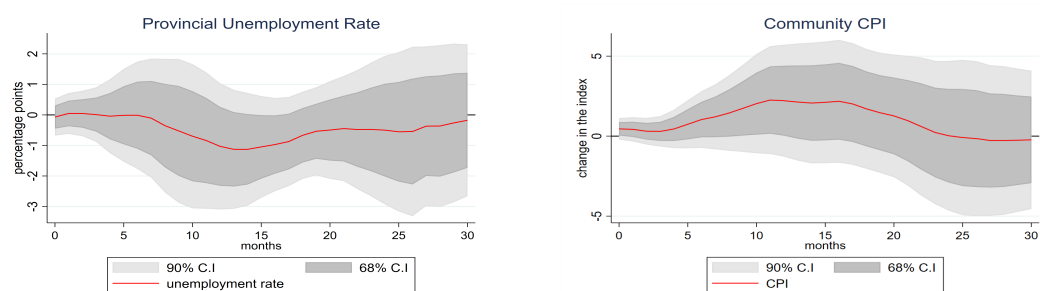
Impulse responses to the sum of Christmas Lottery prizes and El Niño Lottery prizes. The left panel presents responses in the linear LP model (3.3.1), while the right panel presents responses in the state-dependent LP model, where the solid blue line refers to the response in high-unemployment states and the dotted red line refers to the ones in low-unemployment states. Christmas Lottery and El Niño prizes are net of taxes and measured in 1000 euros per capita. The sample period covered is 2005M5 - 2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

G3 Appendix G to Chapter 3

G3.1 Robustness

Regional Spillover Effects of Lottery Winnings

FIGURE G3.1 Effect of Christmas Lottery Prizes on the Unemployment Rate and CPI-Spillover Effects

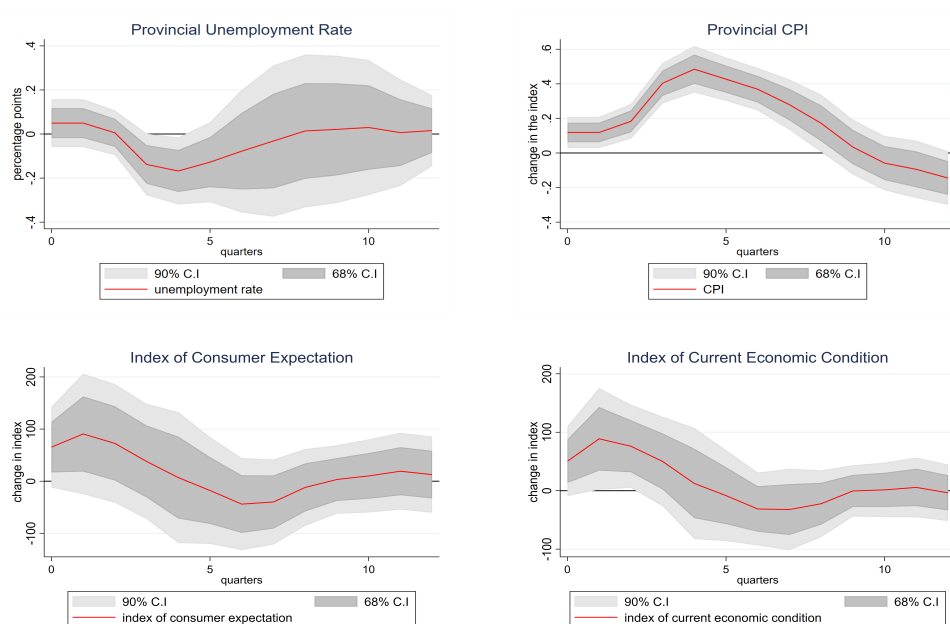


The graph shows the responses in the LP model (3.3.1). The sample period covered is 2005M5-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Aggregating Data in Quarters

Next, we aggregate our data at quarterly frequency as a simple average of monthly data in each quarter. Due to the random sampling of the household sentiment survey, each quarterly data will represent a higher number of questioned households in each province for each quarter. Figure G3.2 shows a similar effect on the macroeconomic aggregates of the regional economy. The confidence bands on the reaction of sentiments, although still above zero at the 68 percent confidence level, are wider. This is because, as we have seen in the analysis at the monthly frequency, the confidence responses are more significant in the first six months after the lottery shock, and aggregation at the quarterly level distorts the significance of this short-run effect. For the same reason, also the size of the responses is distorted and when aggregating the data at quarterly frequency the effect of the shock in both macroeconomic aggregates and sentiment indices appears to be smaller.

FIGURE G3.2 Effects of Christmas Lottery Prizes on Unemployment Rate, CPI and Consumer Sentiment Indices - Aggregating data in quarters

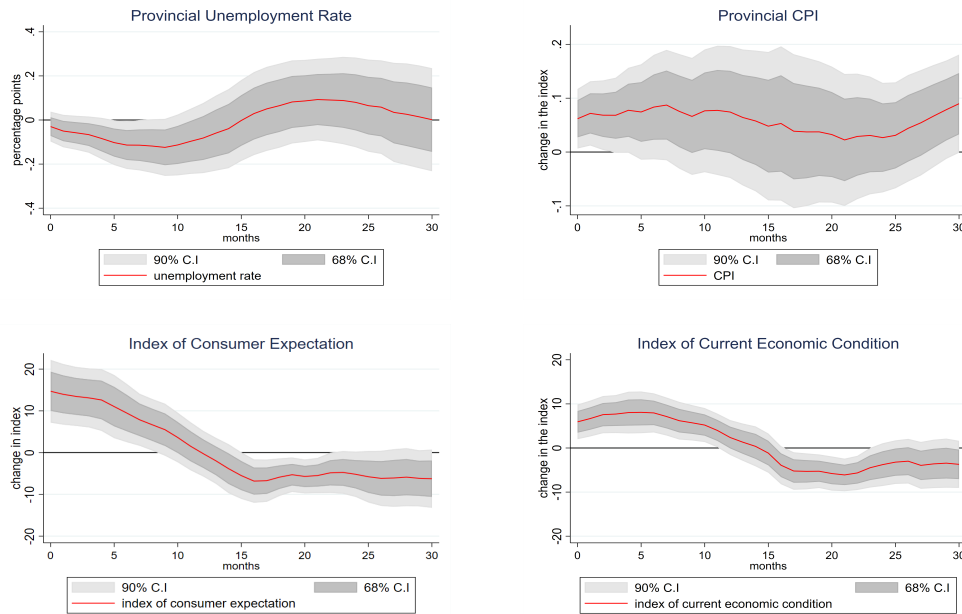


Impulse responses to Christmas Lottery prizes. The graph shows the responses in the LP model (3.3.1). Data has been transformed from monthly to quarterly frequency. Thus, the sample period is 2005Q2-2020Q1. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Dummy for Lottery Shocks

In the analysis so far, we have used a continuous value for reward per capita to explore the macroeconomic effects of lottery winnings. Figures G3.3 shows that if we do not account for the magnitude of the reward and just define a dummy for provinces that have won at least one euro per capita in the lottery, the effect on unemployment and consumer sentiments remains significant. This result is important since it implies that some reward, albeit small, might still stimulate positive sentiment among the individuals in the winning province and affects households' perception of economic conditions and, thus, can have positive real effects.

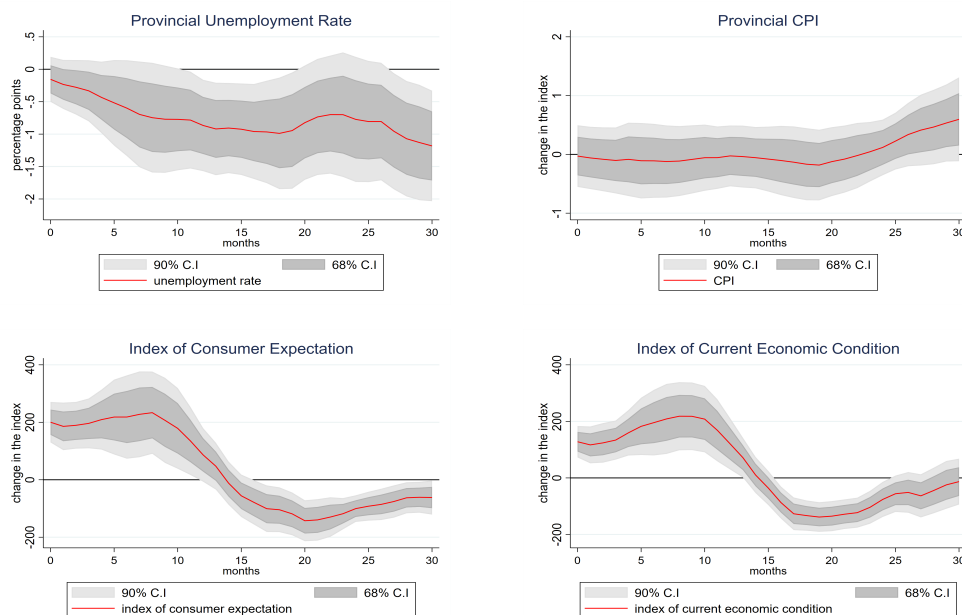
FIGURE G3.3 Effects of Christmas Lottery Prizes on Unemployment Rate, CPI and Consumer Sentiment Indices - Dummy Variable



Impulse responses to Christmas Lottery prizes. The graph shows the responses in the LP model (3.3.1) when the Christmas Lottery variable is defined as a dummy variable equals 1 if the province is awarded at least one euro per capita with any of the top prizes. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months. The sample period is 2011M11-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Lottery Prize Outliers

One might worry that our results are driven by a few outliers that contaminate the effects of lottery prizes on unemployment or sentiment. To alleviate such concerns, we have dropped all the rewards higher than 1000 per capita and repeated our benchmark regressions. Figure G3.4 shows that the effect on unemployment and sentiment indices remains significant and that it is not driven by some big rewards.

FIGURE G3.4 Effects of Christmas Lottery Prizes on Unemployment Rate, CPI and Consumer Sentiment Indices - Outliers

Impulse responses to Christmas Lottery prizes. The graph shows the responses in the LP model (3.3.1) when we omit Christmas Lottery prizes higher than 1000 euros per capita. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months. The sample period is 2005M5-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

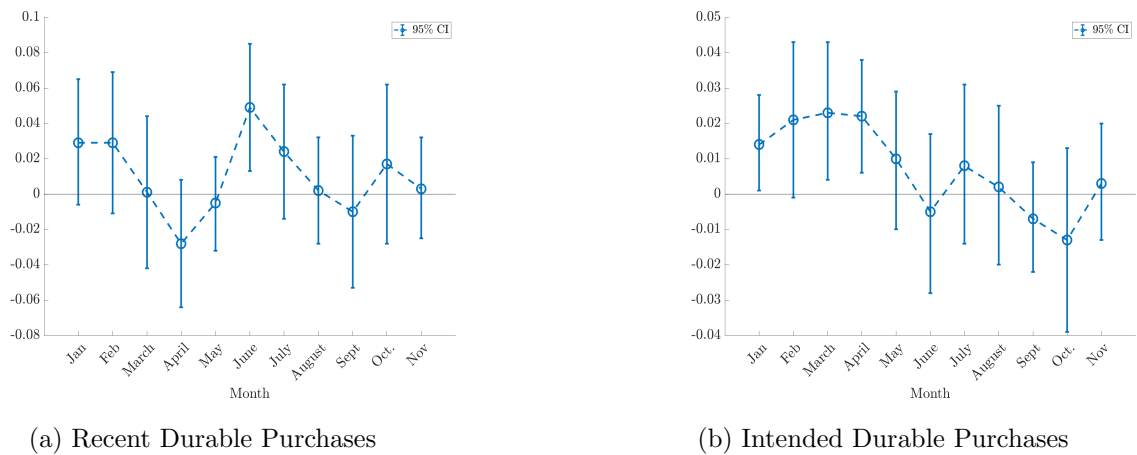
We repeat a similar exercise also at the individual level in order to examine the sensitivity of our results with respect to the effects of the lottery shocks on household durable consumption and confidence. In this way, we make sure our results on the macroeconomic effects of lottery winnings and their propagation through consumers' confidence are not spurious.

On Christmas 2017, the lottery prize per capita in Lugo was €1191.633. We drop from our sample that particular episode since this province received excessively large lottery wins in per capita terms and estimate again the baseline specification as well as the alternative specification in which we control for recessions for both household consumption of durables and consumer confidence. Tables G3.1 and Figure G3.5 collect the results of these exercises. Results are robust, suggesting that the effect of the Christmas lottery on household consumption and consumer sentiment is not driven just by a few consumers becoming extremely optimistic when receiving a considerable amount of money.

TABLE G3.1 Survey evidence on the effects of Spanish Christmas Lottery on consumer sentiment - Dropping Outliers

	(1) Future Household Income	(2) Future Employment Prospects	(3) Future Spanish Economy
Lottery Prize Dummy	0.131*** (0.037)	0.099** (0.050)	0.108** (0.043)
Lottery Expenditures	14.205*** (2.966)	-18.747*** (2.819)	-15.073*** (2.981)
Month \times Province Dummies	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes
Observations	112938	106073	109427
Pseudo R^2	0.041	0.014	0.014

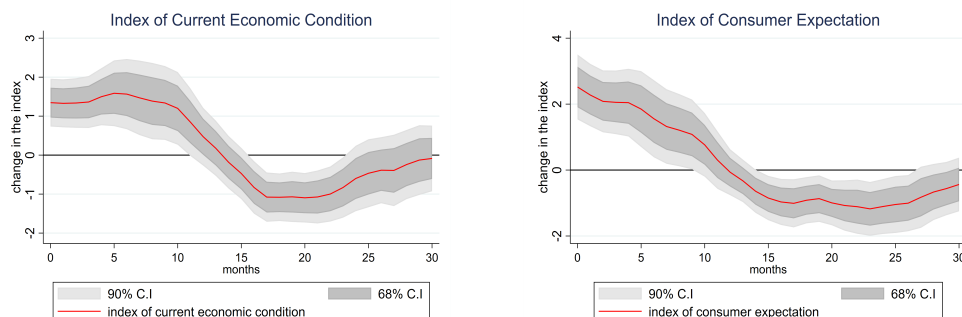
Columns (1)-(6) provide results from an ordered probit where the dependent variable is Q1F-Q3F. *Lottery prize dummy* takes value 1 if awarded Christmas lottery tickets were distributed in that province. *Lottery expenditures* are expressed in per capita terms. Robust standard errors clustered by province in parentheses. The sample includes information from consumer confidence monthly surveys conducted by the Spanish Center for Sociological Research (CIS) between April 2013 and January 2020. We drop Lugo (Christmas 2017). Significance * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

FIGURE G3.5 Effects of Christmas Lottery on Household Durable Consumption - Dropping Outliers

This figure plot the marginal effects associated with the β_s 's coefficients and their 95% CI from estimating Equation (3.3.2) in the main text using a probit model and ordered probit model, respectively. The dependent variable in Panel G3.5a is DC while in Panel G3.5b is FDC. Standard errors are robust and clustered at the province level. We drop from our sample the Christmas Lottery event in 2017 for Lugo

Total Lottery Prizes and Aggregate Sentiment Indices

FIGURE G3.6 Effect of Total Christmas Lottery Prizes on Regional Consumer Sentiment Indices



Impulse responses to Christmas Lottery prizes. The left panel presents the responses in the linear LP model (3.3.1) for the index of consumer current condition, while the right panel presents the responses of the index of consumer expectation. To increase the representativeness of the indices at the regional level, we focus on data with at least 25 respondents in each province and, for each question, we use responses for two consecutive months. Christmas Lottery prizes are net of taxes and measured in logarithm. The sample period covered is 2011M11-2020M1. Standard errors are robust and clustered at the province level and response functions are smoothed by a centered moving average.

Controlling for Cross-section Dynamic Heterogeneity

Given that our analysis could be subject to dynamic heterogeneity, in this section, we estimate the effect of lottery wins for each province separately and then compute a cross-sectional average. In Figure G3.7 we present the weighted average responses of the local projection estimates we have run unit-by-unit for the unemployment rate and CPI, and for the two sentiment indices we consider. We weight responses by the inverse of the standard errors of the unit responses. The Figure confirms the response patterns we have obtained in the cross-section analysis. Hence, dynamic heterogeneity does not distort the picture presented in our baseline regressions.

FIGURE G3.7 Weighted Average of Unit-by-unit Local Projection Estimates

This graph shows the weighted average of unit-by-unit local projection estimates of the effect of Christmas Lottery prizes on the unemployment rate, CPI, and consumer sentiment indices. The weights are the inverse of the standard error of the unit responses. Response functions are smoothed by a centered moving average

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