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Household structure decisions and positive wealth shocks: a natural experiment from the Spanish Christmas lottery

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Abstract

This paper explores whether a positive unexpected exogenous (unearned) wealth shock affects household structure decisions in different Spanish regions. The Christmas draw of the Spanish National Lottery is used in a natural experiment as a proxy for exogenous random variations in provincial wealth. A static and dynamic linear panel event-study design allows for control of changing economic and demographic conditions at the province level and the dynamic effects on the analyzed decisions. The evidence is consistent with families getting divorced and having children when the province in which they live experiences an unexpected increase in wealth, but no conclusive effect on wedding plans is found.

1. Introduction

The wealth effect is an economic phenomenon that explains the increase in consumer spending when real monetary balances and, therefore, consumer wealth increase. Extensive empirical literature has shown a positive relationship between wealth and consumption (Ando & Modigliani, 1963) from both the macroeconomic and microeconomic perspectives (Altissimo et al., 2005). In addition, it can be considered that the very feeling of security in their financial situation may encourage individuals and households to make choices that are different from those that they would make if they did not experience a wealth increase. Beyond the well-known relationship between wealth and consumption, this paper aims to analyze the association between household wealth and/or exogenous economic conditions and the structural decisions that affect household composition.

It is commonly known that households often spend a lot of resources (e.g., time) making decisions that will affect their structure over a long period or even over a lifetime (e.g., getting married, getting divorced, and having children, among others). However, several factors can make household members change their minds and indeed decide faster, including exogenous and unexpected changes in their wealth and environmental economic conditions. Empirical evidence has shown that exogenous wealth shocks can affect individuals' health, happiness, and life satisfaction (Adda et al., 2009; Apouey & Clark, 2015; Hankins et al., 2011; Lindahl, 2005), and hence their behaviors, lifestyle choices, and lifelong decisions.

Household wealth can be affected by the household's structure and financial position as well as determine both, and variations in economic conditions can produce potential endogeneity. The isolation of the effect of wealth on household decision-making can be eased by estimating how household decisions change if a positive exogenous wealth shock is received either directly or through a change in the surrounding economic conditions. Previous literature has addressed this issue by using lottery winnings as a proxy for random wealth shocks. Imbens et al. (2001) used lottery winnings to study the effects of wealth shocks on labor supply, earnings, savings, and consumption decisions. Hankins and Hoekstra (2011) found that gaining wealth (large income shocks) from the lottery significantly reduces the likelihood that single women marry, yet it does not affect the marriage rates of men or the number of divorces. Kuhn et al. (2011), using a natural experiment associated with the Dutch postcode lottery, found that the effects of a temporary unexpected income shock (lottery prize) are limited to cars and other consumer durables. Recently, Bulman et al. (2022) conducted a study in the United States to explore the impact of unearned wealth on marriage and fertility for up to five years after a lottery win. Similarly, Golosov et al. (2023) found that lottery winners are more likely to get married. Using Swedish data, Cesarini et al. (2023) investigated the effects of windfall money from lottery winnings on marriage, divorce risk, and fertility. They found that male lottery winners experience an increase in marriage formation and fertility and a reduced risk of divorce. On the other hand, female lottery winners show an increased risk of divorce in the short term.

The Christmas draw of the Spanish National Lottery is called *El Gordo*, which is Spanish for "the fat one" or "the big one," reflecting the huge jackpot offered. In this paper, *El Gordo* is used as a natural experiment to proxy positive wealth shocks, specifically random exogenous variations in annual provincial wealth. The focus is on exploring whether selling the Christmas draw's winning tickets in a particular province affects the number of marriages, divorces, and births in that province. The unit of analysis is established at the provincial level because this is the minimum level of aggregation that provides all the necessary information about the variables included in the empirical analysis. Both static and dynamic approaches are employed to examine the year-by-year effects of the wealth shock and the average effect over the five years following the event.

The use of *El Gordo* to represent exogenous wealth variation across geographical areas is not new. Bagues and Esteve-Volart (2016) explored the correlation between the votes received by incumbent politicians and economic conditions, exploiting the evidence provided by the Spanish Christmas lottery. Bermejo et al. (2020) also used the Spanish Christmas lottery winnings to estimate the effect of income shocks on entrepreneurship. Ghomi et al. (2023) showed that *El Gordo* winnings decrease the unemployment rate. Boto-García et al. (2023) suggested that these unexpected gains increase both the annual number of outbound tourism trips and the corresponding

average spending. In both cases, it is assumed that the winning province (or provinces) is randomly assigned and the winners tend to be geographically clustered (Bagues & Esteve-Volart, 2016). For each analyzed period, a winning province can receive a monetary shock equivalent, on average, of up to 5.28% of the median GDP of the Spanish provinces in 2018.

2. Background of the Spanish Christmas lottery draw

The Spanish Christmas lottery can be considered a unique lottery since 75% of Spaniards play it and the sales revenue reaches 0.3% of the Spanish GDP (Bagues & Esteve-Volart, 2016). It takes place every year on December 22 and, except for some multi-state lotto games in the United States (e.g., Powerball and Mega Millions), it is the largest lottery draw in the world, offering a jackpot of 688 million euros in the 2020 edition. Unlike other lottery prizes, this prize, which is the total amount of the jackpot prize corresponding to all the issued tickets with the winning number, is usually spread among many people: up to 1,720 winners can win 400,000 euros each. If all the tickets are sold, the total issuance amounts to 3,440 million euros, of which around 2,408 million are allocated to prizes (70% payout rate).

The Spanish Christmas lottery is truly a national event in which society is involved in terms of individual purchases and syndicate play (Garvía, 2007). Lines of people waiting to buy a ticket from "lucky stores" (Guryan & Kearney, 2008) are becoming more and more common. It should be noted that the tickets may become available as early as July each year.

Although the operator introduces changes to the characteristics of the draw with each new edition, the lottery is based on tickets with five-digit numbers ranging from 00,000 to 99,999, just like any regular draw of the Spanish National Lottery. The numbers allocated to each outlet are randomly determined (Bermejo et al., 2020).

Due to the enormous popularity of the game, each set of numbers on each ticket is sold multiple times in several so-called "*series*"; for example, the 2020 edition had 172 series for each of the 100,000 tickets. Between the series, there is no difference in prize money. That is, the prize on a five-digit number is paid for that number in every unit. Therefore, the series number is merely an administrative one. The price of a whole ticket is 200 euros for each "*serie*." Because this may be too expensive for many players, the tickets are usually sold as tenths, making the price of a tenth just 20 euros.

The jackpot prize amounts to 4 million euros for each "*serie*" of the winning number, or 400,000 euros for each tenth, which is equivalent to a return of 20,000 euros of prize money for every euro staked. Therefore, a winning ticket (20 euros) may receive more than the average wealth of a Spanish household (274,000 euros). There is also a second prize of 1.25 million euros (125,000 euros for each tenth) and a third prize of 500,000 euros (50,000 for each tenth). In addition, there are many other small prize categories. Due to data availability limitations, the focus of this study is on the first (jackpot) prize.

Finally, it should be mentioned that since 2013, the portion of a prize exceeding 2,500 euros is susceptible to a tax rate of 20%, whereas prizes of 2,500 euros or less are tax-exempt. In all cases, the prizes are paid immediately through a unique payment.

3. Data and model specification

Information on the variables related to household structure decisions (the numbers of marriages, divorces, and births – per 1,000 people) at the province level is collected by

year for each of the 52 provinces of Spain between 2000 and 2018. The sample period is limited by the availability of Christmas lottery prize data. Each prize is expected to have enough variability in its temporal and geographical dimensions to allow us to distinguish between temporal and geographical effects.

To further describe the dependent variables, Fig. A1 in the appendix describes the evolution of the marriage, divorce, and birth rates over the period 2000–2018. It can be seen that the marriage rate has been in continuous decline in Spain in recent years. Besides the generalization of cohabitation as an alternative to marriage (Hiekel & Castro-Martín, 2014), this pattern can also be explained by economic conditions. In particular, the recent deterioration of the Spanish labor market may be contributing to delays in marriage decision-making (De la Rica & Iza, 2005; González-Val & Marcén, 2018; Gutiérrez-Domènech, 2008). According to the Spanish Statistical Office, in 2018, the unemployment rate in Spain was 15.25%; at the end of the analysis period, Spain had the second-highest unemployment rate among EU countries. In this context, Bellido and Marcén (2021) concluded that marriages exhibit a pro-cyclical behavior in Europe. Even though a rise in the divorce rate can be observed in the early 2000s, the divorce rate seems to exhibit a steady flat trend in recent years. In this respect, Bernardi and Martínez-Pastor (2011) discussed how divorce risk factors have changed over time in Spain; González-Val and Marcén (2018, 2020) found different effects of the gender unemployment rate on the divorce rate.

Regarding births, the declining trend in fertility (and thus births) over the last decade has been particularly evident in southern European countries. These countries were strongly affected by the financial crisis of 2007–2008 and present high rates of unemployment and precariousness (Matysiak et al., 2021). In this regard, Bellido and Marcén (2019) suggested that economic uncertainty and unfavorable labor market conditions might have negatively impacted fertility rates in 30 European countries from 1993 to 2013.

As the main covariate, an indicator of whether there has been a random wealth shock in a province is created based on information from the Christmas lottery. Figure A2 in the appendix shows the number of provinces that won at least a portion of the jackpot prize and the corresponding amount. The *winning provinces* are identified by the location of the sales points that sold the jackpot-winning tickets since most prizes are collected in the province where the tickets were sold (Bermejo et al., 2020). This is a seemingly strong assumption since lottery players may acquire tickets from other provinces either by exchanging or sharing tickets with relatives or people in their social networks or by purchasing lottery tickets outside their province of residence, among others. Bagues and Esteve-Volart (2016) empirically supported such an assumption, concluding that Christmas lottery winners tend to live in the same province where the lottery tickets were sold.

Based on the information collected, a dummy variable for a jackpot-winning province is created and coded as one where all the jackpot-winning tickets are sold in that province: the *only-winning province*. Accordingly, up to 1,720 individuals in an *only-winning province* are expected to collect 400,000 euros each; on aggregate, such a wealth shock exceeds 5% of the median GDP of the Spanish provinces in 2018. Because Christmas lottery players often play in a syndicate (Garvía, 2007), sharing lottery tickets, this figure should be considered as a lower bound of the number of individuals receiving lottery winnings. As reported later on in the paper, a further analysis is performed where the ratio of the collected jackpot share for each

province to that province's GDP is used as the main explanatory variable (discussed in the robustness checks section of the paper).

Table 1 shows relevant figures for the dependent variables (nuptiality rate, divorces and separations rate, and birth rate) in the *only-winning provinces* for the treatment year and four years later. The nuptiality rate consistently decreases in all these provinces while both the divorces and separations rate and the birth rate show more variability, with some provinces experiencing decreases and others experiencing increases over the four-year period.

In addition, for an *only-winning province*, exogenous good economic conditions are generated that may produce a temporary increase in the happiness of that province's inhabitants, including non-lottery players. In turn, this can affect household structure decisions, even when the number of lottery winners is limited to a small number of people.

The available information has a panel data structure, which allows us to control for changing socio-economic and demographic conditions among provinces and for the effects of unobserved variables. Accordingly, macroeconomic and social information for the selected period is gathered from multiple public access databases to control for the characteristics of provinces that can affect household decision-making. This gives the following covariates for inclusion in the model. The real GDP, measured in euros with the purchasing power of 2016, controls for the income effect. The ratio of the foreign population controls for the population's social structure and tries to capture social trends, such as the effect of the migrant population's evolution. The ratio of the population with higher education works as a proxy for human capital, while the unemployment rate by gender allows for a comparison of the effects of male and female unemployment on family structure decisions. Under the life cycle hypothesis (Modigliani & Brumberg, 1954) a relationship may exist between household savings and their feelings of an upcoming marriage, divorce, or birth. In line with previous studies, such as González and Özcan (2013) and Voena (2015), the amount of money allocated to fixed-term deposits is used as a proxy for household savings; the year fixed effects control for possible time-dependent effects. Moreover, a dummy variable controlling for the Express Divorce Law in Spain, Law 15/2005, is included in the corresponding model specification.

Table 1. *Only-winning provinces* figures at year t and year $t+4$

Province	Jackpot year	Nuptiality rate		Divorces and separations rate		Birth rate	
		t	$t+4$	t	$t+4$	t	$t+4$
Segovia	2000	4.360	4.220	1.173	1.742	8.090	8.540
Lleida	2004	4.550	4.220	2.983	2.316	10.320	12.130
Barcelona	2005	4.700	3.840	3.856	2.678	11.500	11.260
Madrid	2009	3.940	3.830	2.253	2.124	11.950	10.220
Huesca	2011	2.800	2.760	1.685	2.252	8.530	8.460
Almería	2015	3.060	2.980	2.064	2.340	11.440	10.140
Madrid*	2016	4.030	1.930	2.091	1.500	9.790	7.780

*Values for 2020 should be interpreted with caution due to the effects of COVID-19.

Table A1 in the appendix reports the sources of the considered variables, while basic descriptive statistics of the variables are shown in Table 2. The data sample used in the empirical part of the study comprises 988 observations from 2000 to 2018.

To check the randomness of winning provinces, a panel probit model is estimated in which the variable to be explained is the probability of a province being an *only-winning province*. The explanatory variables include the following macroeconomic variables: GDP, the ratio of the population with higher education, and the unemployment rate. The estimates in Table 2A in the appendix show that province characteristics do not predict the probability of an *only-winning province*.

Both static and dynamic approaches are considered for the analysis of the wealth shock. The empirical study is based on a linear panel event-study following Freyaldenhoven et al. (2021). Since the Christmas lottery draw takes place on

Table 2. Summary statistics for the key variables

Dependent variables	Description	Obs.	Mean (Std Dev)
# marriage rate	Number of marriages per 1,000 inhabitants	988	3.970 (0.873)
# divorces and separations rate	Number of divorces and separations per 1,000 inhabitants	987*	2.243 (0.624)
# birth rate	Number of births per 1,000 inhabitants	988	9.332 (2.192)
Lottery variables			
El Gordo jackpot (€ thousand)	Jackpot lottery prize	988	556,799.340 (140,008.627)
Winning provinces	Number of provinces winning at least a portion of the jackpot	988	8.368 −11.194
Jackpot-winning provinces[†]	All winning lottery tickets are sold in a unique province	988	0.008 (0.090)
Macroeconomic variables			
GDP (€ million)	Gross domestic product	988	17,662.461 (29,219.500)
Foreign population rate (%)	Proportion of foreign people	988	0.077 (0.055)
Higher-education population rate (%)	Proportion of people holding a high-education degree.	988	16.812 −4.678
Male unemployment rate (%)	Male unemployment rate	988	13.811 −8.067
Female unemployment rate (%)	Female unemployment rate	988	19.745 −9.161
Savings per capita (€)	Money invested in fixed-term deposits.	988	8,618.859 (4,668.524)

*Information for *Ceuta* in the year 2015 is not available.
[†]All winning tickets are sold in a unique province.

December 22 every year, we consider that the treatment takes place the following year after receiving the jackpot. The static effects are estimated as follows:

$$y_{it} = \alpha_i + \delta_t + q_{it}\gamma + \beta z_{it} + C_{it} + \varepsilon_{it} \tag{1}$$

where Y_{it} is the outcome variable (marriage rate, divorces and separations rate, and birth rate) for province i in year t, α_i is the province fixed effect, δ_t is the year fixed effect, and q_{it} is a vector of the covariates that could affect the outcome variable. C_{it} represents a confound that may be correlated with the positive wealth shock. Z_{it} is a vector of dummy variables for the *only-winning province* which takes the value 1 when all the winning tickets have been sold in a unique province in the year t. The key parameter of interest is β; it measures the static effect of the treatment.

The analyzed wealth shock exhibits variation in treatment timing and may involve dynamic effects. This design allows for tracking the observed units before the lottery win and catching pre- and post-wealth shock (treatment) trends, thereby providing a representation of the event's causal impact. The dynamic effects are estimated as follows:

$$y_{it} = \alpha_i + \delta_t + q_{it}\gamma + \sum_{m=-G}^{M} \beta_m z_{i,t-m} + C_{it} + \varepsilon_{it}. \tag{2}$$

Here, the outcome variable at year $t+1$ might be affected by the jackpot prize at most $M \geq 0$ periods before $t+1$ and at most $G \geq 0$ periods after $t+1$. Then, the term $\sum_{m=-G}^{M} \beta_m z_{i,t-m}$ could be interpreted as the effect of the wealth shock during the G periods after treatment. The value of both G and M is assumed to be 4 since the trend during the four years before the treatment is also considered a control. Accordingly, the analysis excludes the periods 2000–2006 and 2016–2018. In this case, the term $\sum_{m=-G}^{M} \beta_m z_{i,t-m}$ measures the year-by-year effects four years before and after the lottery winning. The effects for the endpoint years – those occurring more than four years before and after the wealth shock – are measured through two aggregate coefficients: one preceding and another following the shock.

This model, as a generalized extension of "difference-in-differences" or two-way fixed-effect models, allows for dynamic lags and estimating the event of interest while also controlling for fixed factors by area (province) and time (year) (Clarke & Tapia-Schythe, 2021).

4. Empirical analysis and results

4.1. Static analysis

Table 3 shows the results of the static analysis. The results reveal the positive impacts of lottery winnings on the birth and divorce rates. However, the nuptiality ratio seems to be unaffected by the economic shock: while the coefficient shows a positive direction, it does not reach statistical significance.

4.2. Dynamic analysis

The estimates from the dynamic approach are shown in Table 4; the parameters summarizing the magnitude of the dynamic effects are plotted in Figs 1–3.

Table 3. A linear panel event-study design

Dependent variable ratio per 1,000 inhabitants			
	Nuptiality	Divorces and separations	Births
	(I)	(II)	(III)
Jackpot	−0.002 (0.116)	0.156*** (0.048)	0.254** (0.120)
GDP	−0.004 (0.003)	−0.008** (0.004)	−0.012*** (0.004)
Foreign population (rate)	−4.836*** (1.630)	−2.842** (1.368)	6.730** (72.654)
Higher education (rate)	−0.001 (0.001)	−0.002 (0.001)	−0.004** (0.002)
Male unemployment (rate)	−0.047*** (0.009)	−0.011 (0.008)	−0.047*** (0.016)
Female unemployment (rate)	0.018* (0.009)	−0.002 (0.004)	−0.017 (0.011)
Savings per capita	0.001 (0.001)	0.001 (0.001)	0.001*** (0.000)
Year dummies	Yes	Yes	Yes
Divorce law	No	Yes	No
Time trend	Yes	Yes	Yes
Constant	Yes	Yes	Yes
R^2	0.894	0.878	0.957
Provinces	52	52	52

Static analysis results.
Clustered standard errors at province level in brackets*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

The results show a significant effect of the wealth shock variable on the three dependent variables. Indeed, divorces and separations seem to increase during the second and third years after the shock. On average, marital breaks increase by 0.373 and 0.544 per 1,000 inhabitants in the second and third years, respectively. Concerning the birth and nuptiality rates, a more lasting effect is observed in the years following the wealth shock, with both rates gradually increasing over time.

4.3. Results

The results from the static and dynamic approaches show that a wealth shock increases both the birth rate and the divorces and separations rate. Regarding the nuptiality rate the static analysis does not highlight a statistically significant effect, whereas the dynamic analysis does. Specifically, concerning the decision to get divorced, a wealth shock has a positive impact on the number of divorces in a province. There are 0.373 more divorces per 1,000 inhabitants the year after the lottery winning; this figure rises to 0.544 two years after the lottery winning – in a median province such as Cantabria, this means an estimated increase in the number of divorces and separations from 217 to 316 in the subsequent two years (conditional on all variables in the model). It must be considered that the process of separation and/or divorce is not immediate even when the decision is made

Table 4. A linear panel event-study design

Dependent variable ratio per 1,000 inhabitants			
	Nuptiality	Divorces and separations	Births
	(I)	(II)	(III)
Random wealth shock			
Jackpot-winning province ($t-5$)	−0.126 (0.103)	−0.064 (0.133)	0.084 (0.092)
Jackpot-winning province ($t-4$)	0.036 (0.125)	0.005 (0.054)	−0.105 (0.086)
Jackpot-winning province ($t-3$)	0.039 (0.143)	0.005 (0.080)	−0.033 (0.118)
Jackpot-winning province ($t-2$)	0.050 (0.091)	0.036 (0.045)	0.034 (0.044)
Jackpot-winning province (t)	0.324*** (0.098)	0.151 (0.108)	0.133 (0.177)
Jackpot-winning province ($t+1$)	0.552*** (0.148)	0.373*** (0.174)	0.672*** (0.205)
Jackpot-winning province ($t+2$)	0.746*** (0.197)	0.544** (0.259)	0.859*** (0.354)
Jackpot-winning province ($t+3$)	0.917*** (0.193)	0.681 (0.415)	1.486*** (0.447)
Jackpot-winning province ($t+4$)	1.151*** (0.221)	0.739 (0.571)	2.036*** (0.606)
Jackpot-winning province ($t+5$)	1.410*** (0.337)	0.717 (0.621)	2.782*** (0.745)
Macroeconomic variables			
GDP	0.003 (0.006)	−0.012 (0.008)	−0.019*** (0.007)
Foreign population (rate)	−8.283 (5.993)	−1.763 (3.932)	18.925** (7.839)
Higher education (rate)	−0.001 (0.002)	0.001 (0.001)	−0.003 (0.002)
Male unemployment (rate)	−0.040*** (0.009)	−0.011 (0.008)	−0.020 (0.013)
Female unemployment (rate)	0.005 (0.012)	0.005 (0.007)	−0.065*** (0.015)
Savings per capita	0.001* (0.000)	0.001** (0.000)	0.001*** (0.000)
Year dummies	Yes	Yes	Yes
Divorce law	No	No	No
Time trend	Yes	Yes	Yes
Constant	Yes	Yes	Yes
R^2	0.894	0.899	0.978
Provinces	52	52	52

Dynamic analysis results.
*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

quickly: in Spain, it takes 4–6 months on average. These results are in line with Cesarini et al.'s (2023) findings, which evidence the positive effect of lottery winnings on divorce risk in the short term for female lottery winners. Following Becker's theoretical framework on human decisions about marriage and divorce (1973, 1974) and Becker et al.'s (1977) study, which analyzed the causes of marital stability, many contributions to this field reporting opposite results have been published. In general, it has been suggested that an income or wealth shock
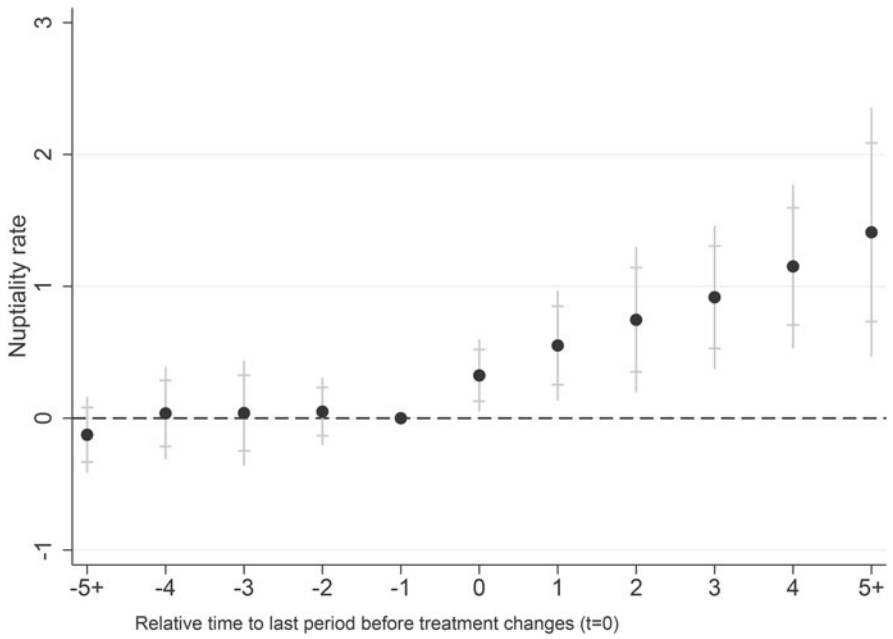
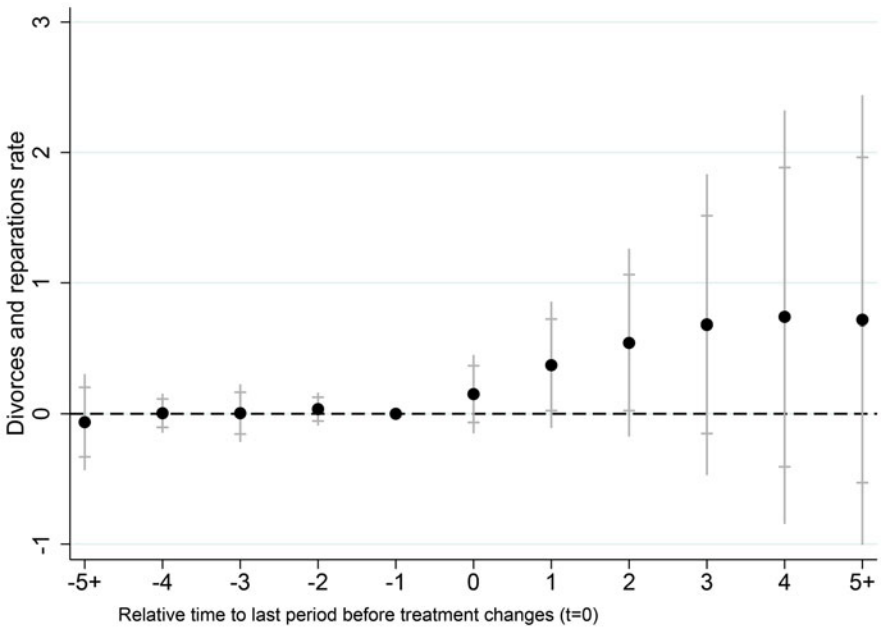**Figure 1.** Event-study plot (nuptiality, marriages rate).

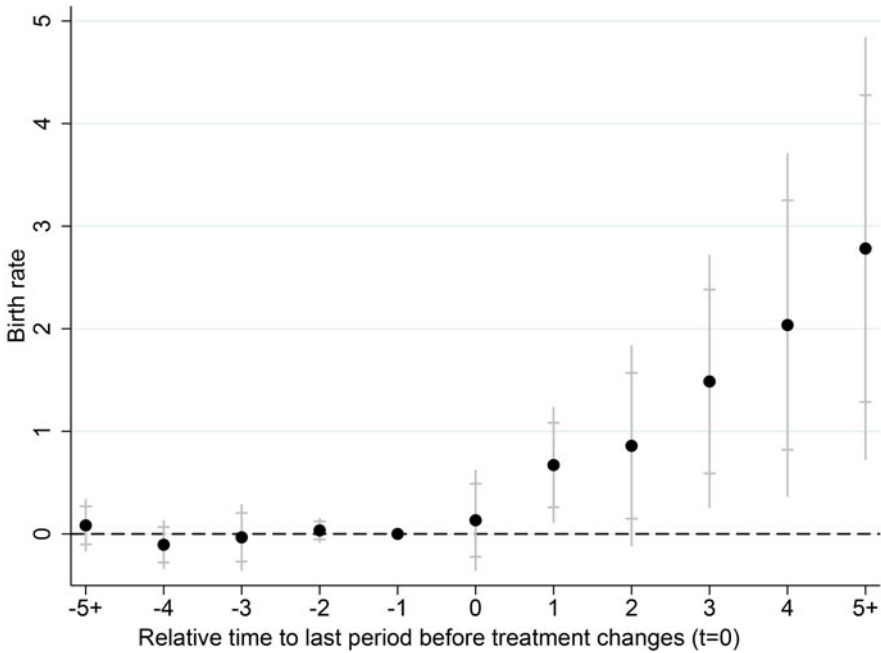**Figure 2.** Event-study plot (divorces and separations rate).

Figure 3. Event-study plot (birth rate).

(positive or negative) affects the probability of getting divorced subject to a sufficiently flexible division of wealth between spouses. Marriages that are already strained may reach a point where there is enough wealth for both parties to pursue separate lives. For example, Nock (2001) and Sayer and Bianchi (2000) found a positive relationship between wives' income and divorce as a higher income provides a chance to exit a "bad marriage." On the other hand, Charles and Stephens (2004) and Nunley and Seals (2010), among others, found that negative (positive) transitory household income shocks increase (decrease) the probability of getting divorced. From the financial perspective of lottery winners, the result here could be explained by the fact that the greater the mismatch between a couple's credit scores, the more likely they are to separate within the first five years (Dokko et al., 2015).

Regarding the effects of the wealth shock on the decision to have children, the results indicate that winning the Christmas lottery jackpot in the year $t-1$ is linked to a significant increase in births in the winning province: around 0.672 per 1,000 inhabitants and up to 2.036 in the fourth year after the wealth shock – which represents around 1,000 births for a median Spanish province (conditional on all variables in the model). This makes sense considering there is a nine-month period until a child is born. Furthermore, becoming pregnant is not achieved immediately by most women. This is in line with the findings of Bulman et al. (2022) and Cesarini et al. (2023), who also found positive effects of unexpected wealth shocks on fertility. Based on the seminal work by Ghez and Becker (1975), several contributions have demonstrated the potential relationship between the economic environment, sometimes determined by unexpected wealth shocks, and

people's decision to have children (Amialchuk, 2006; Black et al., 2013; Lindo, 2010; Lovenheim & Mumford, 2013). This result can also be explained by families anticipating the decision to have children when receiving the wealth shock (lottery prize) or when the exogenous surrounding economic conditions change.

Concerning the decision to get married, the static approach does not show statistically significant effects from lottery winnings. However, the results from the dynamic analysis show positive and significant effects on the nuptiality rate for the years following the windfall money. The observed positive effect is in line with the effects identified by Bulman et al. (2022), Cesarini et al. (2023), and Golosov et al. (2023), and might result in up to 670 new marriages for a median Spanish province (conditional on all variables in the model). It must be noticed that the dynamic analysis accounts for the decreasing trend in marriage rates. This nuanced approach helps capture the evolving impact of the event over time, potentially explaining the observed difference in statistical significance between the static and dynamic approaches.

As for the control variables, the results do not show a significant effect for the income variable, whereas the specification for the birth rate has a negative and statistically significant effect. Surprisingly, the decision to get married seems not to be conditioned by provincial income. Nonetheless, the labor situation in the province affects household structure decisions, albeit in different ways according to gender. In line with Larson (1984) and González-Val and Marcén (2018), male unemployment negatively affects the nuptiality rate. On the other hand, female unemployment seems to strongly negatively affect the number of births, as found by Bellido and Marcén (2019).

With respect to the population's social structure, the results show a positive and significant relationship between the foreign population rate in a province and the birth rate in that province. This is consistent with the findings of Tromans et al. (2009), who examined the demographic drivers underlying the number of births in the UK and concluded that two-thirds of the rise in births since 2001 can be attributed to foreign-born women.

Finally, the level of household savings, measured by the amount of money allocated to fixed-term deposits at a provincial level, seems to positively affect the analyzed household decisions.

4.4. Robustness checks

In the 2004 draw, all *El Gordo* lottery tickets that won the jackpot were sold in the town of Sort (*Lleida*) in a single outlet (*La Bruixa d'Or*). The total prize, 390 million euros, was spread over various regions: more than half of the tickets were sold online and the rest were distributed to lottery players in *Mallorca*, *Madrid*, and *Jaen*. The lottery outlet in *Lleida* is famous for having sold the winning tickets of the Christmas lottery jackpot on three occasions: 2003, 2004, and 2007. Table 5 reports the estimated coefficients from the dynamic event-study removing the province of *Lleida* from the sample. The results remain largely unchanged and are in line with those discussed above.

The purchase of lottery tickets by households could be inclined toward summer vacations in coastal provinces. To check this, the event-study model (equation (2)) was re-estimated excluding the coastal provinces from the sample. The results (Table 6) are in line with those previously obtained. Another recent phenomenon to

Table 5. A linear panel event-study design

Dependent variable ratio per 1,000 inhabitants			
	Nuptiality	Divorces and separations	Births
	(I)	(II)	(III)
Random wealth shock			
Jackpot-winning province ($t-5$)	−0.030 (0.168)	−0.147 (0.099)	0.229** (0.107)
Jackpot-winning province ($t-4$)	0.118 (0.186)	−0.082 (0.080)	0.036 (0.122)
Jackpot-winning province ($t-3$)	0.092 (0.184)	−0.090 (0.087)	−0.089 (0.149)
Jackpot-winning province ($t-2$)	0.084 (0.114)	−0.007 (0.036)	0.086 (0.063)
Jackpot-winning province (t)	0.289** (0.127)	0.224** (0.101)	0.061 (0.189)
Jackpot-winning province ($t+1$)	0.492*** (0.242)	0.593*** (0.127)	0.510** (0.240)
Jackpot-winning province ($t+2$)	0.654* (0.335)	0.901*** (0.133)	0.571 (0.391)
Jackpot-winning province ($t+3$)	0.734*** (0.337)	1.185*** (0.287)	1.014*** (0.355)
Jackpot-winning province ($t+4$)	0.912** (0.368)	1.472*** (0.371)	1.406*** (0.476)
Jackpot-winning province ($t+5$)	1.069** (0.450)	1.468*** (0.457)	2.188*** (0.706)
Macroeconomic variables			
GDP	0.004 (0.006)	−0.013** (0.006)	−0.019*** (0.007)
Foreign population (rate)	−8.278 (6.470)	−3.014 (3.820)	19.791** (8.260)
Higher education (rate)	−0.001 (0.002)	0.001 (0.001)	−0.003 (0.002)
Male unemployment (rate)	−0.040*** (0.009)	−0.007 (0.007)	−0.023* (0.013)
Female unemployment (rate)	0.006 (0.012)	0.004 (0.007)	−0.065*** (0.015)
Savings per capita	0.001* (0.000)	0.001*** (0.000)	0.001** (0.000)
Year dummies	Yes	Yes	Yes
Divorce law	No	No	No
Time trend	Yes	Yes	Yes
Constant	Yes	Yes	Yes
R^2	0.894	0.907	0.978
Provinces	50	50	50

Dynamic analysis results excluding *Lleida*.
*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

be considered is the increasing possibility of buying Christmas lottery tickets through the Internet. However, as discussed by Bagues and Esteve-Volart (2016), only around 2% of all tickets are purchased online.

As an additional robustness check and to provide more informative results, a two-way fixed effects panel data are estimated. In this model, following Bagues and Esteve-Volart (2016), the indicators of *only-winning provinces* used in the previous models are replaced with the ratio of the collected jackpot share for each province to

Table 6. A linear panel event-study design

Dependent variable ratio per 1,000 inhabitants			
	Nuptiality	Divorces and separations	Births
	(I)	(II)	(III)
Random wealth shock			
Jackpot-winning province $(t-5)$	−0.228 (0.281)	0.241** (0.090)	0.264 (0.528)
Jackpot-winning province $(t-4)$	−0.147 (0.168)	−0.237** (0.086)	−0.358 (0.505)
Jackpot-winning province $(t-3)$	−0.118 (0.102)	−0.128* (0.050)	−0.202 (0.411)
Jackpot-winning province $(t-2)$	−0.015 (0.021)	0.009 (0.028)	−0.069 (0.157)
Jackpot-winning province (t)	0.339** (0.057)	0.065 (0.044)	0.191 (0.192)
Jackpot-winning province $(t+1)$	0.696*** (0.113)	0.339*** (0.054)	0.748*** (0.258)
Jackpot-winning province $(t+2)$	0.992*** (0.177)	0.604*** (0.112)	0.960* (0.507)
Jackpot-winning province $(t+3)$	1.240*** (0.300)	0.896*** (0.258)	1.757** (0.713)
Jackpot-winning province $(t+4)$	1.406*** (0.353)	0.837** (0.392)	2.434** (0.476)
Jackpot-winning province $(t+5)$	1.648*** (0.468)	0.845* (0.440)	3.249*** (0.947)
Macroeconomic variables			
GDP	0.003 (0.006)	−0.017*** (0.005)	−0.024* (0.012)
Foreign population (rate)	3.560 (4.037)	0.561 (2.264)	9.638** (4.661)
Higher education (rate)	−0.001 (0.002)	0.001 (0.001)	−0.003 (0.003)
Male unemployment (rate)	−0.027** (0.012)	−0.007 (0.008)	−0.008 (0.009)
Female unemployment (rate)	−0.012 (0.009)	0.005 (0.006)	−0.037*** (0.016)
Savings per capita	0.001 (0.000)	0.001 (0.000)	0.001** (0.000)
Year dummies	Yes	Yes	Yes
Divorce law	No	No	No
Time trend	Yes	Yes	Yes
Constant	Yes	Yes	Yes
R^2	0.917	0.870	0.971
Provinces	28	28	28

Dynamic analysis results excluding coastal provinces.
*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

that province's GDP. Thus, all the provinces that have obtained at least a portion of *El Gordo* are now considered:

$$Y_{it} = \alpha_i + \gamma_t + \beta^{DID} Jackpot_{it-k} + \delta X_{it} + \varepsilon_{it}, \qquad (3)$$

where Y_{it} is the analyzed outcome variable (marriage rate, divorces and separations rate, and birth rate) for province i in year t. The terms α_i and γ_t represent the province and

year fixed effects, respectively. X_{it} is the set of controls at the province level; ε_{it} is a random error term. The variable *Jackpot$_{it}$* is defined as the ratio of the effectively collected jackpot share for each province to the corresponding province's GDP in the year $t - k$, where k takes the value 1, 2, 3, or 4. To account for non-linear effects, the squared terms for this variable are considered.

The estimates in Table 7 are in line with those obtained from the static analysis. A positive effect of the jackpot share received by a certain winning province on both the divorces and separations rate and the birth rate in that province is noted years after the lottery winning. Thus, an increase of 1% in the jackpot/GDP ratio causes a 0.006

Table 7. A more informative specification

Dependent variable ratio per 1,000 inhabitants			
	Nuptiality	Divorces and separations	Births
	(I)	(II)	(III)
(Jackpot/GDP)$_t$	0.003 (0.005)	−0.001 (0.002)	0.008 (0.008)
(Jackpot/GDP)$_t^2$	−0.001 (0.001)	0.001 (0.001)	−0.000 (0.001)
(Jackpot/GDP)$_{t+1}$	0.001 (0.006)	0.006*** (0.002)	0.013** (0.006)
(Jackpot/GDP)$_{t+1}^2$	−0.001 (0.001)	−0.001*** (0.000)	−0.001** (0.000)
(Jackpot/GDP)$_{t+2}$	0.001 (0.004)	0.004*** (0.002)	0.003 (0.004)
(Jackpot/GDP)$_{t+2}^2$	−0.001 (0.001)	0.000 (0.000)	−0.001 (0.001)
(Jackpot/GDP)$_{t+3}$	−0.001 (0.004)	0.008*** (0.003)	0.013** (0.006)
(Jackpot/GDP)$_{t+3}^2$	0.001 (0.001)	−0.001** (0.000)	−0.001** (0.000)
(Jackpot/GDP)$_{t+4}$	0.001 (0.003)	0.001 (0.003)	0.016*** (0.004)
(Jackpot/GDP)$_{t+4}^2$	−0.000 (0.001)	0.000 (0.000)	−0.001*** (0.000)
Macroeconomic variables			
GDP	0.002 (0.003)	−0.010** (0.005)	−0.007 (0.007)
Foreign population (rate)	−4.865 (3.360)	−4.114 (3.485)	17.545*** (5.752)
Higher education (rate)	−0.001 (0.001)	−0.001 (0.001)	−0.003 (0.002)
Male unemployment (rate)	−0.034*** (0.008)	−0.008 (0.007)	−0.012 (0.013)
Female unemployment (rate)	−0.006 (0.009)	0.001 (0.007)	−0.068*** (0.013)
Savings capita	0.001** (0.000)	0.001 (0.001)	0.001* (0.000)
Year dummies	Yes	Yes	Yes
Divorce law	No	No	No
Constant	Yes	Yes	Yes
R^2 within	0.769	0.716	0.850
Provinces	52	52	52

Clustered standard errors at province level in brackets.
Panel data estimates (TWFE model). *Lleida* and *Madrid* are not included.
*, **, and *** denote significance at the 10, 5, and 1% level, respectively.

increase in divorces and separations per 1,000 inhabitants. Concerning having children, a similar but greater effect on the birth rate is observed: a 1% increase in the jackpot/GDP ratio causes a 0.013 increase in births per 1,000 inhabitants. In both cases, according to the shape of the estimated relationship, an additional increase in the jackpot/GDP ratio will result in a decreasing marginal effect due to the negative coefficient of the quadratic wealth shock variable. No effect on the number of marriages is apparent.

4.5. Limitations and further considerations

The empirical analysis presented here has some limitations. First, although the data used in this paper overcome the biases induced by self-reporting in surveys of lottery winners, which are commonly used in similar studies, individual-level data were collapsed to the aggregate level of a province. This means that no strong conclusions can be drawn about individual behaviors; in fact, individuals' risk aversion is likely to correlate with both household structure decisions and the probability of winning the lottery. Second, since the three considered variables regarding household structure decisions may have similar underlying determinants, a seemingly unrelated regression (SUR) model (Zellner, 1962) could be considered as an alternative. However, while the coefficient estimates are similar to those from the within-group estimator, the correlation between the errors in the three equations is not particularly strong. Moreover, the efficiency gains of an SUR model compared to a fixed-effect model are relatively modest (the SUR estimates are available on request). Finally, even though economists have traditionally considered the household as a single unit that maximizes a common objective function, some evidence suggests that the household is a collective entity and that choices depend in part on who controls the household's income (Duflo, 2003). This issue is not addressed here and may deserve special attention in future research.

5. Concluding remarks

The decisions of households in developed countries are much more complex today than in past decades. For this reason, the analysis of household decision-making and behavior and the study of the variables that affect household decisions have attracted interest in recent years. This paper presents an empirical exercise that aims to estimate the effect of a significant positive variation in household wealth and/or the surrounding economic conditions on decisions that go beyond mere consumption expenditure and that could affect the household's structure.

Several previous studies have explored the influence of exogenous (unearned) random wealth shocks on various household decisions using lottery winnings as a proxy for such variations in wealth or environmental economic conditions. In this paper, the Christmas draw of the Spanish National Lottery is used as a natural experiment to explore the effect of wealth shocks on household structure decisions. The focus is on exploring whether the fact that the Christmas draw's winning tickets are sold in a particular province affects the number of marriages or divorces and the number of births in that province. The aggregate size of such an exogenous random shock, totaling 700 million euros, is equivalent to 5.28% of the median GDP of Spanish provinces in 2018. Additionally, winning the lottery may generate exogenous good economic conditions in the province, thereby affecting people's overall happiness and decision-making.

Both static and dynamic linear panel event studies were conducted to consider dynamic lags and estimate the event of interest. The results from both studies indicate that a positive unexpected exogenous (unearned) wealth shock is linked to an increase in the number of births and divorces in a province. However, no conclusive results are found regarding the number of marriages. Furthermore, the magnitude of the unexpected impact seems to be conditioned by the amount of the effectively collected prize. Overall, the evidence is consistent with couples getting divorced and having children when their province's economic conditions change due to an unexpected increase in wealth.

From the perspective of policy implications, these results can provide valuable insights for policymakers to increase their accuracy when identifying the regions in which to implement social policies. Given the positive effect found on births, a possible policy implication would be to validate measures that encourage the birth rate by offering monetary support (exogenous) and supporting the decision to have children. Moreover, the statistical data on household structure decision-making have broader implications for population research.

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