Cats, Dogs, and Babies: Quasi-Experimental Evidence on Substitutes or Complements from Linked Administrative Records

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Abstract

Falling fertility is one of the most pressing demographic and economic challenges of the twenty-first century, particularly in East Asia. Among the many popular explanations, the rise of companion animals has captured public imagination, often portrayed as substitutes for children or as complements in family formation. Yet, despite this

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widespread narrative, systematic evidence remains scarce. This paper provides the first large-scale empirical analysis combining individual-level administrative data and quasi-experimental methods to examine the relationship between pet ownership and childbearing. We link Taiwan's universe of pet registry records with administrative tax files, constructing a ten-year panel covering 23 million individuals and millions of registered cats and dogs.

Our analysis proceeds in three steps. First, we document descriptive patterns: pet ownership peaks in the twenties while childbearing peaks later, and cross-sectional correlations differ by species: dogs are positively associated with children, cats negatively. Second, we estimate substitution elasticities. Exploiting the staggered rollout of child bonuses, we find that dog ownership rises by 21% following a birth, yielding a Marshallian cross-price elasticity of -1.32. Using lottery winnings to isolate income effects, we estimate a Hicksian elasticity of -1.29, confirming that children and pets are net complements. Third, event studies show that adopting a dog raises the probability of subsequent childbearing by 33%, consistent with a "practice child" mechanism, while childbirth reduces later pet adoption.

These findings expand the economics of fertility by introducing pets as a previously overlooked determinant of household decisions. They also reveal that pro-natalist policies affect not only fertility itself but related choices such as pet acquisition, broadening our understanding of modern family economics.

Keywords: Fertility, Pet Ownership, Pro-natalist Policies

1 Introduction

Falling fertility rates have emerged as one of the defining demographic and economic challenges of the twenty-first century. Fertility has declined across much of the developed world, dropping from an average of 3.3 children per woman in 1960 to about 1.5 in 2022 among OECD countries. This decline has pushed fertility well below the replacement level of approximately 2.1 (OECD, 2024*b*). Across East Asia, the drop is even more dramatic: virtually every country has seen fertility fall to "ultra-low" levels, with South Korea and Taiwan among the lowest globally. A vast literature has examined the causes of this decline, emphasizing factors such as housing costs, labor market dynamics, shifting gender norms, and the rising opportunity cost of childbearing (Kim, Tertilt and Yum, 2024; Myong, Park and Yi, 2021; Doepke et al., 2023). Yet, despite decades of research, many features of contemporary households remain understudied in relation to fertility.

One salient and increasingly widespread feature of modern households is pet ownership. Dogs and cats are not only common but are often treated as family members, shaping daily routines, financial choices, and long-term planning. A recent survey shows that about 28.3% of households in Taiwan owned a pet in 2023: 13.8% had dogs and 10.4% had cats (Wu, 2024). Public commentators have speculated that pets may act as substitutes for children, delaying or reducing fertility. For instance, Pope Francis warned that "dogs and cats take the place of children" and argued this trend may "diminish us" and "take away our humanity" (Francis, 2022). Meanwhile, J. D. Vance remarked that "we are effectively run ... by a bunch of childless cat ladies ... miserable at their own lives ... so they want to make the rest of the country miserable too" (Vance, 2021). Despite these high-profile comments, systematic empirical evidence is virtually absent. The relationship between pets and children remains unsettled, influenced by anecdote, judgment, and cultural bias. This highlights the need for rigorous analysis rather than speculation.

This paper provides the first large-scale empirical evidence on whether pets and children are substitutes or complements. Using newly linked administrative data from Taiwan, we combine the universe of pet registry records with individual-level tax files to construct a ten-year panel covering 23 million individuals and millions of registered cats and dogs. These data allow us to observe pet ownership, fertility, and socioeconomic outcomes with unprecedented precision.

Our analysis proceeds in three steps. First, we document descriptive patterns. Two stylized facts stand out. (i) Pet ownership and childbearing follow distinct life-cycle trajectories: individuals are most likely to acquire pets in their twenties and early thirties, while childbirth peaks several years later. (ii) The cross-sectional correlation between pets and children differs sharply by species. Households with dogs are more likely to have children, while households with cats are less likely to, and these associations cannot be explained by age, income, or wealth alone.

Second, we move beyond correlation to estimate elasticities of substitution. We exploit the staggered rollout of Taiwan's newborn child bonus, which provided a lump-sum transfer per newborn, as an exogenous reduction in the cost of childbearing. Immediately following the introduction of bonuses, the probability of having a new dog increases by roughly 21%. From this, we estimate a Marshallian cross-price elasticity of -1.32, suggesting that children and pets are gross complements.

Third, we disentangle substitution from income effects using Taiwan's unique receipt lottery, which randomly awards cash prizes to consumers based on purchase receipts. This generates quasi-random variation in disposable income. We estimate the income elasticity of dog ownership to be 0.11, slightly smaller than the income elasticity of childbearing. Combining these estimates, we derive a Hicksian elasticity of -1.29, indicating that pets and newborn children are in fact net complements once income effects are accounted for.

We then investigate mechanisms. A popular view is that pets, especially dogs, serve as "practice children." Our evidence supports this hypothesis. Using an event-study framework, we show that households that adopt a dog subsequently increase the probability of childbearing by approximately 33% compared to those who adopt later. By contrast, childbirth sharply reduces the likelihood of subsequent dog adoption. Heterogeneity analyses further reinforce the learning mechanism: the fertility-enhancing effect of dog ownership is concentrated among individuals without prior children, while for those who already have children, dog adoption is associated with fewer subsequent births. Moreover, dogs exert stronger effects than cats, consistent with the idea that raising dogs more closely mirrors child-rearing.

Finally, we want to emphasize that the analysis we have made is related to the newborn child. There are aspects that are similar to the newborn children and those that are not. For example, we find effects in the same direction but of smaller magnitude in an event study framework examining the birth of a grandchild. In contrast, we find an increase in pet ownership after one's spouse passes away, adult child passes away, or divorce, suggesting that adult children could be substitutes unlike the newborn child.

Our paper connects to research in sociology, psychology, and public health that examines how pets fit into family life. Sociologists emphasize that companion animals often function as family members and may even substitute for human companionship (Veevers, 2016; Charles and Davies, 2008). Psychologists highlight the diverse ways people relate pets to childrearing, with mixed evidence on whether attachment to pets discourages or complements fertility intentions (Gillet and Kubinyi, 2025; Guo et al., 2021). Public health studies further document that pets can improve mental health and children' s socioemotional development (Marsa-Sambola et al., 2017; Zilcha-Mano, Mikulincer and Shaver, 2012). Together, these fields underscore the emotional and relational importance of pets but have rarely linked it to fertility behavior.

The study most closely related to ours is Schwarz, Troyer and Walker (2007), who used cross-sectional U.S. consumer expenditure data to examine whether pets and children act as substitutes or complements. Employing house ownership as an instrument, Schwarz, Troyer and Walker (2007) concluded that pets tend to be substitutes during the early stages of children's lives but may become complements later on. Our findings echo part of this life-cycle pattern: once households have a child, the probability of subsequently acquiring a pet declines. However, our analysis extends this literature in several ways. We exploit rich administrative panel data from Taiwan, cover a broader time horizon, and apply quasi-experimental variation from policy reforms to identify substitution and complementarity effects. Chatterjee and Butler (1997) also touches on the choice of pet ownership.

Beyond the pet literature, our study contributes to the economics of fertility. Existing research has emphasized the role of structural, cultural, and institutional determinants, particularly in Asia, where fertility decline has been most severe (Myong, Park and Yi, 2021;

Kim, Tertilt and Yum, 2024). We complement this work by introducing pet ownership as a novel and previously overlooked dimension of household decision-making that interacts with fertility choices.

We also add to the evaluation of pro-natalist policies. Prior work has established that fertility bonuses, tax incentives, and transfer programs can affect birth timing and completed fertility (Milligan, 2005; González, 2013; González and Trommlerová, 2023). Our findings demonstrate that such policies can also generate spillovers to other family decisions, in this case influencing pet acquisition. This highlights the broader reach of pro-natalist measures beyond their intended target.

Finally, we expand the scope of family economics. Traditional models of the household focus on marriage, fertility, and intra-household allocation but largely omit companion animals. By explicitly incorporating pets into the analysis, we recognize their central role in modern families and show how decisions about children and pets are jointly determined. This perspective encourages a rethinking of the boundaries of family economics and calls attention to the growing importance of non-human family members in shaping household utility.

In sum, our contributions are fourfold: (i) we bring new large-scale evidence to a literature that has until now been dominated by qualitative or small-sample studies of pets and families; (ii) we add to the economics of fertility by introducing pet ownership as a previously unconsidered determinant of fertility behavior; (iii) we extend evaluations of pro-natalist policies by demonstrating that such programs influence related household choices beyond fertility itself; and (iv) we broaden the scope of family economics by formally incorporating pets into models of household decision-making.

The remainder of the paper is organized as follows. Section 2 describes the data and sample. Section 3 presents descriptive evidence. Section 4 estimates elasticities of substitution. Section 5 investigates mechanisms through dynamics and heterogeneity. Section 6 concludes.

2 Data

2.1 Pet Registry

Due to potential risks of rabies, the Taiwanese government has required all households to register their dog ownership since September 1st, 1999.[1] Any individual above age 20 (lowered to 18 after 2020) is eligible to register. The cost of registration is typically subsidized by the local governments. Take Taipei city, for example, the cost of registration and chip insertion is NTD250 (USD 8.48). Owners are also incentivized to comply with the registration requirement: once registered, the pet is implanted with a microchip. This chip enables anyone who finds a stray animal to scan it and trace the pet back to its owner.

The rules for cat registration vary by county. For example, Taipei City has required all cats to be registered since July 1st, 2016.[2] Starting August 1st, 2025, all counties in Taiwan require cat registration. Households that fail to comply may face fines of up to NTD15,000. For registered pets, we observe information on the registration date, species (dog or cat), and an anonymized owner ID.

The official survey estimates that the registration coverage rate is approximately 70.6% for dogs and 58.4% for cats as of 2023 (Ministry of Agriculture, Taiwan, 2024). Our pet registry data span from 1999 to 2020 and include variables on the registration date, species, and anonymized owner ID. When ownership changes, the registry also records the new owner, allowing us to track pet transfers across households. However, the registry does not reliably record whether a pet has passed away, which may introduce some measurement error in identifying active pet ownership.

2.2 Fiscal Information Agency (FIA) Data

Our primary individual-level data come from the administrative tax and registry records maintained by Taiwan's Fiscal Information Agency (FIA). The dataset consists of two main components: a family and household information section, and an income and asset section.

[1] Source: `https://www.moa.gov.tw/ws.php?id=12635`

[2] Appendix C.8 presents results using a sample restricted to the post-2016 period in Taipei City. The findings suggest that these rule changes do not drive our main results.

The family and household information section provides unique individual identifiers, parental identifiers (mother and father), spouse identifiers, and exact birthdates. This structure allows us to reconstruct family trees, identify household composition, and link individuals across generations. The data include all individuals with household registration in Taiwan, regardless of tax filing status or taxable income, thereby covering the entire resident population.

The income and asset section records detailed information on income and assets. Each income and asset entry is available at the source level, allowing us to distinguish between different income types (such as wage, business, and capital income) and asset categories (such as deposits, property, and securities). The data also include geographic identifiers such as county and postal code of registration, which enable regional analyses.

We combine the two sections using the unique individual identifier to construct an annual panel dataset spanning 2009 to 2020. This integration provides a comprehensive view of each individual's demographic background, family structure, and economic status. The resulting panel serves as the foundation for our analysis of the relationship between pet ownership and fertility behavior.

3 Descriptives

3.1 Summary Statistics

We begin by illustrating the broad pattern of pet registration over time, as shown in Figure 1. This figure demonstrates that the flow of newly registered pets in Taiwan has grown steadily since the early 2000s. In contrast, the number of children born each year has gradually declined over the same period. Because of these opposing trends, the flow of newly registered pets now exceeds the number of newborn children.

To better understand the individuals behind these trends, we next examine basic summary statistics comparing pet owners and parents. Table 1 provides a side-by-side view of key characteristics, including pet type, gender, age, marital status, number of children, annual income, estate holdings, and whether the individual is located in a metropolitan area.

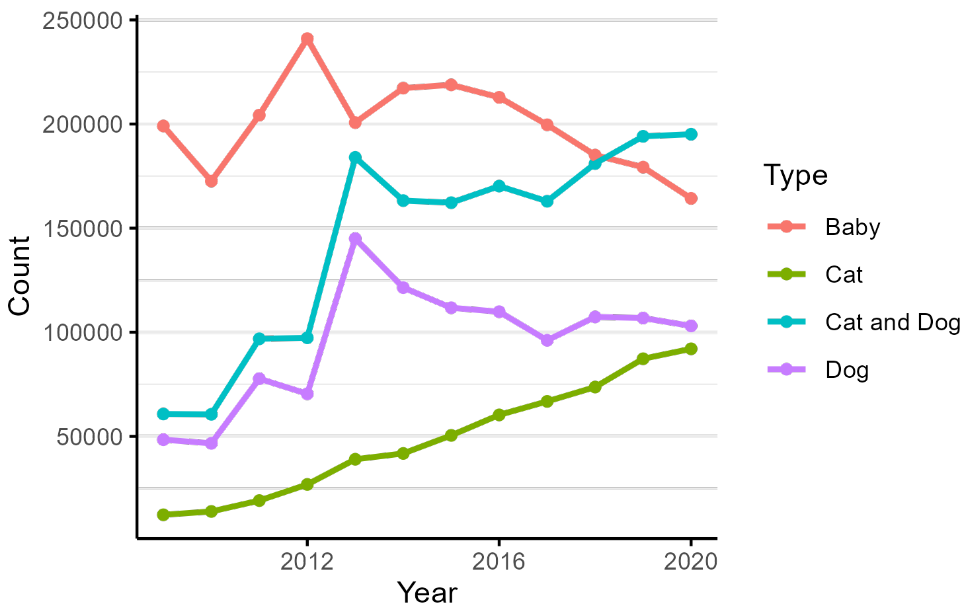

Figure 1: Trends for Registered New Cats, Dogs, and Babies.

Note: The figure displays the number of newly registered cats and dogs alongside the official counts of newborn babies in Taiwan from 2009 to 2020. Notable fluctuations in births appear in 2010 (Year of the Tiger) and 2012 (Year of the Dragon) under the lunar calendar, both of which are well known to influence fertility decisions in Taiwanese and Chinese culture. The sharp rise in pet registrations in late 2013 is likely attributable to a free registration campaign held from September to October 2013 (Council of Agriculture, Taiwan, 2013). As shown in Appendix C.1, our results are robust to excluding these observations.

By contrasting these groups, we can observe whether pet owners differ systematically from parents along demographic or economic lines.

Table 1: Summary Statistics: Pet Owners and Matched Non-Owners

Variable	With Dog	Without Dog	With Cat	Without Cat
Men	0.43	0.43	0.37	0.37
Age	48.66	48.66	39.03	39.03
Married	0.57	0.58	0.42	0.45
With Child	0.67	0.66	0.45	0.48
Household Size	3.66	3.87	3.75	3.98
Income (1000 NTD)	532	581	489	512
House Owner	0.49	0.45	0.36	0.32
City Resident	0.71	0.70	0.73	0.70
N	1,068,973	1,068,973	336,999	336,999

Note: For each individual owning a dog (cat), we randomly draw one individual of the same sex and age without a dog (cat) for comparison. "Men," "Married," "With Child," "House," and "City" indicate the means of binary variables for being male, being married, having at least one child, owning a house, and residing in one of the six major cities in Taiwan, respectively. Income is the annual total income measured in thousands of NTD.

Although these averages are informative, they may conceal substantial variation over the life cycle. Figure 2 plots the cross-sectional distribution of pet ownership and childbearing by age. This figure allows us to see how pet ownership and childbearing overlap or diverge across the life cycle.

Two main insights emerge from this age profile. First, individuals tend to acquire pets relatively early in life, often before or during the early stages of family formation. Second, among individuals who have children, many also own pets at younger ages, suggesting that having pets and children may coincide rather than substitute for each other at certain points in the life cycle.

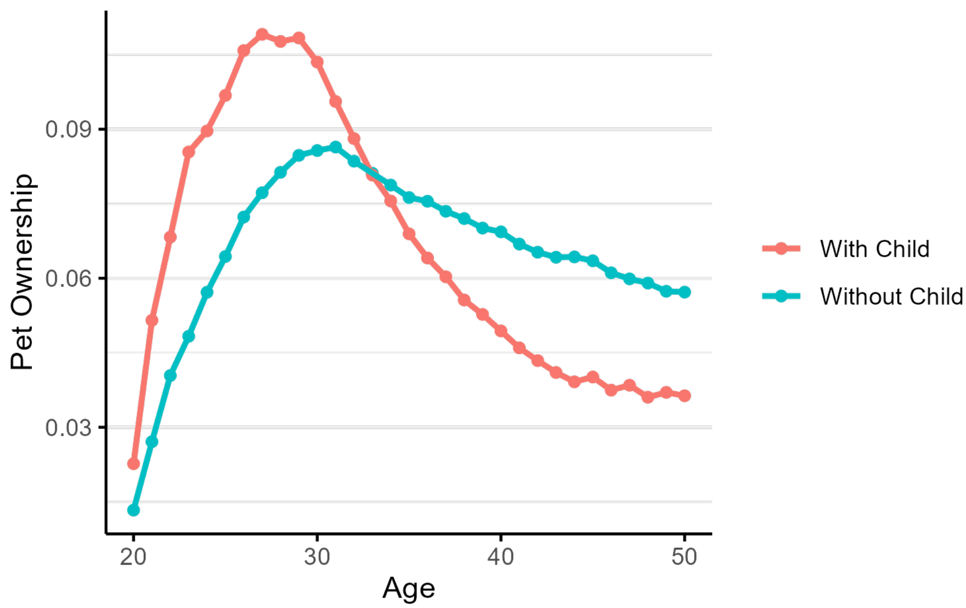

Figure 2: Age Profile of Pet Ownership and Childbearing (Cross-Sectional Stock).

Note: This figure plots the share of individuals owning a pet by age and parental status in year 2020. For example, among 20-year-olds without a child, approximately 1.5% own a pet.

3.2 Cross-Sectional Correlation

While these descriptive patterns provide useful context, they do not by themselves clarify how pet ownership relates to childbearing once we account for other household and individual characteristics. To address this, we regress pet ownership on a dummy variable indicating whether an individual has children, controlling for economic and demographic characteristics. Table 2 reports the estimates for dogs, and Table 3 reports the results for cats.

Several findings stand out when we compare these results to the descriptive patterns. First, we find a positive correlation between dog ownership and having children. Second, this relationship remains largely unchanged when we include controls for income, assets, and other economic conditions, indicating that economic status alone does not drive this pattern. Third, once we add detailed demographic characteristics such as age, gender, and marital status, the estimated effect becomes smaller but remains positive and statistically significant. This suggests that demographic factors explain part of the relationship, but not all of it. Finally, we observe that cat ownership shows a similar correlation in magnitude but with the opposite sign.

Taken on their own, these descriptive patterns do not reveal whether pets and children are complements or substitutes, but they suggest the potential importance of unobserved characteristics that jointly influence both pet ownership and childbearing.

4 Elasticity of Substitution

4.1 Theoretical Framework

The descriptive analysis in the previous section is informative and provides a clear picture of the patterns we observe. However, these patterns alone do not establish whether children and pets function as substitutes or complements. Following basic economic theory, we define substitution and complementarity through the cross-price elasticity of demand. In our context, there are two relevant cross-price elasticities. One approach is to consider how changes in the cost of having a child affect the demand for pets. Alternatively, we can examine how changes in the price of pets influence the demand for children.

These two elasticities are generally different. Let d denote pets (dogs) and c denote children, we can denote the two gross (Marshallain) elasticities:

$$\epsilon_{dc}^{M} = \frac{\partial \ln x_d}{\partial \ln p_c}, \epsilon_{cd}^{M} = \frac{\partial \ln x_c}{\partial \ln p_d}$$

By the property of Slutsky symmetry, we have the following expression:

$$s_d \epsilon_{dc}^{M} = s_c \epsilon_{cd}^{M} + s_d s_c (\eta_c - \eta_d), \tag{1}$$

where s_i is expenditure share of good i, η_i is the income elasticity of good i.

This identity highlights that the asymmetry in Marshallian cross-price elasticities is not arbitrary but follows directly from differences in expenditure shares and income elasticities. When two goods differ in how much households spend on them or how sensitive they are to income, the observed responses to price changes will naturally be asymmetric. The identity formalizes this by showing that the difference between the two cross-price elasticities, once weighted by budget shares, is entirely explained by the income elasticity gap.

Table 2: Correlation Between Having a Child and Dog Ownership

Dependent Variable:	Has Dog			
Model:	Baseline	Economic Controls	Demographic Controls	Economic + Demographic
Variables				
Constant	0.0304***	0.0207***	0.0347***	0.0267***
	(6.04×10^{-5})	(7.22×10^{-5})	(0.0001)	(0.0001)
Has Child	0.0257***	0.0207***	0.0092***	0.0090***
	(8.31×10^{-5})	(9.04×10^{-5})	(0.0001)	(0.0001)
Asset		$1.12 \times 10^{-11***}$		$1.08 \times 10^{-11***}$
		(5.81×10^{-13})		(5.82×10^{-13})
Home Ownership		0.0154***		0.0135***
		(9.58×10^{-5})		(9.96×10^{-5})
Stock Holdings		6.5×10^{-12}		-7.72×10^{-12}
		(4.98×10^{-12})		(4.98×10^{-12})
Income		$-3.97 \times 10^{-9***}$		$-3.57 \times 10^{-9***}$
		(8.4×10^{-11})		(8.43×10^{-11})
Has Work		0.0178***		0.0177***
		(9.53×10^{-5})		(9.6×10^{-5})
Age			0.0001***	$8.09 \times 10^{-5***}$
			(3.13×10^{-6})	(3.19×10^{-6})
Male			-0.0235***	-0.0231***
			(0.0002)	(0.0002)
Married			0.0116***	0.0074***
			(0.0001)	(0.0001)
Household Size			-0.0001***	$-9.4 \times 10^{-5***}$
			(3.5×10^{-6})	(3.5×10^{-6})
Age × Male			0.0003***	0.0003***
			(3.8×10^{-6})	(3.8×10^{-6})
Fit statistics				
Observations	24,302,615	24,300,481	24,302,615	24,300,481
R^2	0.00392	0.00675	0.00571	0.00817

Note: The dependent variable is an indicator for whether an individual owns a dog. Column (1) reports the baseline specification with only the child indicator. Column (2) adds economic controls: asset holdings, stock holdings, income (measured in NTD), home ownership (binary indicator), and work status. Column (3) adds demographic controls: age, gender, marital status, and the age–gender interaction. Column (4) includes both sets of controls. "Has Child" indicates whether the individual has at least one child. "Has Work" indicates current employment. Robust standard errors are reported in parentheses. Significance levels: $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3: Correlation Between Having a Child and Cat Ownership

Dependent Variable:	Has Cat			
Model:	Baseline	Economic Controls	Demographic Controls	Economic + Demographic
Variables				
Constant	0.0161***	0.0101***	0.0235***	0.0169***
	(3.45×10^{-5})	(4.12×10^{-5})	(7.48×10^{-5})	(7.88×10^{-5})
Has Child	-0.0042***	-0.0040***	-0.0053***	-0.0046***
	(4.75×10^{-5})	(5.16×10^{-5})	(7.77×10^{-5})	(7.79×10^{-5})
Asset		$-4.68 \times 10^{-12***}$		$-2.52 \times 10^{-12***}$
		(3.32×10^{-13})		(3.32×10^{-13})
Home Ownership		0.0011***		0.0021***
		(5.47×10^{-5})		(5.69×10^{-5})
Stock Holdings		$-1.1 \times 10^{-11***}$		$-1.7 \times 10^{-11***}$
		(2.84×10^{-12})		(2.84×10^{-12})
Income		$-1.42 \times 10^{-9***}$		$-1.05 \times 10^{-9***}$
		(4.8×10^{-11})		(4.81×10^{-11})
Has Work		0.0137***		0.0134***
		(5.44×10^{-5})		(5.48×10^{-5})
Age			-0.0001***	$-7.63 \times 10^{-5***}$
			(1.79×10^{-6})	(1.82×10^{-6})
Male			-0.0110***	-0.0107***
			(0.0001)	(0.0001)
Married			0.0039***	0.0015***
			(6.41×10^{-5})	(6.49×10^{-5})
Household Size			$-3.92 \times 10^{-5***}$	$-2.52 \times 10^{-5***}$
			(2×10^{-6})	(2×10^{-6})
Age × Male			$7.7 \times 10^{-5***}$	$5.88 \times 10^{-5***}$
			(2.17×10^{-6})	(2.17×10^{-6})
Fit statistics				
Observations	24,302,615	24,300,481	24,302,615	24,300,481
R^2	0.00033	0.00342	0.00169	0.00472

Note: The dependent variable is an indicator for whether an individual owns a cat. Column (1) reports the baseline specification with only the child indicator. Column (2) adds economic controls: asset holdings, stock holdings, income (measured in NTD), home ownership (binary indicator), and work status. Column (3) adds demographic controls: age, gender, marital status, and the age–gender interaction. Column (4) includes both sets of controls. "Has Child" indicates whether the individual has at least one child. "Has Work" indicates current employment. Robust standard errors are reported in parentheses. Significance levels: $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Applied to our setting, childbearing accounts for a substantially larger share of household expenditure than pet ownership, and its income elasticity is somewhat higher (0.15 versus 0.11, as shown later in Section 4.3). This structure implies that changes in the cost of children can have a noticeable impact on pet ownership decisions, both through substitution and through the induced change in real income. In contrast, changes in the cost of owning a dog are less likely to influence fertility behavior, as they represent a smaller share of the household budget and generate a smaller shift in effective purchasing power. The identity in Equation 1 thus clarifies why we expect the elasticity of pet ownership with respect to the cost of children to be larger than the reverse, even if both are jointly determined.

These two quantities provide a closely related but very different interpretation. Arguably, the more policy-relevant parameter is ϵ_{cd}^{M}, as people have proposed using the bonus on pets to stimulus the increase in the number of children (Davidson, 2023). Our plan is to estimate all the quantities in the above Equation 1. We will use the child bonus as our main source of variation in identifying the ϵ_{dc}^{M} (Section 4.2). We then use the receipt lottery to identify the income elasticities (Section 4.3). Finally, we use the expenditure surveys to obtain the expenditure share and apply Equation 1 to derive ϵ_{cd}^{M} from the remaining parameters (Section 4.4).

4.2 Identification of the Elasticity of Substitution

The key challenge in identifying the parameters lies in finding exogenous variation in the cost of having a child. The descriptive analysis in the previous section can be interpreted as showing how certain factors affect this cost. For example, home ownership may lower the barriers to having a child. However, owning a home may also reduce the cost of having a pet. Even after controlling for the rich set of observables in the tax data, unobserved confounders could still influence both the cost of childbearing and other family-related choices.

The ideal research design would be an experiment in which bonuses for childbearing are randomly assigned, allowing for a direct comparison between those whose costs are reduced and those whose costs are not.

Although we do not observe such an experiment, we exploit multiple quasi-experimental policy changes to estimate how exogenous shifts in the cost of children affect pet ownership.

In particular, we use the introduction of childbirth bonuses. We also draw on expansions of child tax deductions, which, despite more complex eligibility rules, effectively reduce the cost of raising a child. We present the results from this latter source of variation in Appendix C.3. The findings from both approaches are consistent.

Our main identification strategy is exploiting the one-shot child bonus offered by the local governments. Local governments across Taiwan provide one-time childbirth bonuses as part of broader efforts to alleviate the immediate financial burden of having a child and to address persistently low fertility rates. These lump-sum payments are typically disbursed upon a child's household registration and vary by municipality, reflecting differences in local fiscal capacity and policy priorities. For example, as of early 2023, Taipei City increased its childbirth bonus for the first child from NTD20,000 to NTD40,000, while Taoyuan City has long offered NTD30,000, with periodic adjustments over time. Eligibility criteria typically include a residency requirement, often requiring one or both parents to have lived in the city for at least one year, along with timely completion of registration.

The timing of these bonuses differs substantially across counties, creating useful variation for empirical analysis. Taipei's program was among the earliest, launching in 2010 with a NTD20,000 bonus and expanding in subsequent years. Many other municipalities adopted similar programs later, often offering smaller amounts initially, such as NTD10,000 to NTD30,000. This staggered rollout provides a quasi-experimental setting in which local policy differences can be interpreted as plausibly exogenous shocks to the effective cost of childbearing. Figure 3 presents the rollout scheme.

From a theoretical standpoint, a one-time, lump-sum childbirth bonus directly reduces the up-front or "gross" price of having a child at the time the decision is made, without affecting ongoing childrearing costs. Unlike other commonly used sources of variation in the cost of children, such as changes in tax policy, housing prices, or childcare availability, this policy offers a clearly defined and measurable reduction in the monetary cost of childbearing. Because the payment is delivered after birth and registration, it constitutes a discrete and well-timed financial incentive. In our framework, such variation allows us to examine how reductions in the immediate and quantifiable cost of childbearing influence household behavior, particularly in the allocation of resources across competing life decisions.

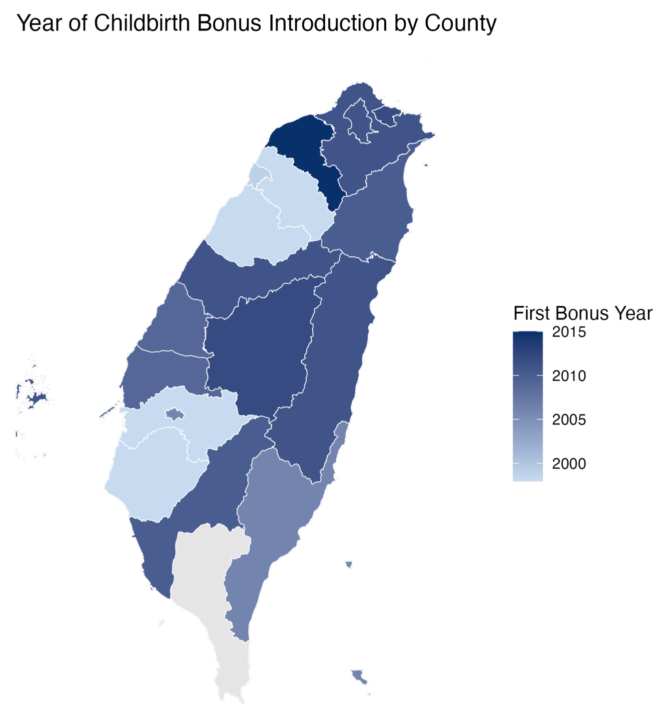

Figure 3: Child Bonus Across Counties Over Time

Note: Pintong county does not initiate a child bonus before the end of our sample period.

The effectiveness of this specific bonus has been heavily studied (Lai, 2024; Wang and Yang, 2022; Huang and Tsai, 2023). The consensus of the literature appears to be that this kind of bonus has significant but small effect on the number of childbirth. Previous literature has used various event study methods, with staggered design, synthetic controls, and various sample selection criteria.

To estimate the effect of childbirth bonuses on pet decisions, we closely follow the event study framework developed by Callaway and Sant'Anna (2021), using counties that introduce the bonus increase later as the control group. We define the event as the first year in which a county increases its childbirth bonus, and define treatment at the county-year level. Because all counties eventually adopt or expand the bonus, we use later-treated counties as comparisons. This approach has the advantage of comparing treated and control units that are likely more similar in their long-run policy trajectories than comparisons using never-treated units.

Formally, we define cohort g as the county-year in which the childbirth bonus first increases, and r as the relative time since that event. For example, cohort $g = 2012$ includes individuals living in counties that increased their bonus in 2012, and $r = 1$ corresponds to one year after the policy change (i.e., calendar year 2013). We estimate the ATT separately for each cohort and event time pair (g, r), using a simple difference-in-differences specification. The estimation sample for each (g, r) includes counties treated in year g and counties that have not yet been treated by year $g + r$. We then estimate the following regression:

$$Y^g_{ict} = \alpha^g_i + \theta^{g,r}\mathbf{1}\{t = g + r\} + \gamma^{g,r} D^g_c \mathbf{1}\{t = g + r\} + \epsilon^g_{ict}, \qquad (2)$$

where Y^g_{ict} denotes the outcome for individual i living in county c in year t, α^g_i is an individual fixed effect (allowed to vary across subsamples), $\theta^{g,r}$ is the cohort-specific time effect, D^g_c is an indicator for counties treated in year g, and $\gamma^{g,r}$ is the cohort- and event-time-specific ATT. We average the estimated $\gamma^{g,r}$ across cohorts, weighting by cohort size.

In this setting, the unit of treatment is county, while outcomes are observed at the individual level. We cluster standard errors at the county level to account for serial correlation and shared policy exposure. Year-of-birth fixed effects are included to absorb time trends that vary across cohorts. A key identifying assumption is that the timing of bonus introduction is as good as random with respect to unobserved determinants of dog ownership.

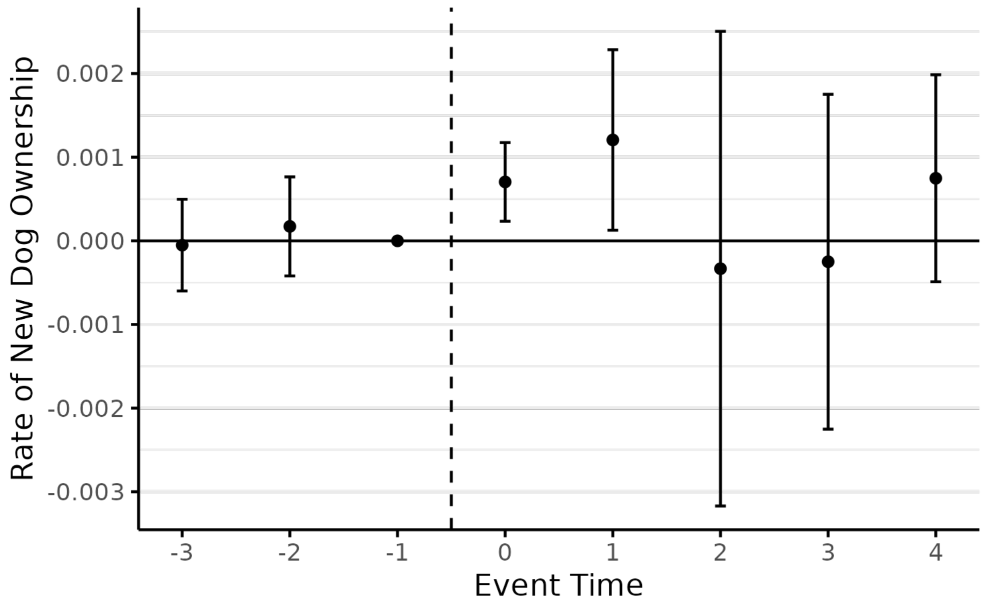

Figure 4: Effect of Childbirth Bonus Increases on the Annual Flow of Dog Ownership

Note: This figure plots the estimated coefficients from Equation 2. The x-axis indicates years relative to the bonus increase, and the y-axis shows the difference in rates of new dog ownership. Standard errors are clustered at the county level, and error bars denote 95% confidence intervals.

Figure 4 presents the event study estimates of the effect of childbirth bonus increases on the probability of acquiring a new dog. In what follows, we focus on the results for dogs; corresponding results for cats are reported in Appendix D. The pre-treatment coefficients are very close to zero and relatively flat, providing strong support for the validity of the later-treated comparison group and the parallel trends assumption.

Immediately following the implementation of the bonus, we observe a clear increase in the flow of new dog ownership. The estimated effect is largest in the first year after treatment and remains elevated in the second year, although the standard error in period two is relatively wide.[3] Relative to a pre-treatment mean of 0.0033 in annual dog acquisition, the first-year increase of 0.07 percentage points corresponds to a 21.2% rise. This magnitude is nontrivial given the relatively low baseline rate of dog ownership and the modest size of the bonus.

[3] The size of the standard errors varies across event times because the composition of the comparison group changes depending on how many counties remain untreated at each horizon.

The effect appears quickly following the policy change but fades out within a few years. By the third and fourth post-treatment years, the point estimates decline and become statistically indistinguishable from zero. This pattern contrasts with the fertility response observed in related work, where the effect of the bonus tends to materialize more gradually and persist over time. The faster onset and shorter duration of the pet ownership response may reflect lower adjustment costs, fewer institutional frictions, or more flexible decision-making in pet-related behavior.

We present the effect estimates on fertility of the child bonus in Appendix C.5. The bonus effect on fertility is small but still consistent with a significant cross-price elasticity with respect to dog ownership. As discussed earlier, the magnitude of this cross-response depends on both the relative expenditure shares and the income elasticities of the two goods. Given that the expenditure share on pet ownership is small, a relatively modest bonus for children can still generate a substantial proportional change in pet behavior. In our setting, the implied Marshallian cross-price elasticity is approximately -1.32, suggesting a relatively strong degree of complementarity. One possible interpretation, which we elaborate in Section 5, is that dog ownership may serve as a preparatory step or a substitute within broader household planning, reflecting behavioral linkages between family formation and pet acquisition.

We further conduct a range of robustness checks to assess the credibility of our findings. First, we re-estimate the model excluding counties that later reduced the bonus amount. As shown in Appendix C.2, the results remain largely unchanged, suggesting that our estimates are not driven by these policy reversals. These alternative models produce estimates that are consistent in sign and timing with our main event study results. Next, to address the possibility that individuals may relocate in response to bonus eligibility, we follow an approach similar to Wang and Yang (2022) in Appendix C.4, restricting the sample to non-movers. While this reduces statistical power, the estimates remain similar in magnitude and direction, providing additional support for our interpretation.

As an additional test of the substitution mechanism, we examine a separate policy that also reduces the relative cost of childrearing: the 2018 expansion of the child tax credit. This reform introduced a NTD120,000 deduction per dependent child for households above a specified income threshold. We estimate the effect of this tax change on pet ownership and present the results in Appendix C.3. The estimates suggest a modest increase in pet ownership following the tax expansion, consistent with the interpretation that changes in the financial cost of children can influence decisions in adjacent domains such as pet acquisition. Although this design does not offer the same quasi-experimental variation as the staggered bonus rollout, the direction of the effect is broadly consistent with our main findings.

4.3 Identification of the Income Elasticity: Lottery Windfall

To implement Equation 1, we require estimates of the income elasticities of childbearing and pet ownership. These elasticities determine how household demand responds to changes in real income and are critical for interpreting the asymmetry in cross-price elasticities. Ideally, identifying income elasticity would require exogenous variation in household income. We leverage such a source through a unique institutional feature of Taiwan's tax system.

Taiwan's sales tax system provides a natural experiment for income shocks through its uniform invoice lottery program. As part of a nationwide effort to reduce tax evasion, nearly all consumption receipts are eligible for bi-monthly lottery drawings, with prizes reaching up to NTD10 million. Receipt holders are randomly selected, and prizes are distributed regardless of income level or background. These awards thus constitute plausibly exogenous, positive income shocks.

We follow a similar identification strategy as in Tsai et al. (2022), who examine the fertility response to lottery winnings. In our case, we study how lottery windfalls affect pet ownership behavior (results for fertility outcomes are reported in Appendix C.6). Specifically, we use a later-treated event study design, comparing winners to those who win in future lottery periods. This approach allows us to isolate the effect of transitory income gains on pet ownership and thereby estimate the income elasticity of demand. The estimates generated from this analysis serve as inputs for the theoretical decomposition in Appendix F.1, linking the behavioral responses to changes in childbearing cost and pet ownership.

To estimate the income elasticity of pet ownership, we adopt the same event study framework used in the childbirth bonus analysis. The key difference is that the treatment here occurs at the individual level, rather than at the county level. Specifically, we define treatment as winning more than NTD200,000 in the uniform invoice lottery, and we compare early winners to later winners. The formal specification is given by:

$$Y_{ict}^{g} = \alpha_i^g + \theta^{g,r}\mathbf{1}\{t = g + r\} + \gamma^{g,r} D_i^g \mathbf{1}\{t = g + r\} + \epsilon_{ict}^g, \tag{3}$$

where Y_{ict}^{g} denotes the pet ownership outcome for individual i in county c and year t, and D_i^g indicates whether individual i won the lottery in cohort g. Individual fixed effects α_i^g absorb time-invariant heterogeneity, and standard errors are clustered at the individual level to account for within-person serial correlation. As before, we estimate the ATT separately for each cohort-event time pair and take a weighted average.

The results are presented in Figure 5. We find no evidence of pre-trends prior to the lottery win, supporting the identifying assumption that later winners serve as a valid comparison group. Following the receipt of the lottery windfall, there is a significant increase in dog ownership. Compared to the child bonus results, the response to lottery winnings is somewhat smaller in magnitude but consistent in direction. These findings reinforce the interpretation that pet ownership is positively income-elastic and responsive to household financial resources, providing a key input into the theoretical decomposition of substitution and income effects discussed earlier.

4.4 Estimating the Remaining Quantities

With the empirical estimates of the cross-price elasticity and income elasticities in hand, we now turn to quantifying the remaining parameters required to interpret Equation 1, in particular the expenditure shares for children and pets. While most of the underlying calculations and data sources are detailed in Appendix F.1, here we summarize the key figures and provide the resulting elasticity estimates.

According to the 2023 Taiwan pet industry report (Liu et al., 2024), the average annual expenditure per dog-owning household is NTD30,093. Using data from the Family Income and Expenditure Survey, we estimate the average annual disposable income of pet-owning households to be NTD1,116,195, and their average annual consumption to be NTD930,374.2. This implies a pet expenditure share of approximately 0.0323.

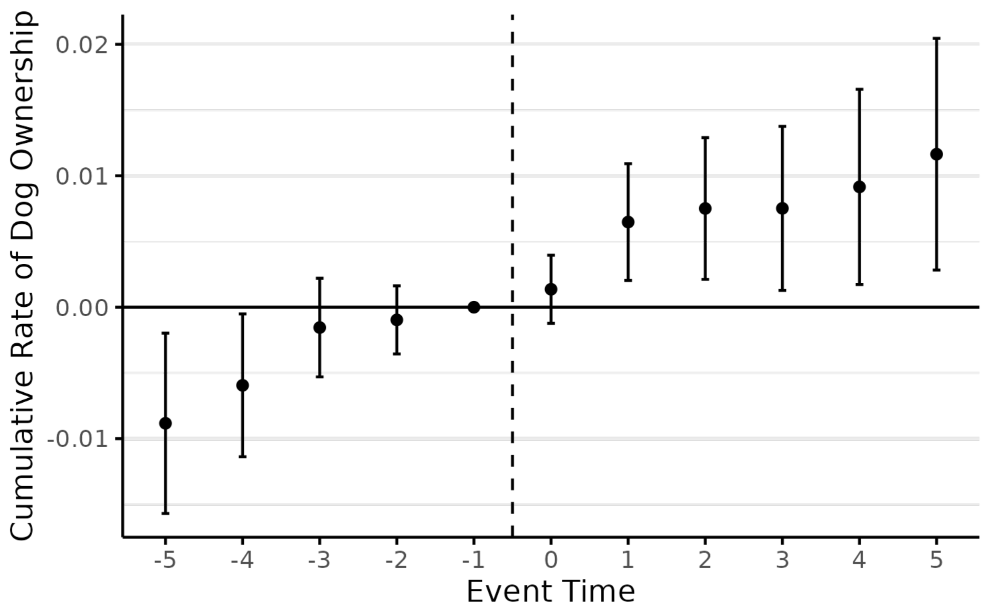

Figure 5: Effect of Lottery Winnings on the Annual Flow of Dog Ownership

Note: This figure plots the estimated coefficients from Equation 3. The x-axis indicates years relative to the lottery winnings, and the y-axis shows the difference in rates of new dog ownership. Standard errors are clustered at the individual level, and error bars denote 95% confidence intervals.

Estimating the expenditure share for children is more complex, as detailed child-specific spending is not separately reported in household survey data. As a proxy, we use the equivalence scale approach, where a child under age 14 is assigned a weight of 0.3. For a three-person household with two adults and one child, this implies that the child accounts for 0.3 out of a total equivalized household size of 1.8, or roughly 17% of consumption. Alternative estimates in the literature suggest child expenditure shares as high as 22% in the United States. To remain conservative and context-appropriate, we adopt a baseline value of 0.20 in our calculations.

Using these expenditure shares along with the previously estimated income elasticities ($\eta_c = 0.15$, $\eta_d = 0.10$) and the cross-price elasticity ($\epsilon^M_{dc} \approx -1.32$), we can solve for the implied elasticity of child demand with respect to the price of dog ownership to be -0.21 using the identity in Equation 1. The details of this derivation are presented in Appendix F.1.

To recover the Hicksian (compensated) cross-price elasticity between children and dogs, we apply the Slutsky decomposition that links Marshallian and Hicksian elasticities through the income effect. Formally,

$$\epsilon^H_{ij} = \epsilon^M_{ij} + s_j \eta_i,$$

where ϵ^M_{ij} is the Marshallian elasticity of good i with respect to the price of good j, s_j is the expenditure share of good j, and η_i is the income elasticity of good i. Using the estimates obtained earlier, we have $\epsilon^M_{cd} = -0.214$, $s_d = 0.032$, and $\eta_c = 0.150$, which gives

$$\epsilon^H_{cd} = -0.214 + 0.032 \times 0.150 = -0.207.$$

The resulting Hicksian elasticity of -0.21 indicates that, after compensating for income effects, dogs and children remain complements.

In summary, using quasi-experimental designs based on child bonuses and income lotteries, our estimates indicate a complementarity between childbearing and pet ownership. This finding differs from many prior beliefs discussed earlier. The estimated effect of -0.21 is sizable. However, even if we take this estimate at face value and make a generous extrapolation, promoting pet ownership is unlikely to "solve" the fertility problem, as is sometimes suggested. It is also important to emphasize that this estimate is inherently static, as it is identified from a one-time policy variation. The dynamic patterns and underlying mechanisms are much richer, as discussed in Section 5.

5 Mechanism

The preceding analysis indicates that children and dogs behave more like complements than substitutes in household decisions. We now turn to potential mechanisms that may explain this relationship. A recurring theme in survey evidence is that a substantial share of respondents report acquiring a dog as a way to "practice" for having children. This anecdotal observation motivates a closer look at the dynamics between childbearing and pet ownership using longitudinal data.

5.1 Dynamic Patterns

The causal estimates in Section 4 are primarily static in nature and do not reveal the sequencing of events between acquiring a pet and having a child. To explore the underlying mechanism of complementarity, we examine dynamic patterns in the data, focusing on the timing of births relative to pet acquisitions and vice versa. Specifically, we conduct descriptive event studies using two types of comparison groups. The first comparison group matches individuals on age and gender who have never experienced the event in question. The second uses a "later-treated" framework, comparing those who have experienced the event at different times. While these exercises are not intended to identify causal effects, because acquiring a pet or having a child is itself a choice, they serve as descriptive tools that shed light on the temporal relationship between the two events.

We begin by examining raw event-time averages. Figure 6 plots the probability of having a newborn child for individuals who acquire a dog, relative to those who do not. The outcome variable is measured as a flow. We find that, prior to acquiring a dog, individuals without a dog have a consistently lower probability of having a baby. After dog acquisition, the probability of having a child rises sharply and continues to increase in subsequent years.

Figure 7 shows the reverse relationship: the probability of acquiring a dog for individuals who have a newborn child. Several patterns are noteworthy. First, those who will have a baby

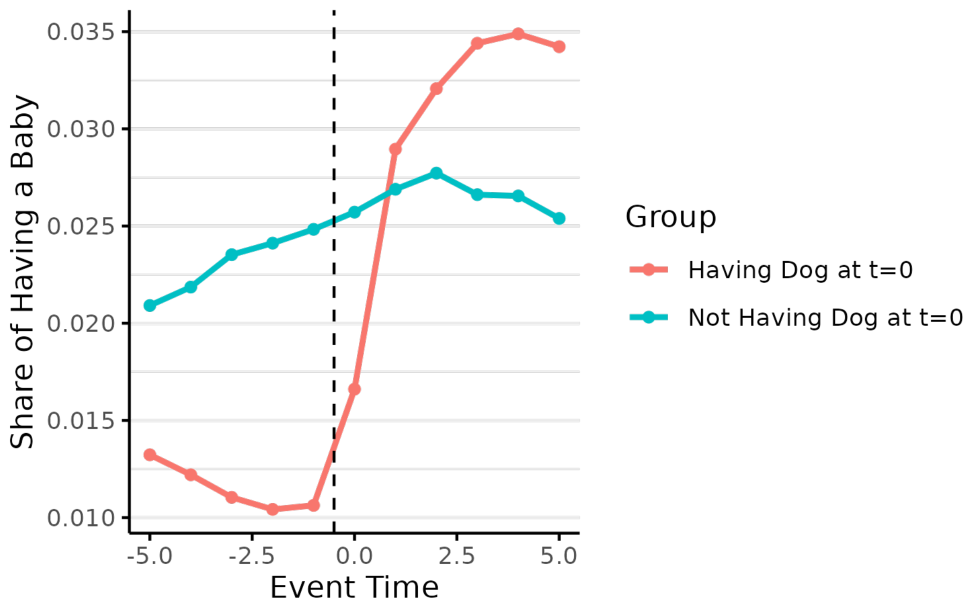

Figure 6: Raw Data Comparison of Childbearing Around the Onset of Dog Ownership

Note: This figure plots the raw mean of the indicator for having a newborn child relative to the year of dog acquisition. The treatment group (red) is aligned on the actual year of dog acquisition. The comparison group (blue) is assigned a placebo event year drawn at random.

in the future already exhibit a higher rate of dog acquisition prior to childbirth. Second, immediately after the birth of a child, the probability of acquiring a dog falls markedly. Interestingly, the pre-event trends are close to parallel. These raw data shows the flow of babies and dogs. We present the stock of these values in Appendix B.

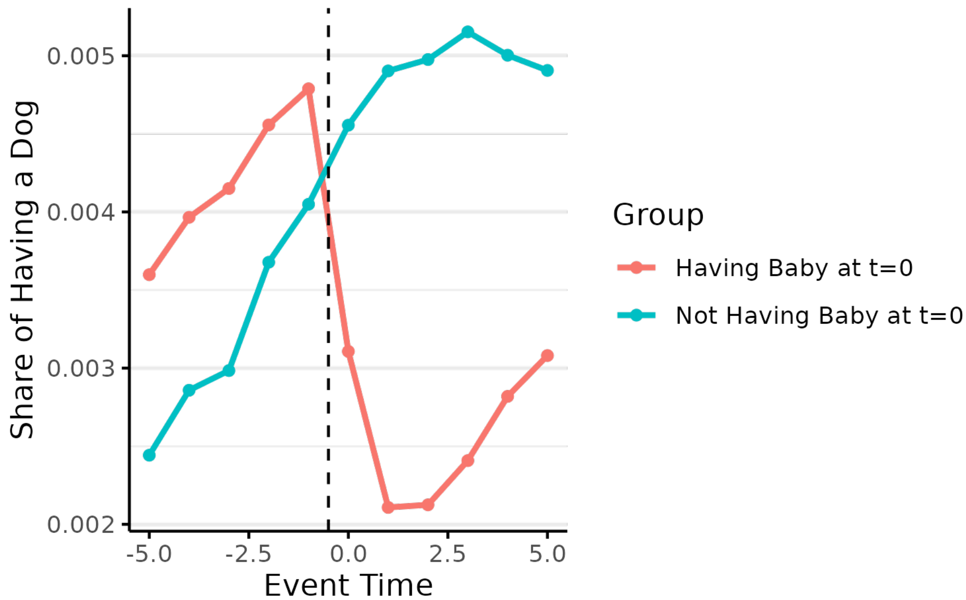

Figure 7: Raw Data Comparison of Dog Ownership Around the Onset of Childbearing

Note: This figure plots the raw mean of the indicator for acquiring a new dog relative to the year of childbirth. The treatment group (red) is aligned on the actual year of childbirth, while the comparison group (blue) is assigned a randomly drawn placebo event year.

The same qualitative patterns emerge when using a descriptive event study design with later-treated individuals as the control group. As shown in Figures 8 and 9, the probability of having a baby rises sharply after acquiring a dog, while the probability of acquiring a dog falls sharply after the birth of a child. The same pattern holds if we restrict our focus to first-time dog owners (Appendix C.7). Additional results using the number of new dogs as the outcome variable and those using the household as the unit of analysis are reported in Appendix C.9 and Appendix C.10, respectively. We also extend this analysis to the grandparent generation. Figure 10 shows that the probability of acquiring a dog increases modestly following the birth of a grandchild, suggesting that the association between family formation and pet ownership extends beyond the nuclear family, albeit to a lesser degree.

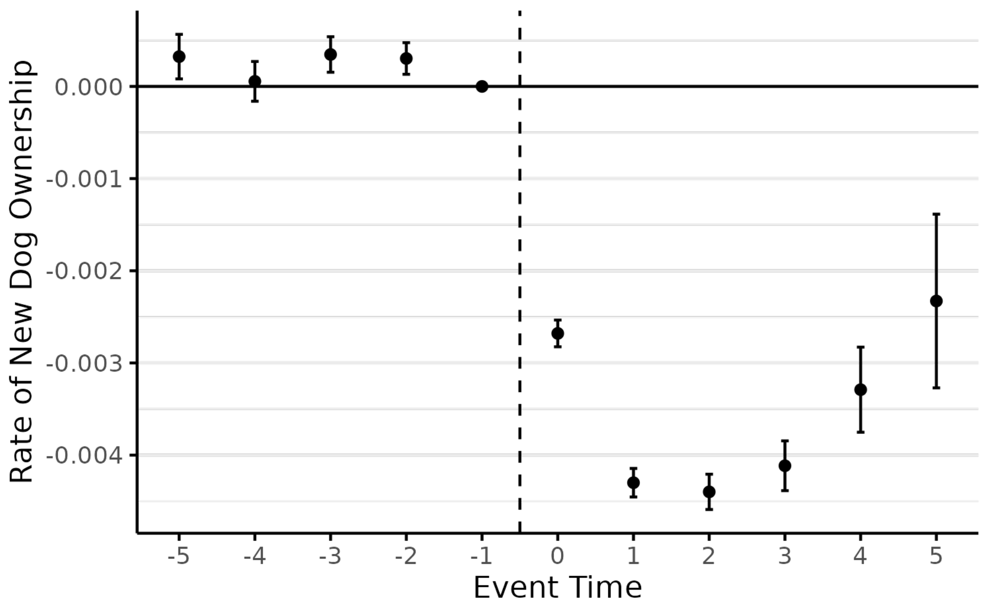

Figure 8: Event Study of Childbearing Around the Onset of Dog Ownership

Note: This figure plots event study estimates of acquiring a new dog relative to the year of childbirth. The control group consists of individuals who give birth in later years. The x-axis indicates years relative to childbirth, and the y-axis shows the difference in the probability of acquiring a new dog. Standard errors are clustered at the individual level, and error bars denote 95% confidence intervals.

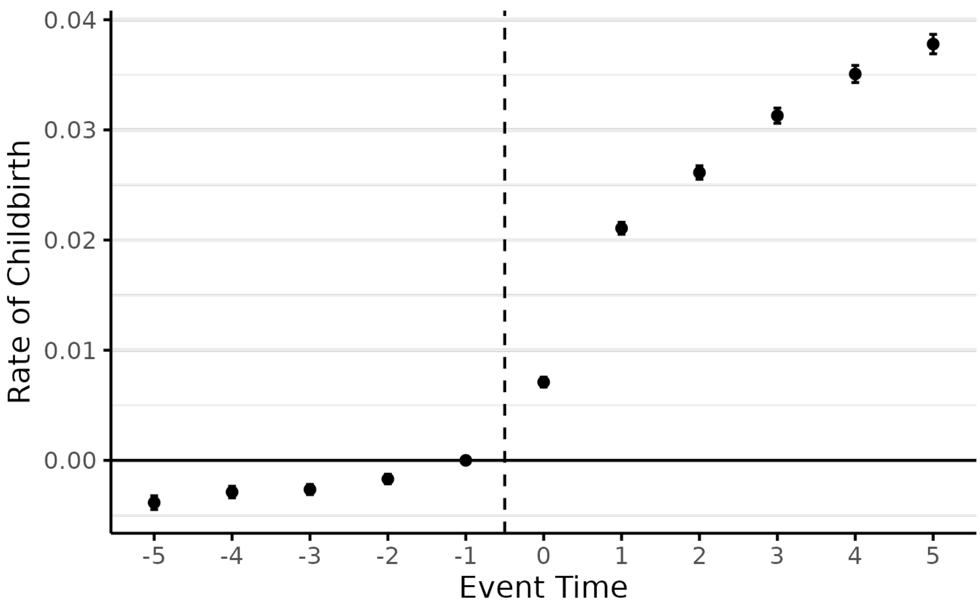

Figure 9: Event Study of Dog Ownership Around the Onset of Childbearing

Note: This figure plots event study estimates of having a newborn child relative to the year of dog acquisition. The control group consists of individuals who acquire a dog in later years. The x-axis indicates years relative to dog acquisition, and the y-axis shows the difference in the probability of having a newborn child. Standard errors are clustered at the individual level, and error bars denote 95% confidence intervals.

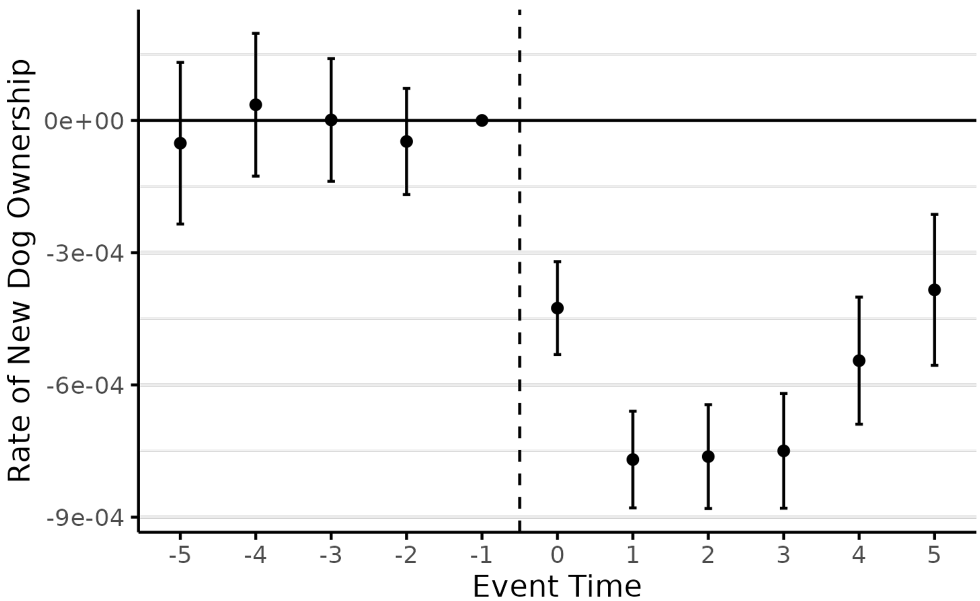

Figure 10: Event Study of Dog Ownership Around the Onset of Grandchildbearing

Note: This figure plots event study estimates of acquiring a new dog relative to the year of a grandchild's birth. The control group consists of individuals who have a grandchild in later years. The x-axis indicates years relative to the grandchild's birth, and the y-axis shows the difference in the probability of acquiring a new dog. Standard errors are clustered at the individual level, and error bars denote 95% confidence intervals.

Given the evidence presented above, we now consider a potential mechanism that can explain the observed complementarity between childbearing and dog ownership: pets as a "practice family." By this, we mean that some households may acquire a pet, particularly a dog, as a way to prepare for the responsibilities, routines, and shared decision-making associated with raising a child. In this interpretation, pet ownership serves both as a test of caregiving capacity and as a way for couples to gauge compatibility in managing joint responsibilities.

The first piece of evidence supporting this mechanism comes from direct anecdotal accounts. Survey data indicate that one of the most frequently cited reasons for acquiring a dog is to "practice" for having children (Gonzales et al., 2023). This is explicit self-reported evidence, and thus points directly toward the practice-family interpretation.

The dynamic patterns documented above are also consistent with this story. The probability of having a child increases sharply following the acquisition of a dog, and the rise in the flow of births continues over subsequent years. This pattern suggests that dog ownership may accelerate the transition to childbearing for households without children at baseline.

The heterogeneity between dogs and cats further reinforces this interpretation. Caring for a dog generally requires more time, involvement, and structured daily routines than caring for a cat, making it a closer analog to childrearing. Consistent with this, we find that the estimated effects are systematically larger for dogs than for cats.

Finally, if the practice-family channel is indeed central, then the response to acquiring a dog should differ markedly between households that already have children and those that do not. Specifically, we would expect the increase in births to be concentrated among those without prior children, since existing parents have already experienced the responsibilities of childrearing and therefore have less to "learn" from pet ownership. Figure 11 supports this prediction: households with no children at baseline exhibit a sizable increase in births after acquiring a dog, whereas households with existing children experience no increase (and even a modest decline) in subsequent births.

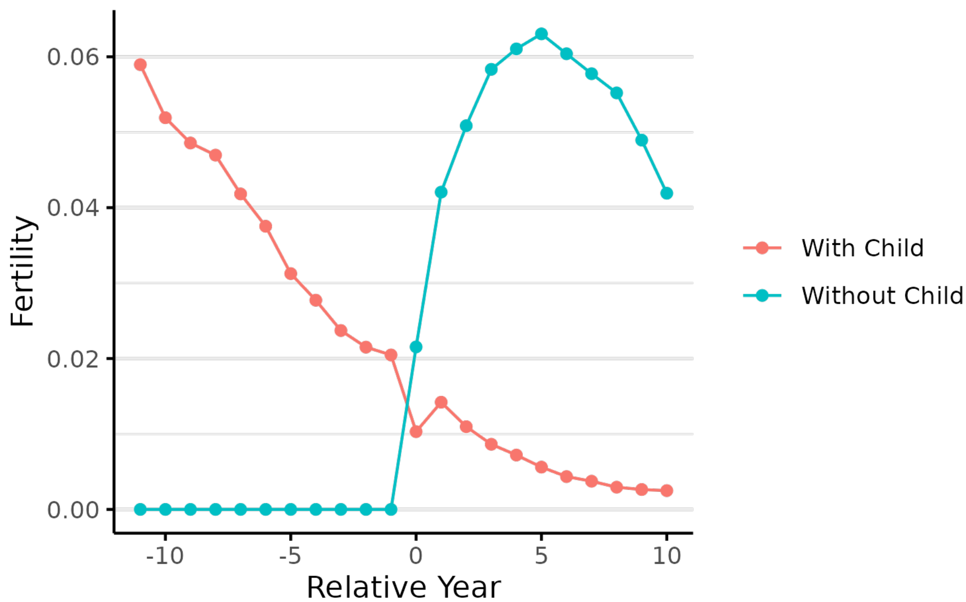

Figure 11: Raw Data Comparison of Additional Childbearing Around the Onset of Dog Ownership

Note: This figure plots the raw mean probability of having an additional child relative to the year of dog acquisition. The blue line shows individuals without a child prior to acquiring a dog, while the red line shows individuals who have a child before acquiring a dog.

5.2 Alternative Explanations

While the descriptive patterns and heterogeneity analyses provide evidence consistent with the "practice family" interpretation, other explanations are also possible. In particular, the observed complementarity between dog ownership and childbearing could arise from differences in underlying preferences across individuals, or from indirect channels such as changes in partnership formation. Before concluding that the practice-family mechanism is the primary driver, we consider two alternative explanations: selection into a "type" that values both pets and children, and effects operating through marriage.

A straightforward alternative to the "practice family" interpretation is that there are simply different types of people. One "family-loving" type sequentially acquires a dog and then has children, while another type does neither. This view is consistent with the dynamic patterns observed so far, but it requires several additional assumptions that make it less compelling.

First, it must be the case that for the family-loving type, dogs always precede children, and when a dog is acquired later in life, it does not lead to additional children. Second, the "type" would have to be malleable rather than fixed. In our main analysis, we find that child bonuses and other tax benefits increase dog ownership. For the selection story to fit these findings, bonuses would need to induce individuals to switch from a "non-loving" type to a "family-loving" type. While we cannot fully distinguish between type-switching and the practice-family mechanism, the weight of the evidence makes the latter a more parsimonious explanation.

Another possible mechanism is that dog ownership indirectly affects fertility through marriage. For example, walking a dog may increase opportunities to meet potential partners, either through social interactions or by making owners appear more approachable. If dog ownership facilitates partner matching, this could increase marriage rates, which in turn may lead to higher fertility.

To assess this, we estimate an event study similar to those presented earlier in this section, replacing births with marriage as the outcome in Appendix E. As shown in Figure 42, the pre-event trend for marriage differs markedly from the parallel patterns seen in the childbearing results, with divergence beginning well before the acquisition of a dog.

Another related issue is health concerns for children. It is well known in Taiwan that cat feces pose a toxoplasmosis exposure risk for pregnant women (Taiwan Centers for Disease Control, 2018). This may help explain why cat ownership could relate to newborn outcomes. However, almost all patterns we find are common to dogs and cats, with smaller magnitudes for cats, so toxoplasmosis exposure is unlikely to be the main driver.

In sum, while we cannot rule out these alternative mechanisms, the combination of anecdotal evidence, dynamic patterns, and heterogeneity across pet types provides stronger support for the "practice family" interpretation as the primary channel linking dog ownership and childbearing.

5.3 Heterogeneity Analysis

We present the event study results for different subsamples in Appendix G. Specifically, we examine heterogeneity by sex, income, and homeownership.

We consider sex and income because they capture differences in household roles and available resources, both of which are relevant for understanding the trade-offs between raising children and keeping dogs. We also examine homeownership, given that the rental market imposes constraints since many rental units do not allow pets.

We do not find substantial heterogeneity by sex. However, we observe some differences by income: higher-income individuals experience a smaller decline in the probability of owning a dog after having a child, likely due to less binding time and resource constraints. They also exhibit a larger increase in the probability of having a child after acquiring a dog. Surprisingly, we find little difference by homeownership status.

5.4 Other Aspects of Substitution

So far, we have focused on the relationship between new births and dog ownership. Much of the public discourse on substitution and complementarity between pets and children does not clearly specify which stage of the life cycle is under consideration. As the previous sections have shown, timing is crucial in understanding this relationship, and its importance extends more broadly.

Our data allow us to briefly explore other dimensions of substitution and complementarity. For instance, one may ask how pets interact with different stages of family life—whether they act as substitutes or complements once children reach adulthood or when grandchildren arrive. As shown earlier in Figure 10, the probability of acquiring a new dog declines sharply following the birth of a grandchild.

We further examine two additional life events. Figure 12 shows that the death of a child is associated with an increased probability of dog ownership. Similarly, Figure 13 demonstrates that the death of a spouse has an even larger effect.

Further research is needed to establish the causal nature of these relationships, as the evidence we present is suggestive. However, the absence of strong pre-trends provides some reassurance, and it seems implausible that reverse causality (e.g., pet ownership causing a death) or omitted confounders could fully account for the observed patterns. Taking these results into account, the overly simplified public discussions of "complements" and "substitutes" may stem from differences in the life stages being considered.

6 Conclusion

This paper provides the first large-scale empirical evidence on the relationship between pet ownership and fertility. Using rich administrative data from Taiwan, we document that pets interact with household decisions about childbearing in systematic and economically meaningful ways.

Our findings can be summarized along three dimensions. First, observationally, individuals with dogs are more likely to have children. Dog ownership is positively correlated with characteristics associated with fertility, such as stronger economic conditions and more favorable positions in the marriage market, but these factors alone cannot explain the positive association. Second, causally, exploiting quasi-experimental variation in the cost of raising a child from child bonuses and income shocks from the receipt lottery, we estimate the Marshallian and Hicksian cross elasticities and find that pets and children are complements. Third, dynamics matter. Individuals who adopt dogs subsequently exhibit higher

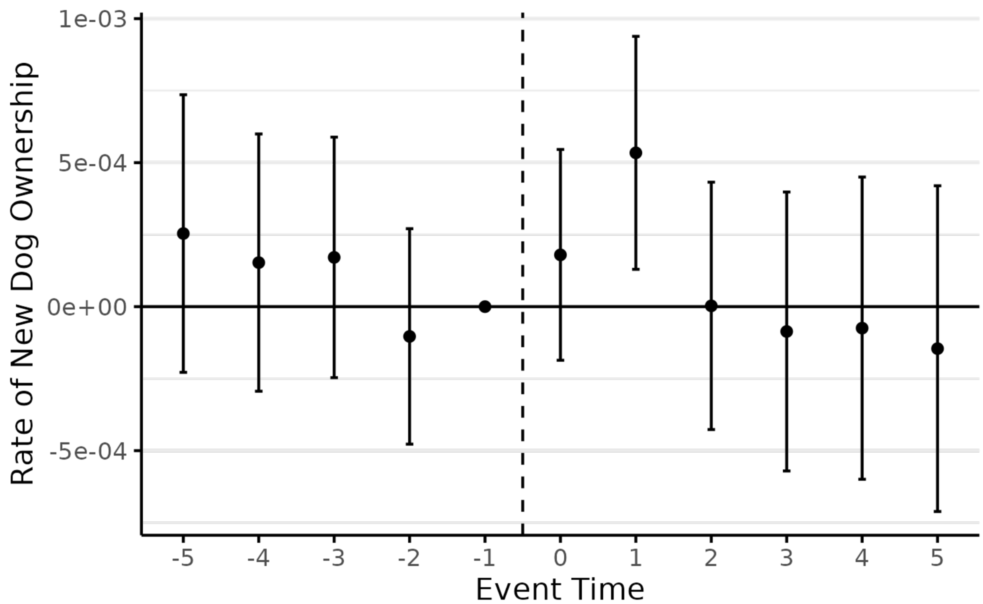

Figure 12: Event Study of Dog Ownership Around the Death of a Child

Note: This figure plots event study estimates of acquiring a new dog relative to the year of a child's death. The control group consists of individuals whose child dies in later years. The x-axis indicates years relative to the child's death, and the y-axis shows the difference in the probability of acquiring a new dog. Standard errors are clustered at the individual level, and error bars denote 95% confidence intervals.

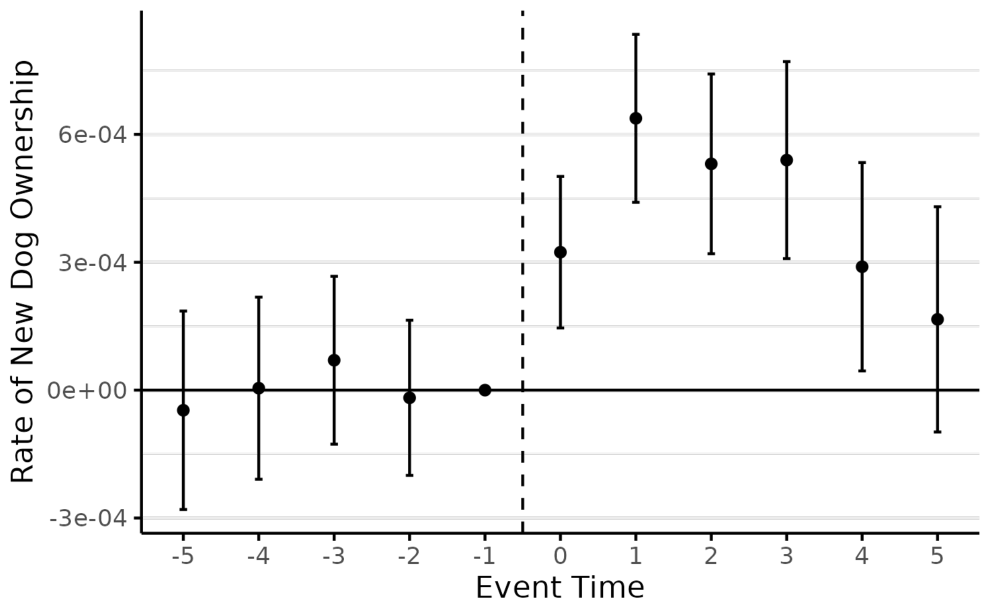

Figure 13: Event Study of Dog Ownership Around the Death of a Spouse

Note: This figure plots event study estimates of acquiring a new dog relative to the year of a spouse's death. The control group consists of individuals whose spouse dies in later years. The x-axis indicates years relative to the spouse's death, and the y-axis shows the difference in the probability of acquiring a new dog. Standard errors are clustered at the individual level, and error bars denote 95% confidence intervals.

probabilities of having children, consistent with dogs fostering routines of care, encouraging home-centered lifestyles, and serving as a form of "starter family." Conversely, after the arrival of a newborn, the likelihood of acquiring a new dog declines sharply. Later in life, however, pet ownership often rises following major life transitions such as divorce or the loss of a spouse or child, reflecting pets' role as emotional and social companions.

Taken together, our analysis highlights the broader role of pets in shaping household behavior and well-being. Companion animals influence how people allocate time, form relationships, and adapt to life-course transitions. Beyond fertility, they represent an increasingly integral component of modern family life, mediating care, companionship, and emotional support in ways that intersect with demographic and social change. Understanding these dynamics can enrich family economics and social policy, offering new insights into how modern households organize and adapt.

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A Descriptive: Married Individuals

Figure 14 plots the cross-sectional distribution of pet ownership by age among married individuals, stratified by whether they have children. Compared to the full-population figure (Figure 2), this restricts the sample to married individuals, providing a more direct comparison of pet ownership conditional on family formation status.

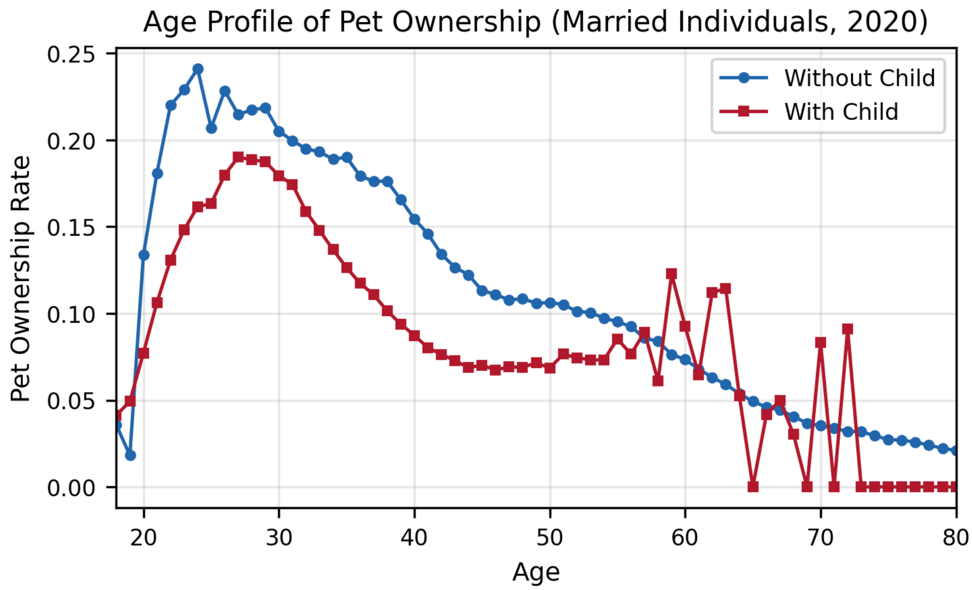

Figure 14: Age Profile of Pet Ownership Among Married Individuals (Cross-Sectional Stock, 2020).

Note: This figure plots the share of married individuals owning a pet by age and parental status in year 2020. The blue line represents married individuals without children, and the red line represents married individuals with at least one child. Pet ownership rates are highest among younger married individuals without children, peaking around age 24.

B Raw Data Cumulative

Here we report cumulative, or stock, measures that mirror the flow patterns (Figure 6 and 7) in the main text. Figure 16 plots the stock of children around the event of acquiring a dog. Figure 15 presents the stock of dog ownership around the birth of a child.

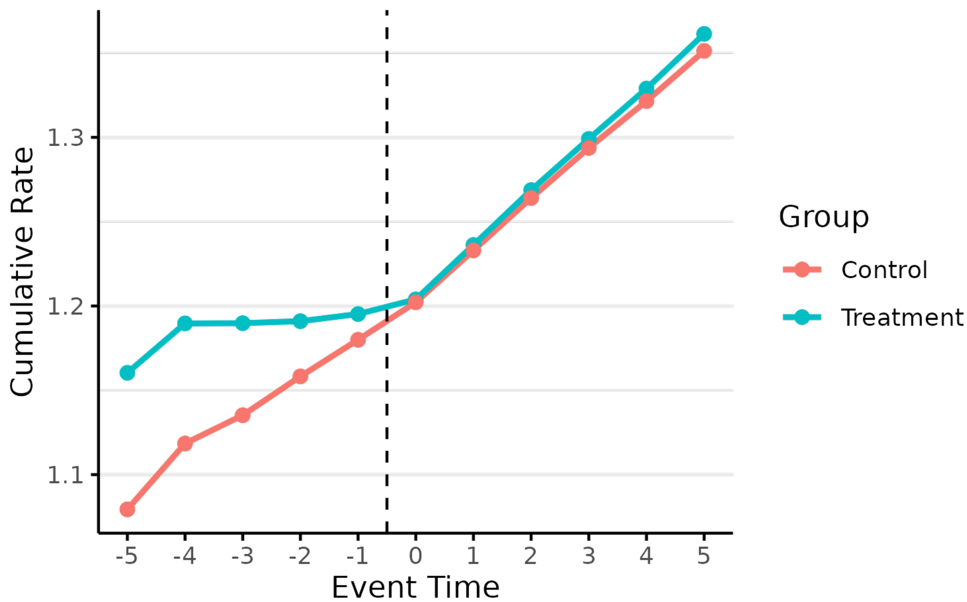

Figure 15: Raw Data Comparison of Cumulative Childbearing Around the Onset of Dog Ownership

Note: This figure plots the raw mean stock of children relative to the year of dog acquisition. The stock is constructed as the cumulative sum of the annual indicator for having a newborn up to each event time for each individual. The treatment group (blue) is aligned on the actual year of dog acquisition. The comparison group (red) is assigned a placebo event year drawn at random.

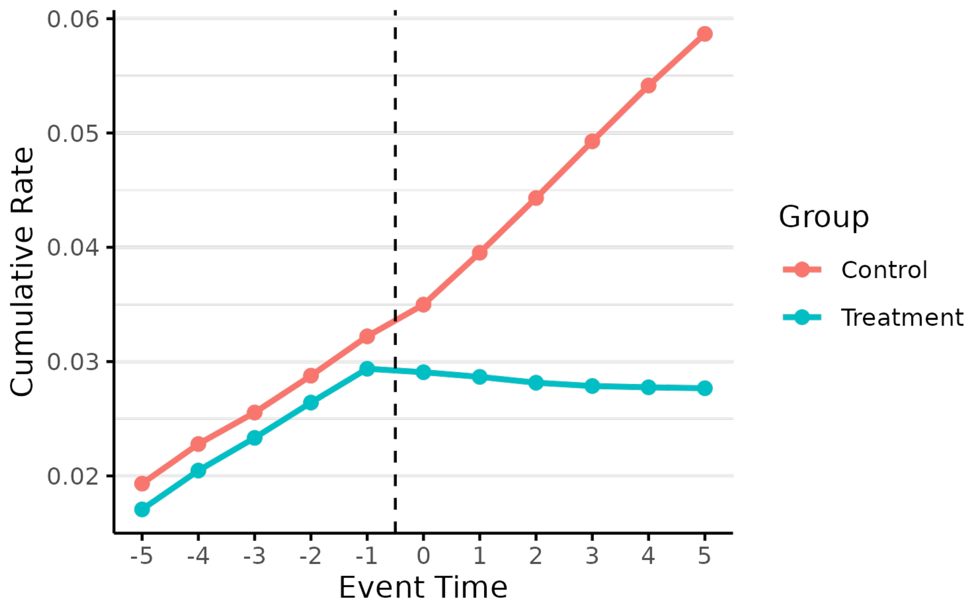

Figure 16: Raw Data Comparison of Cumulative Dog Ownership Around the Onset of Childbirth

Note: This figure plots the raw mean stock of dog ownership relative to the year of childbirth. The stock is constructed as the cumulative sum of the annual indicator for acquiring a new dog up to each event time for each individual. The treatment group (blue) is aligned on the actual year of childbirth, while the comparison group (red) is assigned a randomly drawn placebo event year.

C Robustness

C.1 Removing the 2013 Registration Spike

From September to October 2013, the Council of Agriculture implemented a one-time nationwide campaign that provided free microchipping, waived registration fees, and supplied rabies vaccines in epidemic and high-risk areas as well as private shelters. This temporary incentive generated a sharp, mechanical spike in registrations unrelated to underlying demand. To ensure our findings are not driven by this administrative shock, we re-estimate our specifications excluding observations from September–October 2013. Figure 17 shows the DiD results for childbirth-bonus effects on dog ownership; Figures 18 and 19 report the corresponding event-study estimates for childbearing around dog acquisition and dog acquisition around childbearing, respectively. Across all three exercises, the results are robust to excluding the spike months.

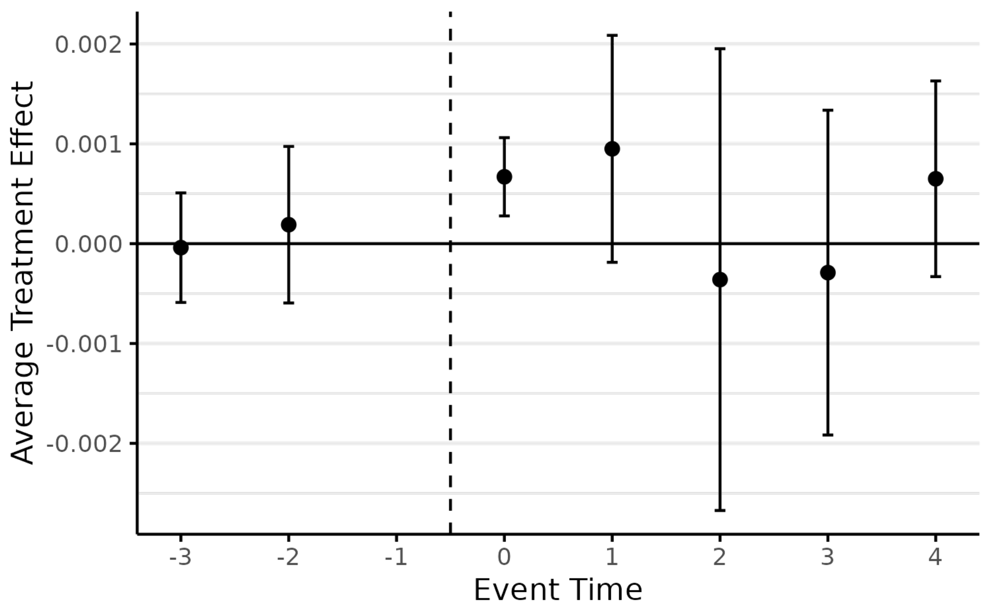

Figure 17: Effect of Childbirth Bonus Increases on New Dog Ownership, Excluding Sep–Oct 2013

Note: This figure reproduces the baseline bonus difference-in-differences estimates after removing observations from September–October 2013, when a national registration campaign caused a mechanical spike in registrations. The specification, controls, and clustering (county level) match the baseline.

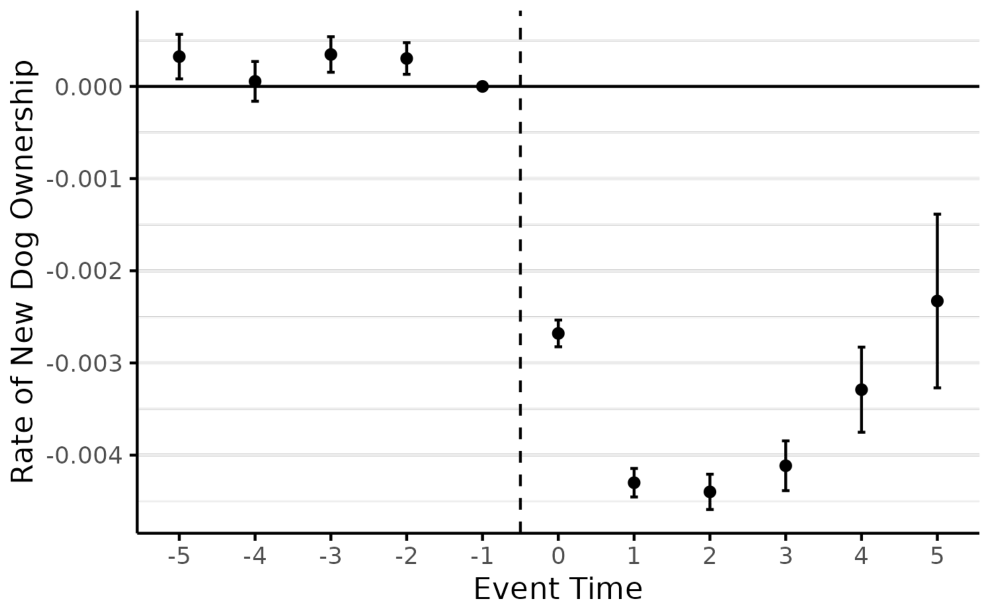

Figure 18: Event Study of Childbearing Around First Dog Acquisition, Excluding Sep–Oct 2013

Note: Event-time coefficients for childbearing outcomes relative to the year of first dog acquisition, excluding September–October 2013 registrations. Later-treated individuals serve as the comparison group. Standard errors are clustered at the individual level; 95% confidence intervals shown.

C.2 Drop Decreases

As described in Figure 3, Hsinchu, Miaoli, and Tainan have experienced bonus drops. We drop samples from these counties and re-estimate the main specification. Results in 20 suggest that signs and magnitudes are virtually unchanged.

C.3 Specifications Using Tax Deductibles

To alleviate childcare costs and encourage fertility, Taiwan introduced the *Special Deduction for Pre-school Children* in 2012 (NTD25,000 per eligible child) and substantially expanded it in 2018 to NTD120,000, alongside a broadened eligibility scope (Ministry of Justice, 2018). We leverage the 2018 expansion as a nationwide policy shock whose *effective* generosity varies mechanically with the taxpayer's marginal tax rate (MTR), because the

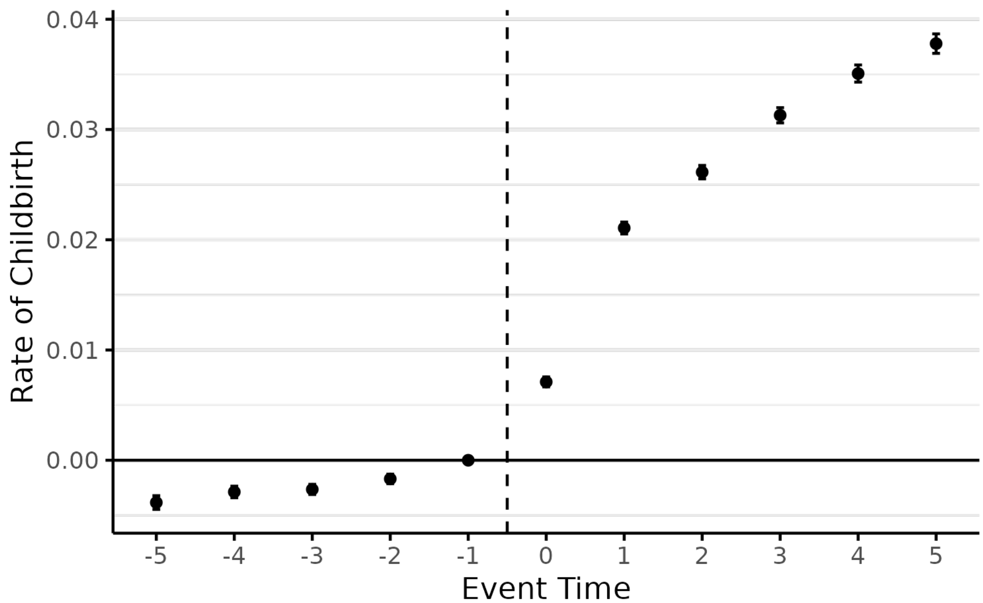

Figure 19: Event Study of Dog Acquisition Around Childbearing, Excluding Sep–Oct 2013

Note: Event-time coefficients for dog ownership outcomes relative to the year of childbirth, excluding September–October 2013 registrations. Later-treated individuals serve as the comparison group. Standard errors are clustered at the individual level; 95% confidence intervals shown.

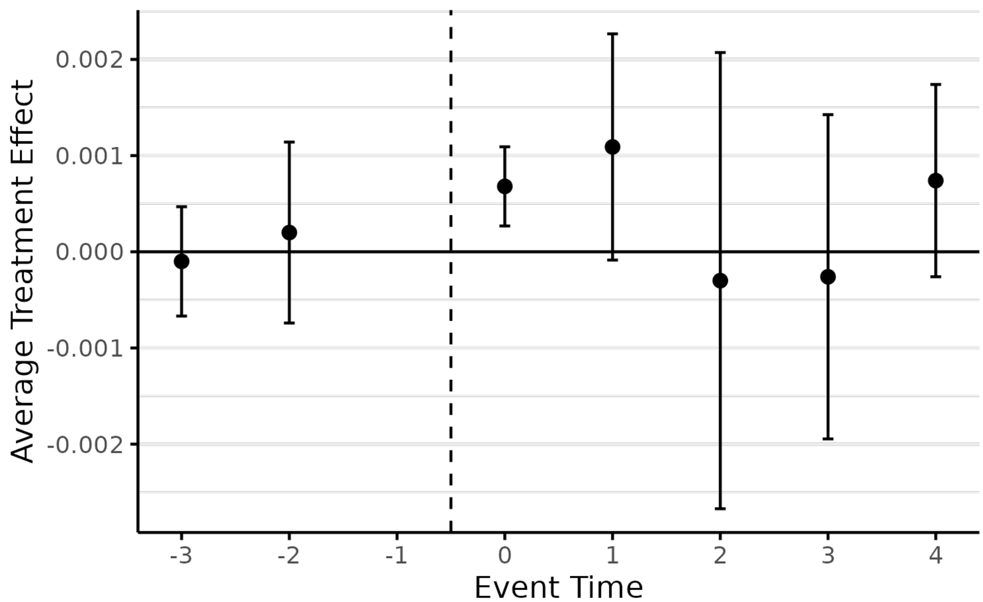

Figure 20: Re-estimating After Excluding Counties with Bonus Decreases

Note: We exclude Hsinchu, Miaoli, and Tainan (counties that experienced bonus drops) and re-estimate the main specification. Signs and magnitudes are virtually unchanged. Detailed numeric results are currently in review/takeout process.

value of a deduction equals MTR × (deduction amount).

We focus on individuals aged 20–44 and years 2013 onward to avoid conflating effects with the 2012 introduction. Let Y_{it} denote the outcome of interest (e.g., birth, marriage, or dog ownership) for individual i in year t. Define $\text{HighMTR}_i = 1$ for taxpayers whose *prior-year* taxable income places them in the 20% bracket and $\text{HighMTR}_i = 0$ for those in the 12% bracket. To enhance comparability, we restrict the sample to a symmetric income bandwidth of NTD100,000 around the relevant bracket cutoffs, using lagged taxable income for classification. Our baseline DiD specification is

$$Y_{it} \;=\; \alpha_i \;+\; \lambda_t \;+\; \gamma_{h(i)} \;+\; \beta \left(\text{Post}_t \times \text{HighMTR}_i\right) \;+\; X_{it}'\delta \;+\; \varepsilon_{it},$$

where α_i are individual fixed effects, λ_t are year fixed effects, $\gamma_{h(i)}$ are county/household area fixed effects, and X_{it} includes standard controls. Post_t equals one for $t \geq 2018$. Standard errors are clustered at the individual level.

To assess dynamics and pre-trends, we estimate an event-study:

$$Y_{it} \;=\; \alpha_i \;+\; \lambda_t \;+\; \gamma_{h(i)} \;+\; \sum_{k \neq -1} \beta_k \, \mathbf{1}\{t - t_0 = k\} \times \text{HighMTR}_i \;+\; X_{it}'\delta \;+\; \varepsilon_{it},$$

with $t_0 = 2018$ and $k = -1$ as the omitted category. Consistent with identification, the event-time coefficients show no systematic differential trends prior to 2018. Because the reform is national, the 12% group serves as a *partially treated* comparison experiencing a smaller policy shock than the 20% group. This attenuation implies our DiD estimates are conservative: relative to a never-treated counterfactual, the true effects would be (weakly) larger in magnitude.

We (i) classify MTR using prior-year taxable income to mitigate endogenous bracket movement, (ii) report bandwidth sensitivity (e.g., ±50k, ±150k), and (iii) verify robustness to alternative fixed-effects structures (county-year or cohort-by-year). Results are stable across these variants.

C.4 Border Sample as Wang and Yang (2022)

One concern of the design using the county-specific fertility bonus is that individuals may strategically choose which registered place of living she lives, and then gain a higher bonus

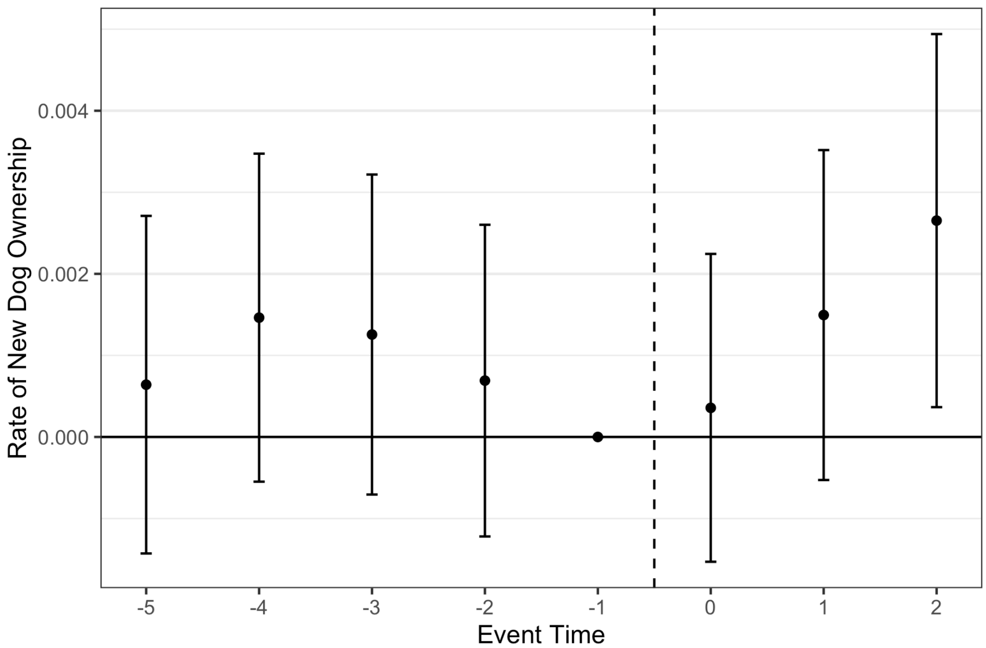

Figure 21: Tax-Deductible Expansion: Event-Study/DiD Estimates

Note: We report effects relative to the reform threshold using always-eligible as the comparison group. While mapping to an elasticity is less direct than in the bonus analysis, the sign is consistent with substitution.

without a real increase in the fertility. Namely, the childbirth bonus may not increase the fertility in a specific county but only increase the number of new birth registered in a specific county.

To address this concern, Wang and Yang (2022) restrict to a border town nonmigrant sample, trying to minimize the effects from the migration. We follow their approach to investigate the results. Due to data limitation, there are certain covariates lacking, so we cannot exactly replicate the results. The results with the most covariates we have are presented in Table 4. Focusing on the border towns significantly reduce the sample size and hence the precision of our estimates. Yet, the point estimates still suggest a consistent pattern that the childbirth and pets are of the same sign.

Dependent Variables:	Child Birth	Has Dog	Has Cat
Model:	(1)	(2)	(3)
Variables			
Age^2	-0.0001**	-3.85×10^{-6}	-1.61×10^{-5}***
	(4.87×10^{-5})	(5.91×10^{-6})	(9.98×10^{-7})
Asset	8.83×10^{-12}	-2.72×10^{-12}	8.76×10^{-13}
	(1.12×10^{-11})	(2.19×10^{-12})	(3.93×10^{-12})
Real Estate	0.0163***	0.0005**	0.0009**
	(0.0020)	(0.0002)	(0.0004)
Treat $\times$ Post	0.0027	0.0010	0.0002
	(0.0031)	(0.0013)	(0.0010)
Fixed-effects			
Ind.	Yes	Yes	Yes
Year	Yes	Yes	Yes
County	Yes	Yes	Yes
Fit statistics			
Observations	2,223,171	2,223,171	2,223,171
R^2	0.16132	0.14728	0.16892
Within R^2	0.00096	1.38×10^{-5}	5.34×10^{-5}

Clustered (County × Year) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 4: Border-Sample Difference-in-Differences as in Wang and Yang (2022)

C.5 Bonus Effects on Children

We present the results of the child bonus on children. We estimate Equation 2 and change the outcome variable into childbirth. Methods and other are as in Section 4. Figure 22 plots the results, similar to Figure 4.

Although we cannot significantly reject the zero effect, we find that the sign of the effects is similar to what have been found in the previous literature. Note that compared to Figure 4, the effect shown in Figure 22 shows up much slower.

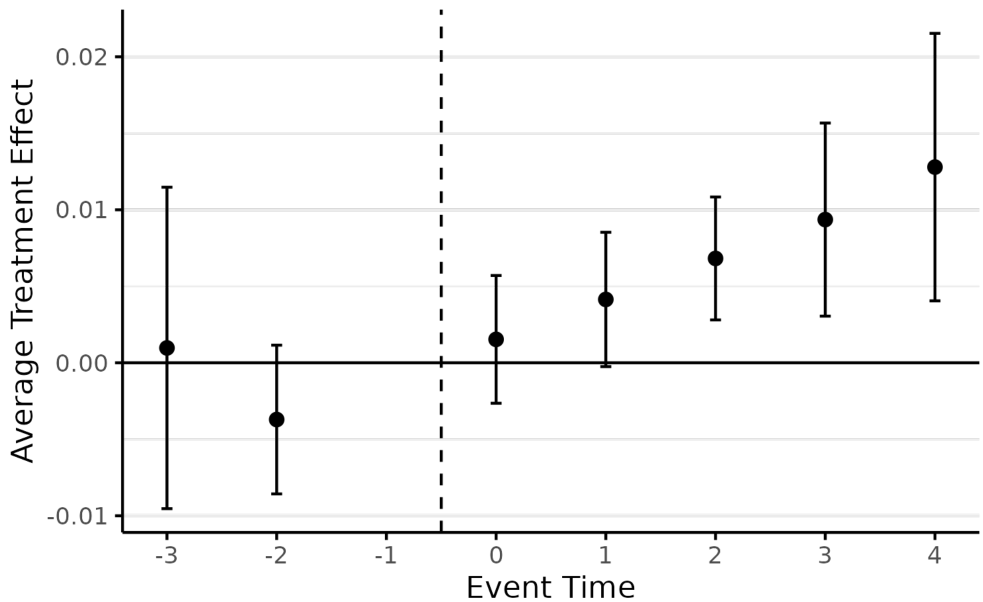

Figure 22: Estimated Effects of Child Bonus on Childbearing

Note: Event-time coefficients for childbearing around bonus introduction indicate substitution patterns consistent with the main findings.

C.6 Lottery Effects on Children

We present the results of the lottery on children. We estimate Equation 3 and change the outcome variable into childbirth. Figure 23 plots the results, similar to Figure 5.

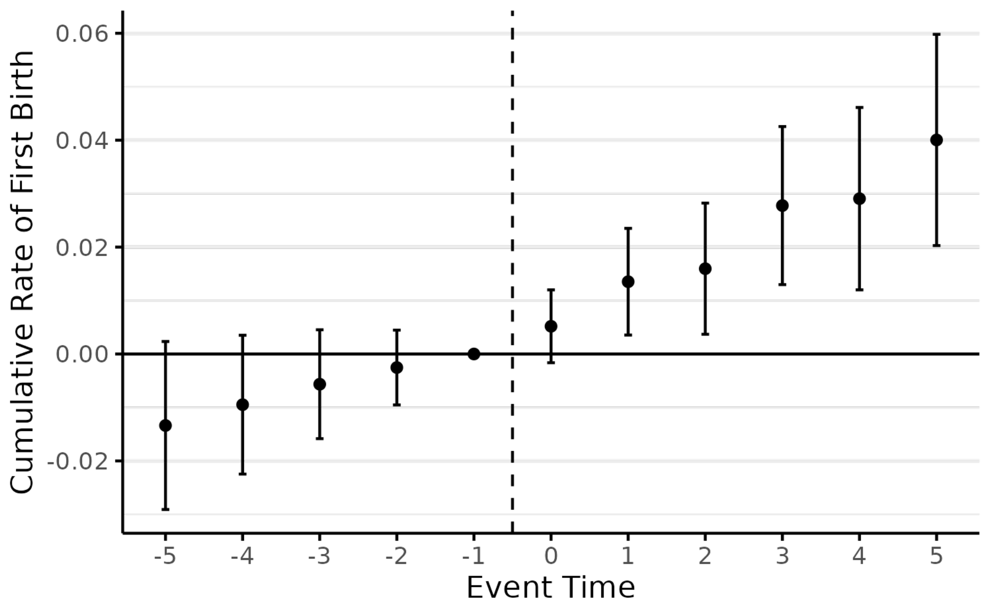

Figure 23: Lottery Shock and Childbearing

Note: Event-study around the lottery event (2×10^6 NTD) shows patterns consistent with the bonus evidence.

C.7 Event-Study Robustness for Dogs: Childbearing on First Dog Ownership

Here we present the results similar to the one in Figure 8 in Section 5. Different from the previous specifications, we restrict the outcome variable to the first time dog ownership in our data instead of any dog ownership in Figure 24, and we change the event to first-time dog ownership in Figure 25. The pattern is similar to the one above.

C.8 Post-2016 Taipei City Sample

One concern of the measurement with the registry data is that the registration rules may affect the results. To address this concern, we restrict our sample to the Taipei City as Taipei City requires both cats and dogs to register on 2016. As shown in Figures 26 and 27, the results remain unchanged for this sample.

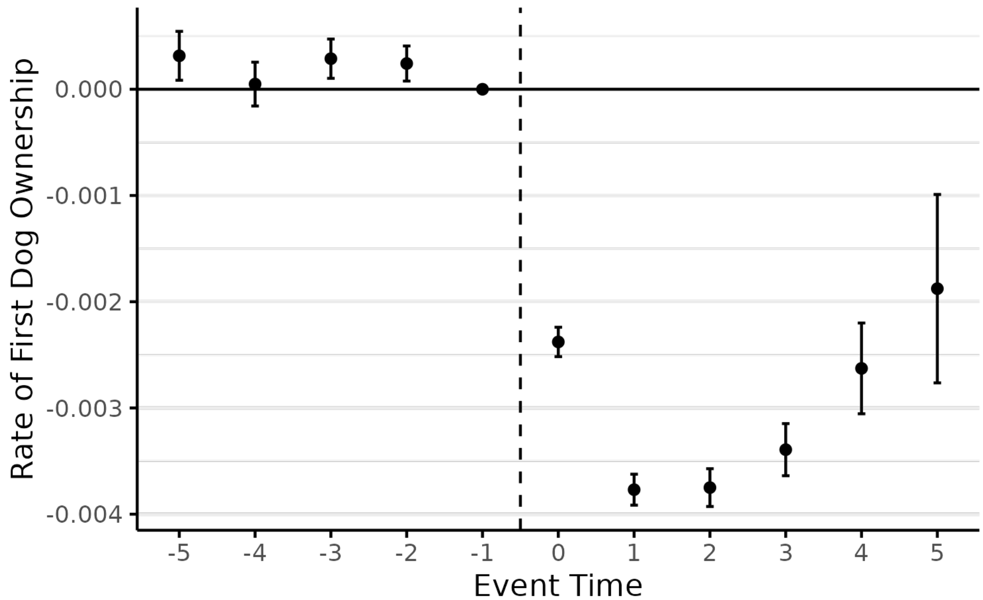

Figure 24: Childbearing on First Dog Ownership Event-Study

Note: Event-time coefficients for onset of first dog ownership.

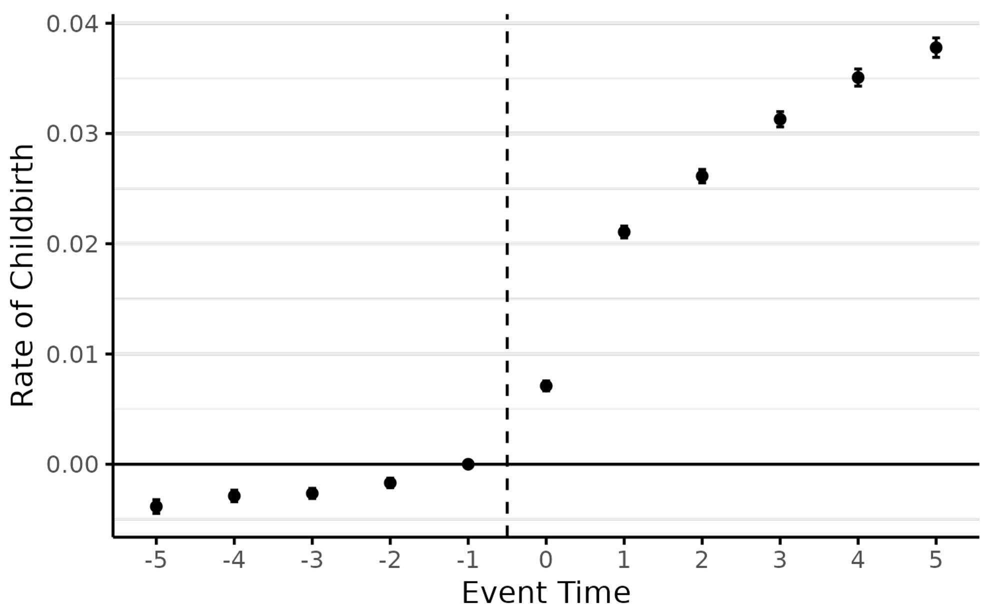

Figure 25: First Dog Ownership on Childbearing Event-Study

Note: Event-time coefficients for onset of first dog ownership using domicile-of-county definition.

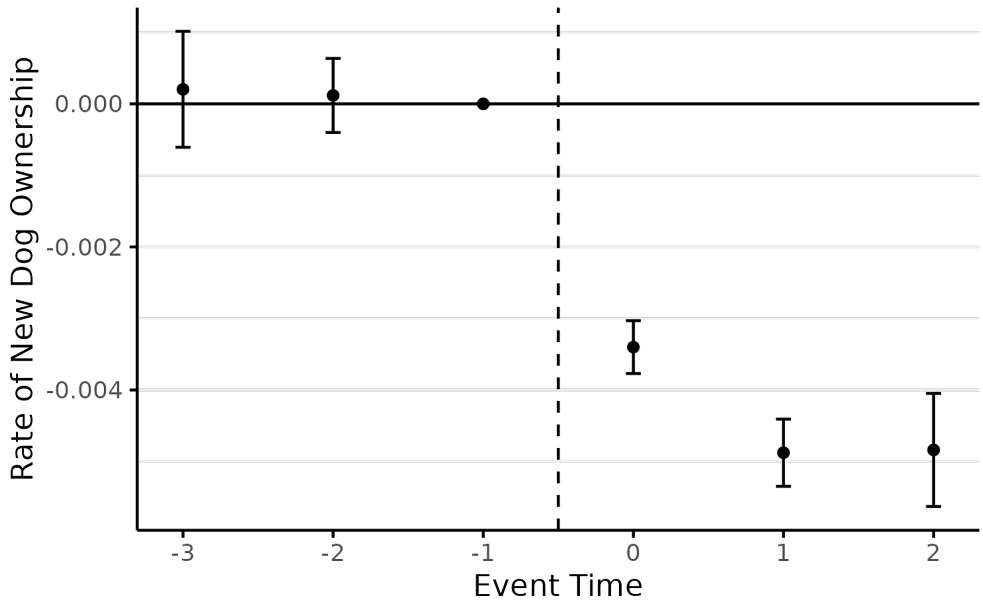

Figure 26: Childbearing on Dog Ownership Event-Study: Post-2016 Subsample

Note: Restricting to post-2016 yields similar patterns, indicating stability to sample choice.

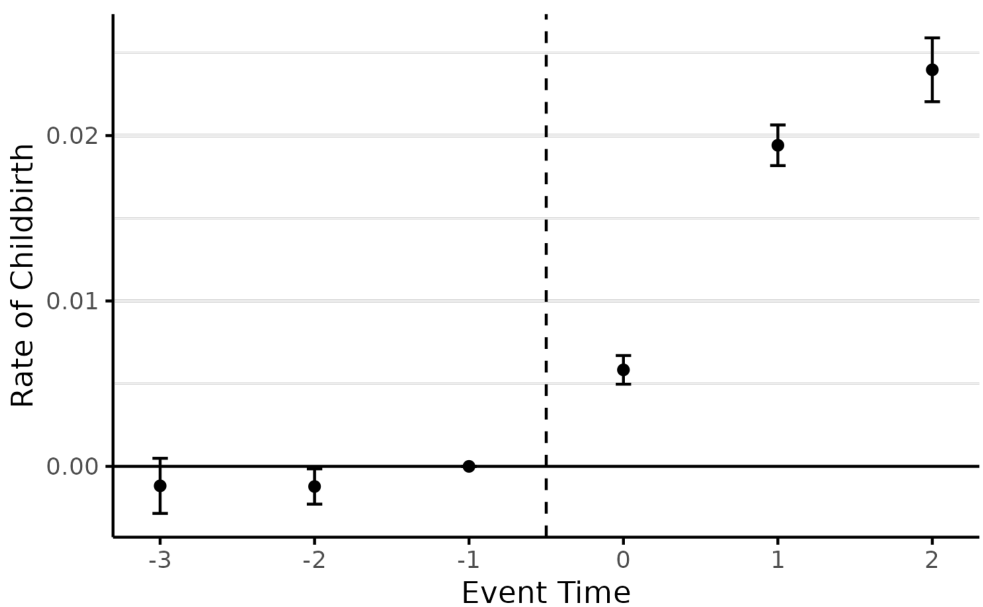

Figure 27: Dog Ownership on Childbearing Event-Study: Post-2016 Subsample

Note: Restricting to post-2016 yields similar patterns, indicating stability to sample choice.

C.9 Intensive Margin: Number of Dogs

Our main analyses focus on the extensive margin, whether an individual owns any dog, using an event-study specification. To assess intensive-margin responses, we re-estimate the event study with the outcome defined as the number of registered dogs. The corresponding figure, Figure 28, shows that the qualitative conclusions remain unchanged.

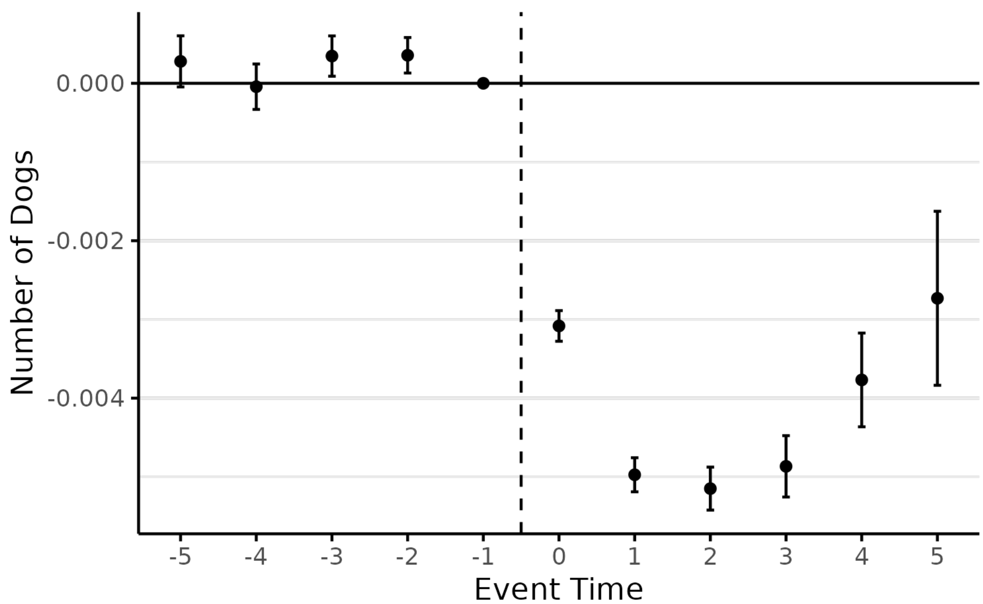

Figure 28: Event Study with Intensive-Margin Outcome: Number of Dogs

Note: This figure plots regression-adjusted event study coefficients where the outcome is the count of registered dogs rather than a binary ownership indicator. The control group consists of later-treated individuals. The x-axis is years relative to the event of interest, and the y-axis shows changes in the expected number of dogs. Standard errors are clustered at the individual level, with 95% confidence intervals shown.

C.10 Household Results

Our baseline analyses use individuals as the unit of observation, which facilitates comparisons among unmarried individuals and allows for rich individual-level controls (e.g., age). In this subsection, we re-estimate the event studies at the household level to gauge the scale and magnitude of responses in a more policy-relevant unit. We consider two complementary events: (i) first dog acquisition and (ii) childbirth within the household. The figures below report regression-adjusted event-time coefficients with later-treated households as the comparison group.

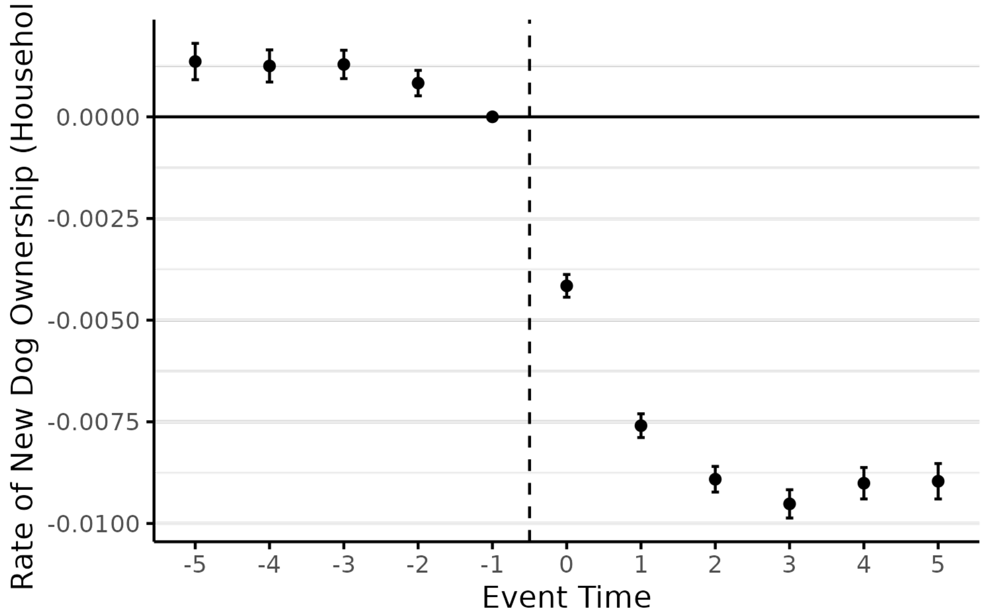

Figure 29: Event Study of Household Childbearing Around First Dog Acquisition

Note: This figure plots regression-adjusted event-study coefficients for household childbearing outcomes relative to the year of first dog acquisition in the household. The control group consists of later-treated households. The x-axis is years relative to first dog acquisition, and the y-axis shows changes in the probability of a birth within the household. Standard errors are clustered at the household level, with 95% confidence intervals shown.

D Results on Cats

We next present results for cats, structured in parallel to the dog analyses. Figures 31–34 document the policy and lottery designs, while Figures 35–41 show raw event patterns and event-study estimates for various life events. Overall speaking, the results from cats resemble to the results from the dogs, despite that cats are negatively correlated to children in the raw data. It's also worth noting that the estimates from cats are typically smaller in magnitude.

We next turn to raw event-study plots and corresponding regression-adjusted estimates.

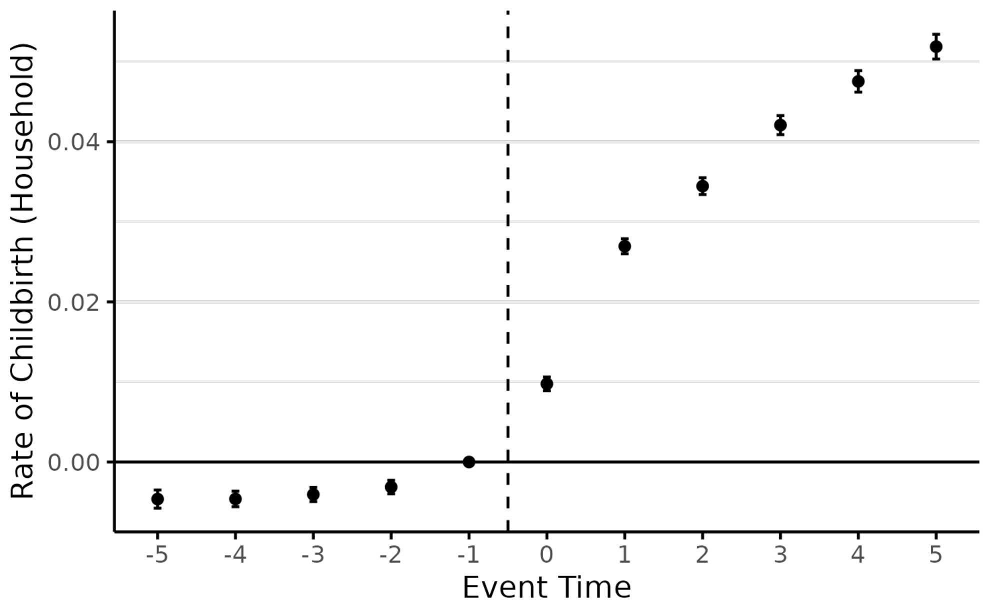

Figure 30: Event Study of Household Dog Ownership Around Childbirth

Note: This figure plots regression-adjusted event-study coefficients for household dog ownership outcomes relative to the year of childbirth in the household. The control group consists of later-treated households. The x-axis is years relative to childbirth, and the y-axis shows changes in the probability that the household owns a dog. Standard errors are clustered at the household level, with 95% confidence intervals shown.

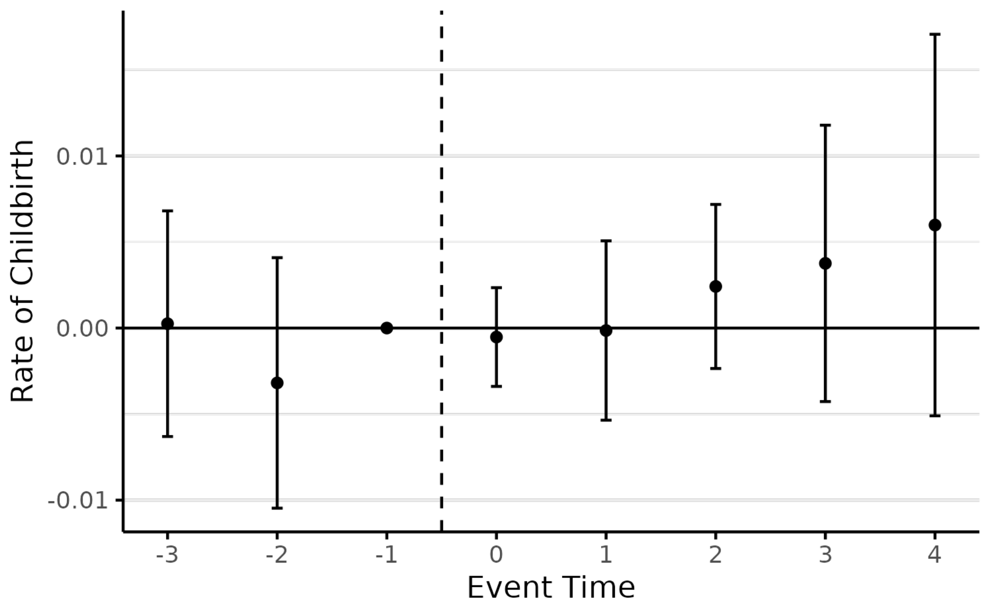

Figure 31: Effect of Childbirth Bonus Increases on Fertility

Note: This figure plots the estimated coefficients from Equation 2 with the indicator variable of having a new child as the outcome variable. The x-axis indicates years relative to the bonus increase, and the y-axis shows differences in childbearing rates. Standard errors are clustered at the county level, with 95% confidence intervals shown. This serves as a benchmark for comparison with cat ownership responses.

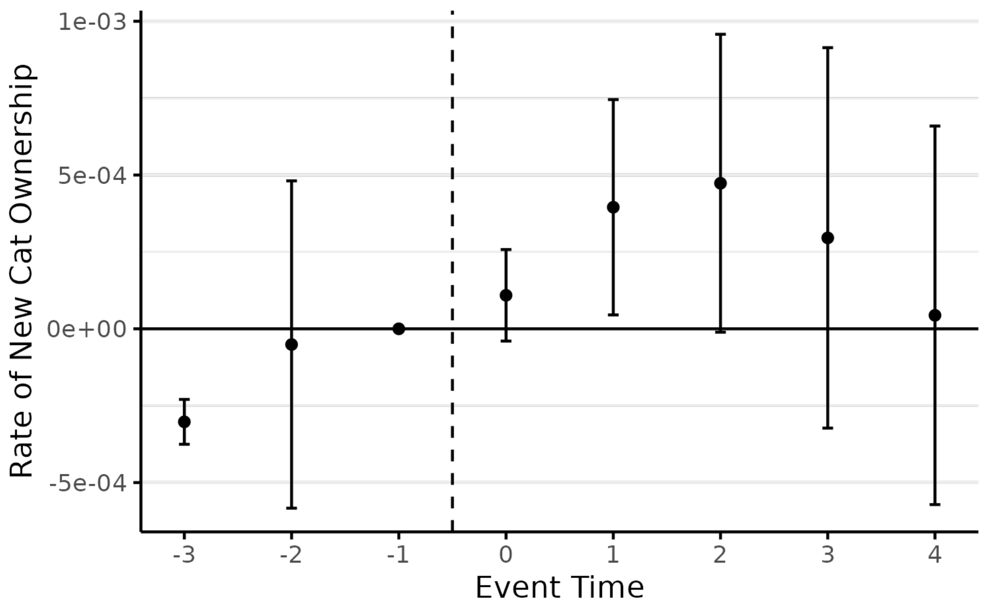

Figure 32: Effect of Childbirth Bonus Increases on the Annual Flow of Cat Ownership

Note: This figure plots the estimated coefficients from Equation 2 with the indicator variable of having a new cat as the outcome variable. The x-axis indicates years relative to the bonus increase, and the y-axis shows the difference in rates of new cat ownership. Standard errors are clustered at the county level, and error bars denote 95% confidence intervals. The pattern echoes the substitution responses observed for dogs.

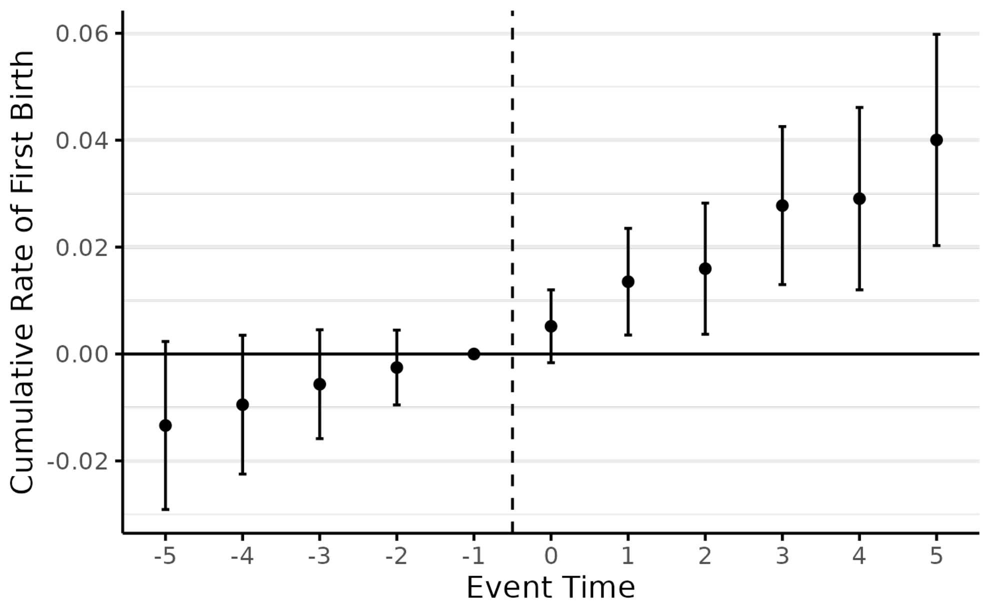

Figure 33: Effect of Lottery Winnings on Fertility

Note: This figure plots the estimated coefficients from Equation 3 with the indicator variable of having a new child as the outcome variable. The x-axis indicates years relative to the lottery winnings, and the y-axis shows differences in childbearing rates. Standard errors are clustered at the individual level, with 95% confidence intervals shown. This provides a direct income shock comparison for fertility outcomes.

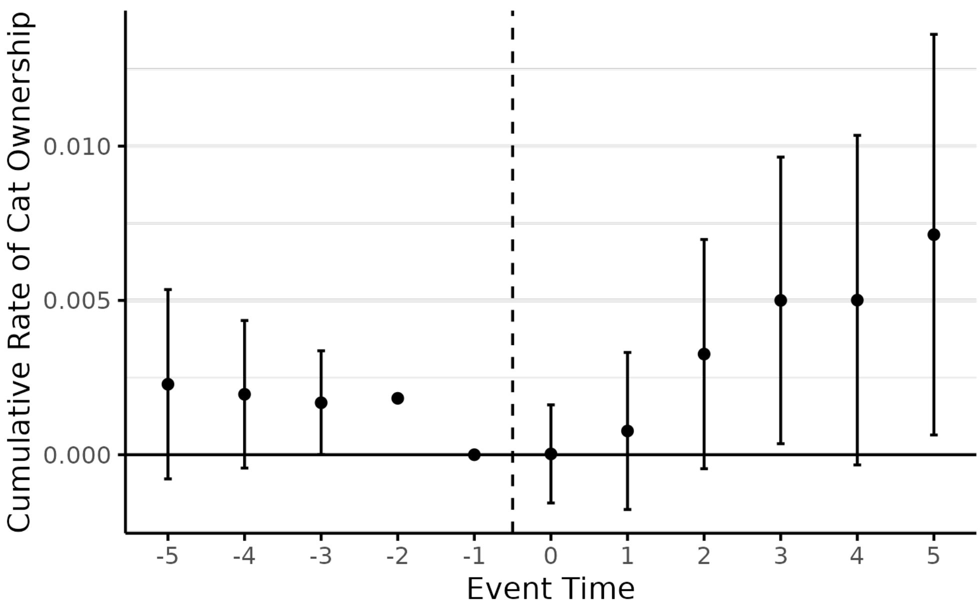

Figure 34: Effect of Lottery Winnings on the Annual Flow of Cat Ownership

Note: This figure plots the estimated coefficients from Equation 3 with the indicator variable of having a new cat as the outcome variable. The x-axis indicates years relative to the lottery winnings, and the y-axis shows the difference in rates of new cat ownership. Standard errors are clustered at the individual level, and error bars denote 95% confidence intervals. The estimates suggest substitution toward cats in response to windfall income.

Figures 35–38 show how cat ownership and childbearing co-move, while Figures 39–41 examine other major family shocks.

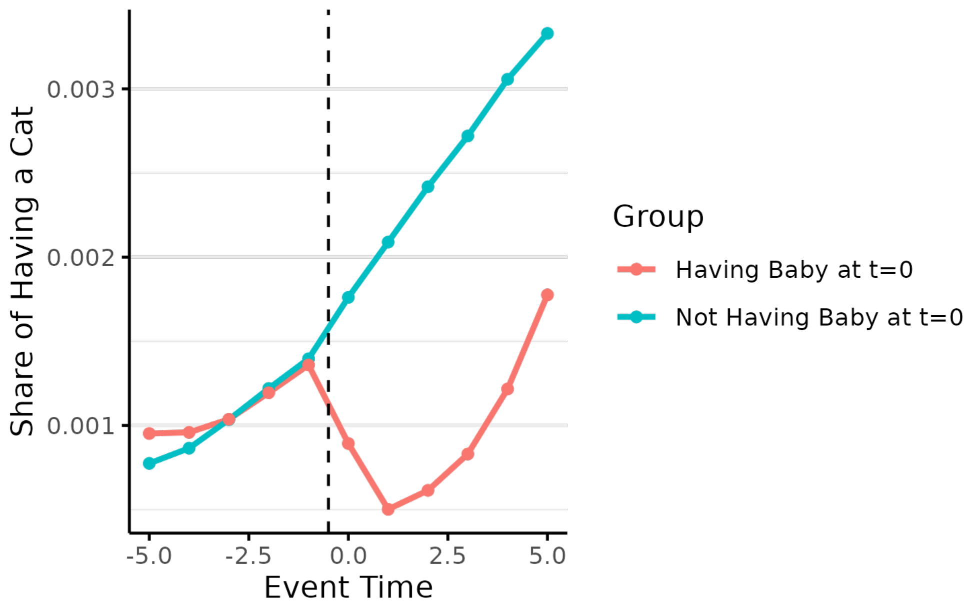

Figure 35: Raw Event Study: Childbearing Around Cat Ownership

Note: This figure shows raw means of childbearing outcomes by event time relative to first acquiring a cat. The x-axis is years relative to cat acquisition, and the y-axis is the average childbearing rate.

E Outcome on Marriage

We examine how marriage timing evolves around the first acquisition of a dog using a regression-adjusted event-study design. Figure 42 plots cohort-relative coefficients where later-treated individuals serve as the comparison group, and time is measured in years relative to the acquisition year.

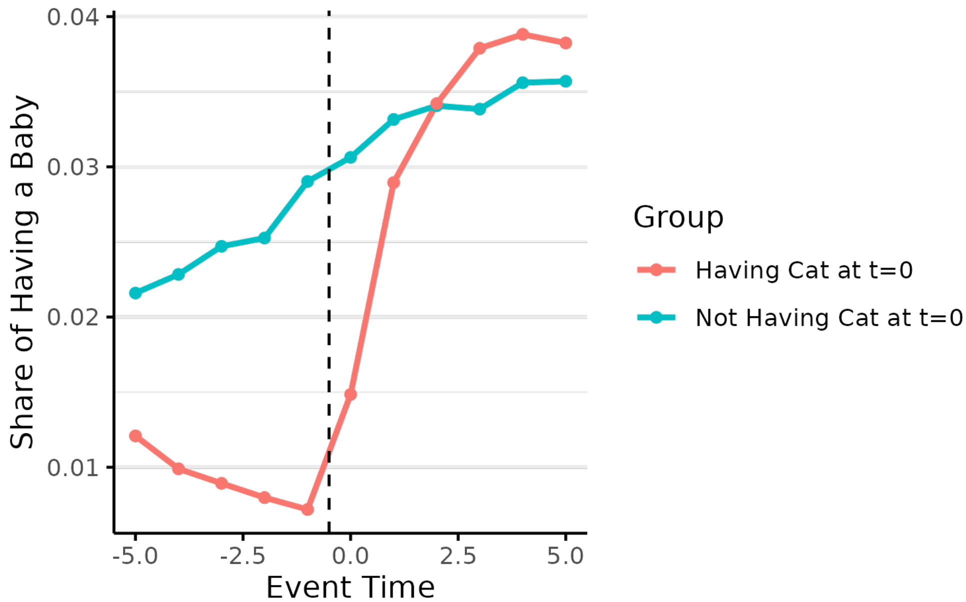

Figure 36: Raw Event Study: Cat Ownership Around Childbearing

Note: This figure shows raw means of cat acquisition by event time relative to childbirth. The x-axis is years relative to childbearing, and the y-axis is the average probability of acquiring a cat.

F Other Details

F.1 Expenditure Shares

In order to translate the reduced-form effects into elasticities, we first calculate the expenditure shares of pets and children within household budgets. For pets, we rely on data on average annual expenditures in 2023, which amount to approximately 30,093 NTD for dogs and 24,577 NTD for cats (Directorate-General of Budget, Accounting and Statistics, Executive Yuan, 2025). These figures are then normalized by household consumption, which we obtain from an expenditure survey that reports total average consumption of 930,374 NTD for households with an average income of 1,116,195 NTD. Dividing pet expenditures by this consumption measure yields an expenditure share of about 3.23% for dogs.

Estimating the resource share devoted to children is more complex, as household consumption on children is only partially captured in reported expenses. We therefore adopt an equivalence-scale approach that translates household composition into consumption weights.

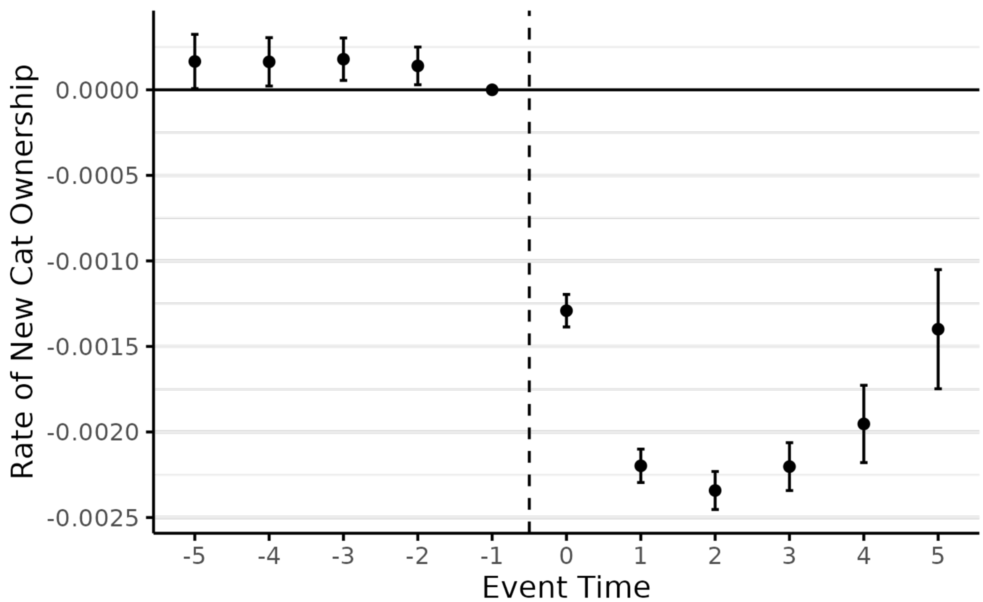

Figure 37: Event Study of Childbearing Outcomes Around Cat Ownership

Note: This figure plots regression-adjusted event study coefficients of childbearing relative to the year of first cat acquisition. The control group consists of later-treated individuals. The x-axis is years relative to cat acquisition, and the y-axis shows the difference in childbearing probability. Standard errors are clustered at the individual level, with 95% confidence intervals shown.

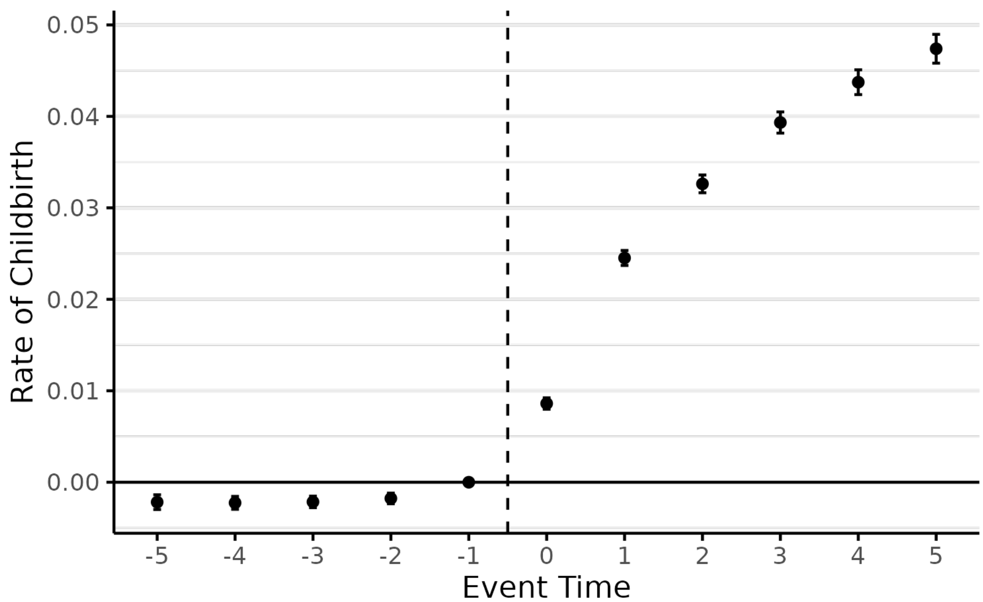

Figure 38: Event Study of Cat Ownership Around the Birth of a Child

Note: This figure plots regression-adjusted event study coefficients of cat ownership relative to the year of childbirth. The control group consists of later-treated individuals. The x-axis is years relative to childbearing, and the y-axis shows the difference in the probability of acquiring a cat. Standard errors are clustered at the individual level, with 95% confidence intervals shown.

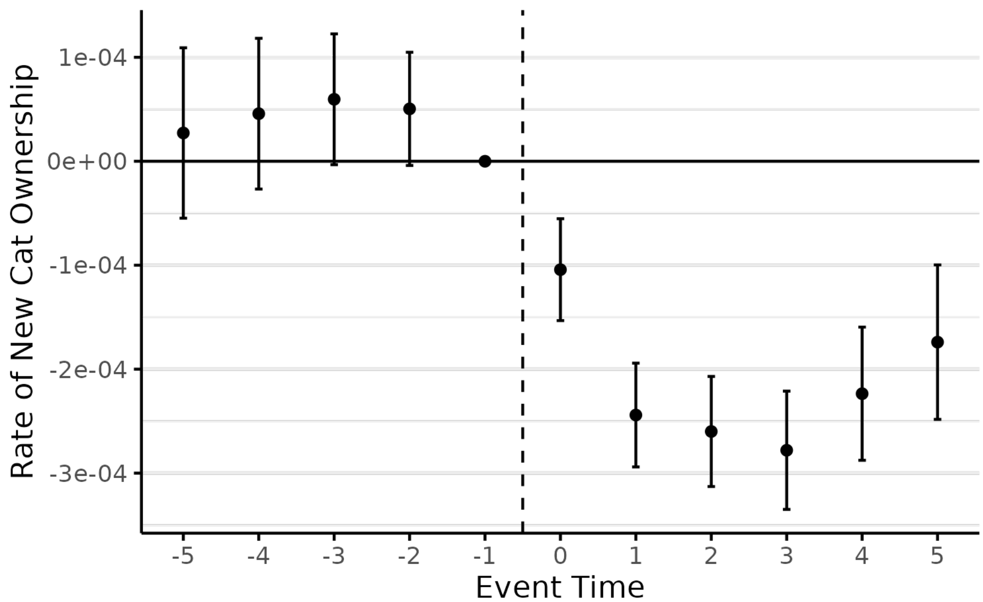

Figure 39: Event Study of Cat Ownership Around the Birth of a Grandchild

Note: This figure plots event study coefficients of cat ownership relative to the year of a grandchild's birth. The x-axis is years relative to the grandchild's birth, and the y-axis shows the change in probability of owning a cat. Standard errors are clustered at the individual level, with 95% confidence intervals shown.

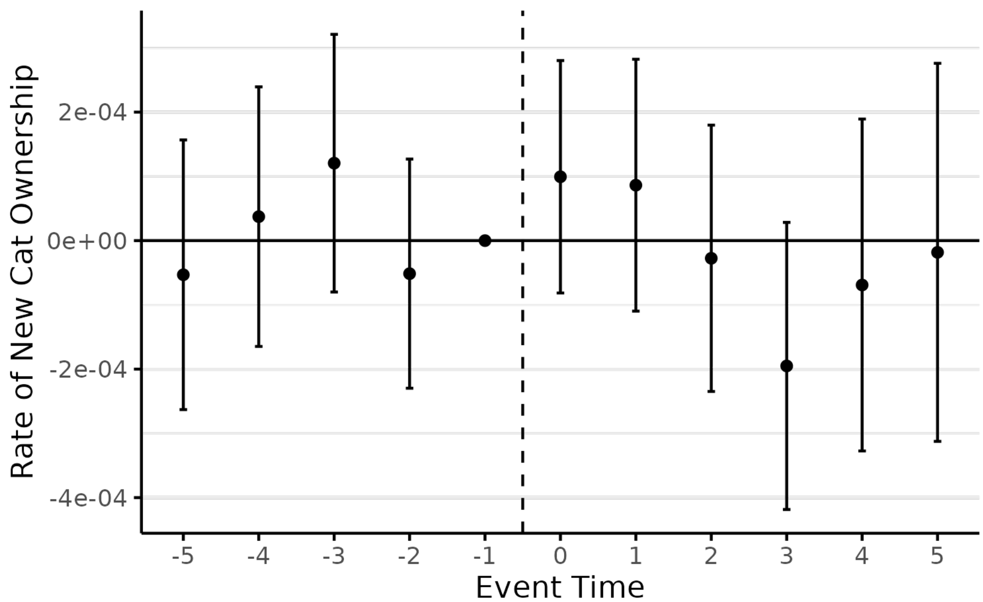

Figure 40: Event Study of Cat Ownership Around the Death of a Child

Note: This figure plots event study coefficients of cat ownership relative to the year of a child's death. The control group consists of individuals whose child dies later. The x-axis is years relative to the child's death, and the y-axis shows the change in probability of owning a cat. Standard errors are clustered at the individual level, with 95% confidence intervals shown.

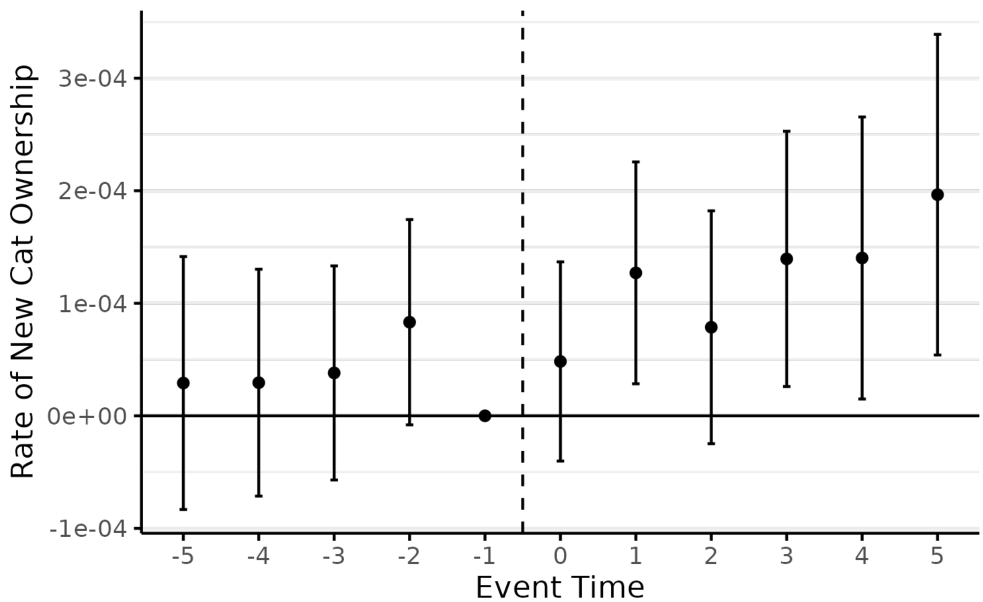

Figure 41: Event Study of Cat Ownership Around the Death of a Spouse

Note: This figure plots event study coefficients of cat ownership relative to the year of a spouse's death. The control group consists of individuals whose spouse dies later. The x-axis is years relative to the spouse's death, and the y-axis shows the change in probability of owning a cat. Standard errors are clustered at the individual level, with 95% confidence intervals shown.

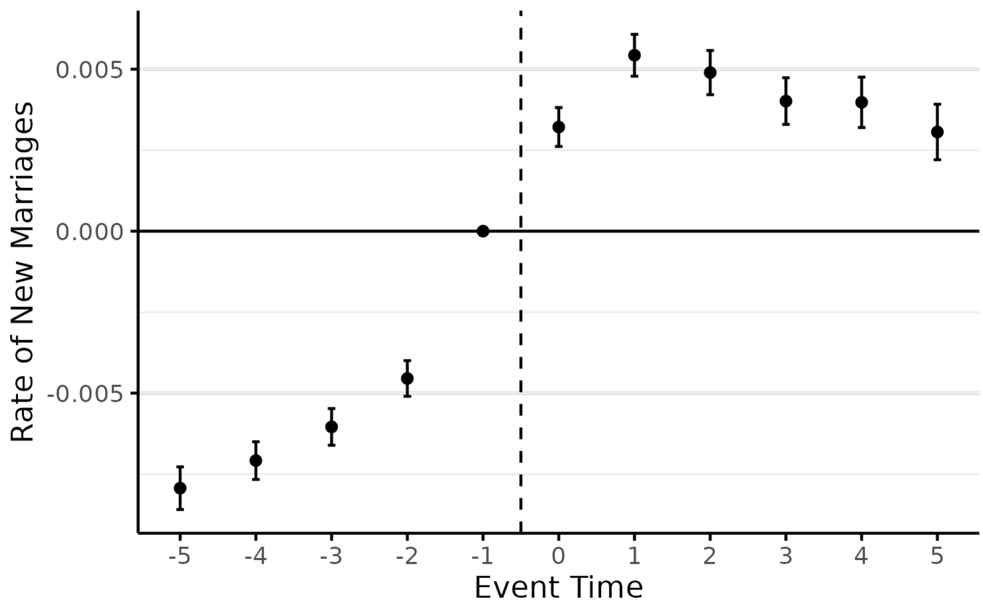

Figure 42: Event Study of Marriage Outcomes Around Dog Ownership

Note: This figure plots regression-adjusted event study coefficients of marriage relative to the year of first dog acquisition. The control group consists of later-treated individuals. The x-axis is years relative to dog acquisition, and the y-axis shows the difference in the probability of marrying. Standard errors are clustered at the individual level, with 95% confidence intervals shown.

Following the conventional scale, a child under age 14 is assigned a weight of 0.3 relative to an adult (OECD, 2024*a*). In a household with two adults and one child, the implied share is $\frac{0.3}{2.3} \approx 13\%$, or $\frac{0.3}{1.8} \approx 17\%$ if two adults are given unit weight and the child is scaled accordingly.

With these expenditure shares in hand, we then proceed to combine them with the reduced-form estimates of how price variation in one domain affects the quantity demanded in the other. The mapping from reduced-form coefficients to elasticities follows the standard demand-system logic. Specifically, if $\hat{\beta}$ denotes the reduced-form effect of a change in the price of good x on the quantity of good y, then the implied cross-price elasticity is given by

$$\eta_{xy} \;=\; \hat{\beta} \cdot \frac{p_x}{q_y} \cdot \frac{C}{s_y},$$

where p_x is the average price of good x, q_y is the average quantity of good y, C is total household consumption, and s_y is the expenditure share of good y. This transformation ensures that the elasticity is dimensionless and directly interpretable as the percentage change in y associated with a one percent change in the price of x.

Finally, we supplement these calculations with alternative elasticity estimates based on income variation. Using household income data—averaging 357,228 NTD in one benchmark subsample—we compute an income elasticity of pet expenditures of roughly 0.11, with alternative estimates closer to 0.15 depending on the source. By the Slutsky equation, the total (Marshallian) price elasticity can then be expressed as

$$\epsilon^M_{xy} \;=\; \epsilon^H_{xy} - s_y \cdot \eta_y,$$

where ϵ^H_{xy} is the Hicksian (compensated) elasticity, s_y is the expenditure share of good y, and η_y is the income elasticity of demand for y. This decomposition allows us to assess how sensitive our results are to assumptions about income responsiveness. The combination of expenditure shares, reduced-form coefficients, and income elasticities yields a consistent set of elasticity estimates that can be compared across specifications and data sources.

G Effects Heterogeneity

In this section we present the event study results by different sex, income status, and house ownership status. The results correspond to Figure 8 and 9 in the main text.

G.1 Heterogeneity by Sex

We first present the results by sex. Figures 43 and 44 report the event study of childbirth on dog acquisition for males and females, respectively. Figures 45 and 46 report the event study of dog acquisition on childbearing for males and females, respectively.

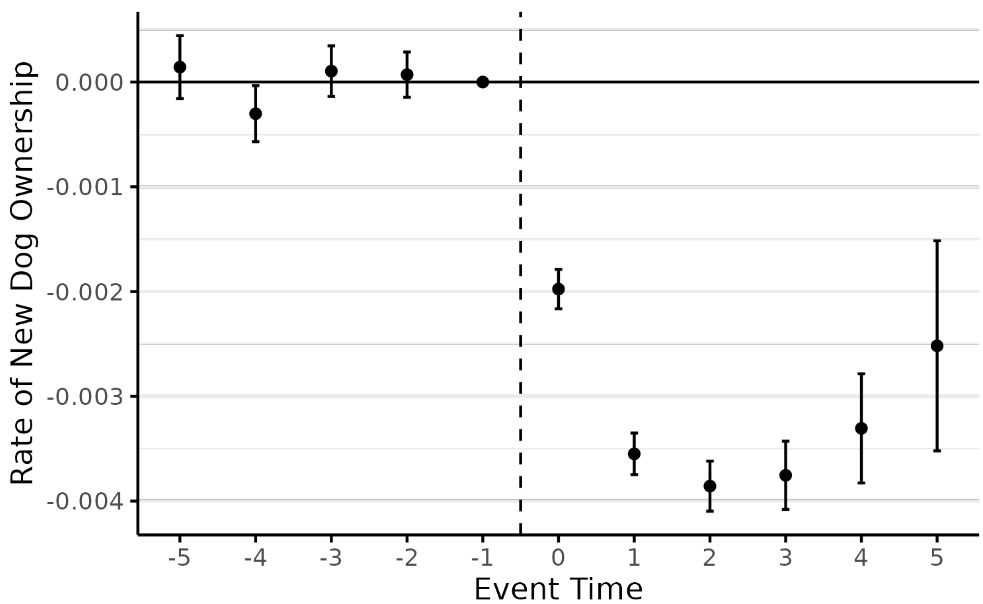

Figure 43: Event Study by Sex (Male): Dog Acquisition Around Childbirth

Note: Event-time coefficients for the probability that a male acquires a new dog, aligned on the year he has a newborn child. The comparison group consists of males who have a child in later years. The x-axis shows years relative to childbirth and the y-axis shows differences in the probability of acquiring a dog relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

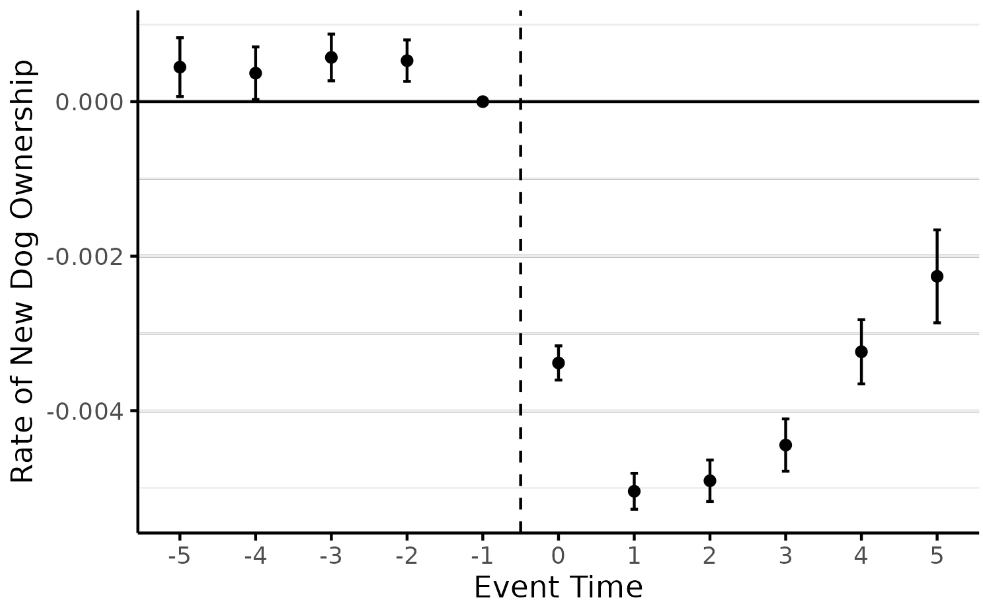

Figure 44: Event Study by Sex (Female): Dog Acquisition Around Childbirth

Note: Event-time coefficients for the probability that a female acquires a new dog, aligned on the year she has a newborn child. The comparison group consists of females who have a child in later years. The x-axis shows years relative to childbirth and the y-axis shows differences in the probability of acquiring a dog relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

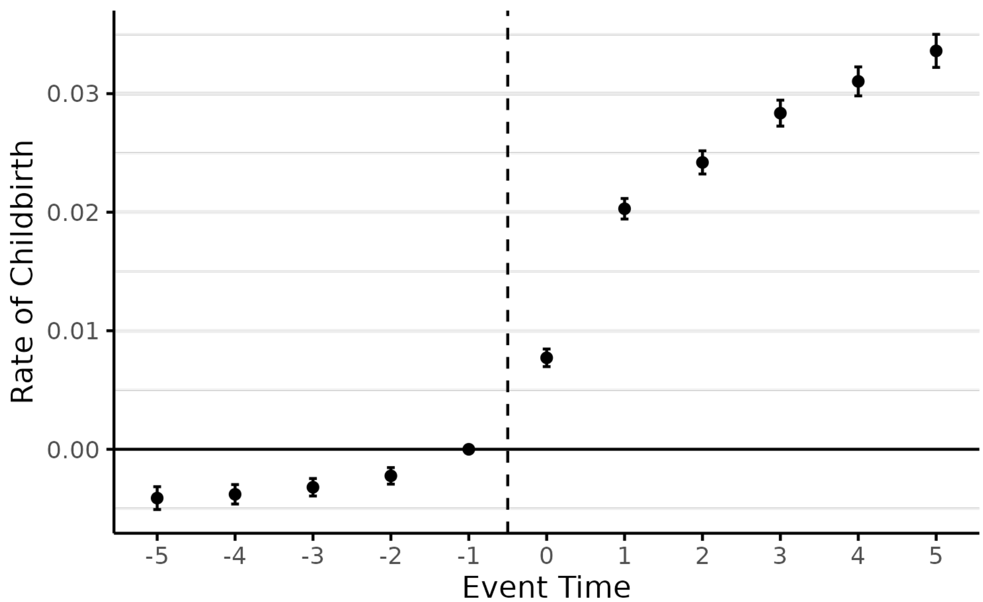

Figure 45: Event Study by Sex (Male): Childbearing Around Dog Acquisition

Note: Event-time coefficients for the probability that a male has a newborn child, aligned on the year of his first dog acquisition. The comparison group consists of males who acquire a dog in later years. The x-axis shows years relative to dog acquisition and the y-axis shows differences in the probability of having a newborn child relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

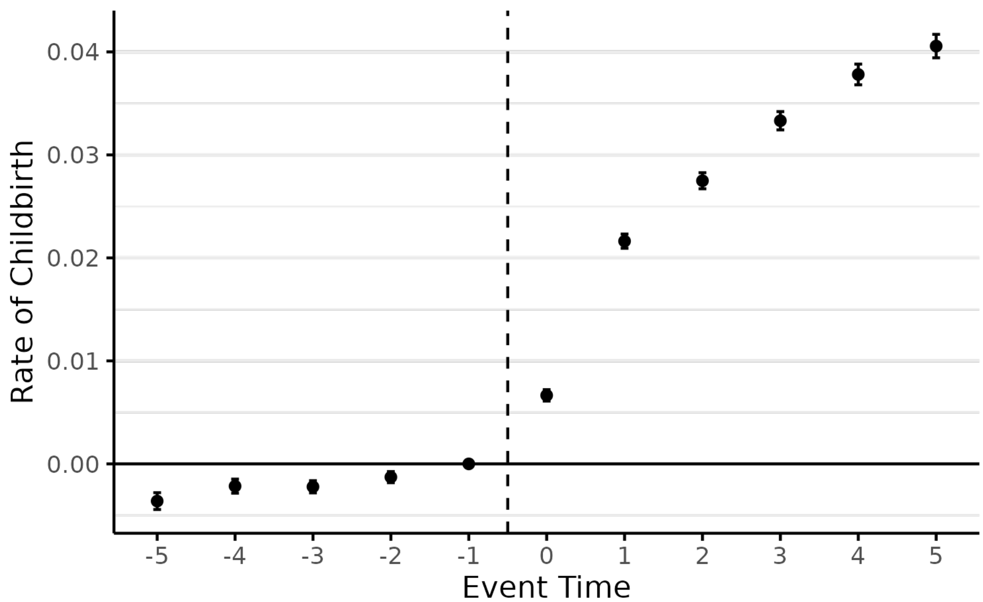

Figure 46: Event Study by Sex (Female): Childbearing Around Dog Acquisition

Note: Event-time coefficients for the probability that a female has a newborn child, aligned on the year of her first dog acquisition. The comparison group consists of females who acquire a dog in later years. The x-axis shows years relative to dog acquisition and the y-axis shows differences in the probability of having a newborn child relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

G.2 Heterogeneity by Income

We examine whether event-time responses vary across income groups. Figures 47 and 48 report event-study coefficients for dog acquisition around childbirth among individuals with no reported income (income0) and those in the top income quartile (income4), respectively. Figures 49 and 50 report the corresponding coefficients for childbearing around first dog acquisition in the same two income strata.

Across all four panels, the event time is aligned on the focal event year and coefficients are interpreted relative to an omitted pre-event period. Each figure uses later-treated units within the same income group as the comparison set and clusters standard errors at the individual level. These panels allow readers to compare magnitudes and timing across the no-income and top-quartile groups without mixing populations.

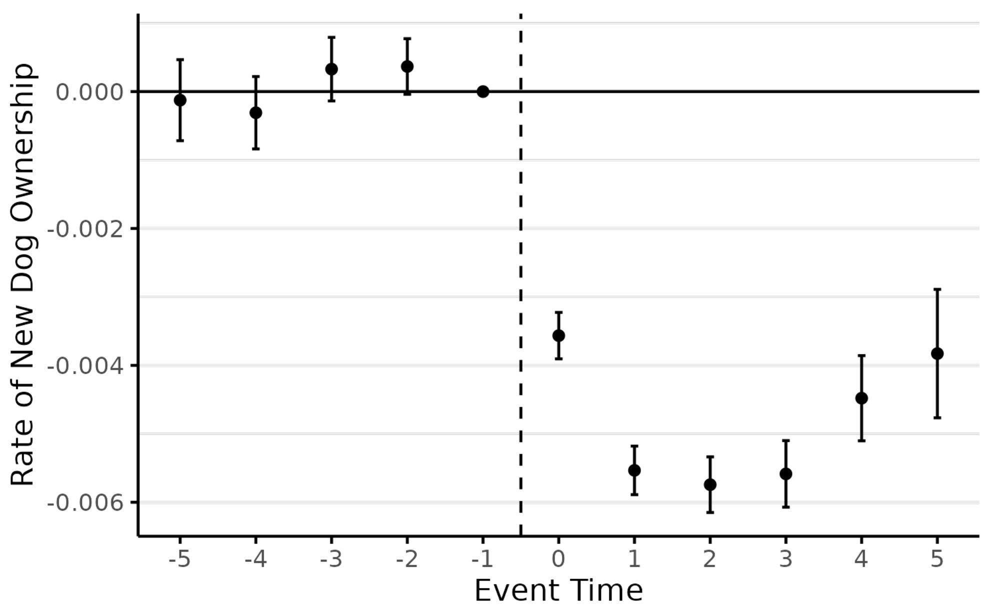

Figure 47: Event Study by Income (No Income): Dog Acquisition Around Childbirth

Note: Event-time coefficients for the probability of acquiring a new dog among individuals with no reported income, aligned on the year of childbirth. The comparison group consists of those who give birth in later years within the same income group. The x-axis shows years relative to childbirth; the y-axis shows differences in the probability of acquiring a dog relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

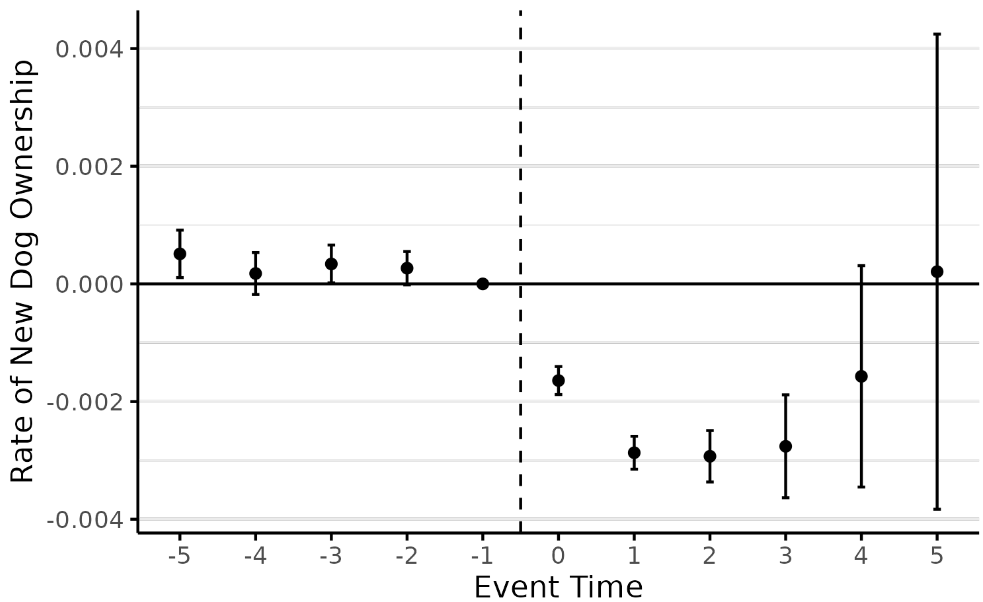

Figure 48: Event Study by Income (Top Quartile): Dog Acquisition Around Childbirth

Note: Event-time coefficients for the probability of acquiring a new dog among individuals in the highest income quartile, aligned on the year of childbirth. The comparison group consists of those who give birth in later years within the same income group. The x-axis shows years relative to childbirth; the y-axis shows differences in the probability of acquiring a dog relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

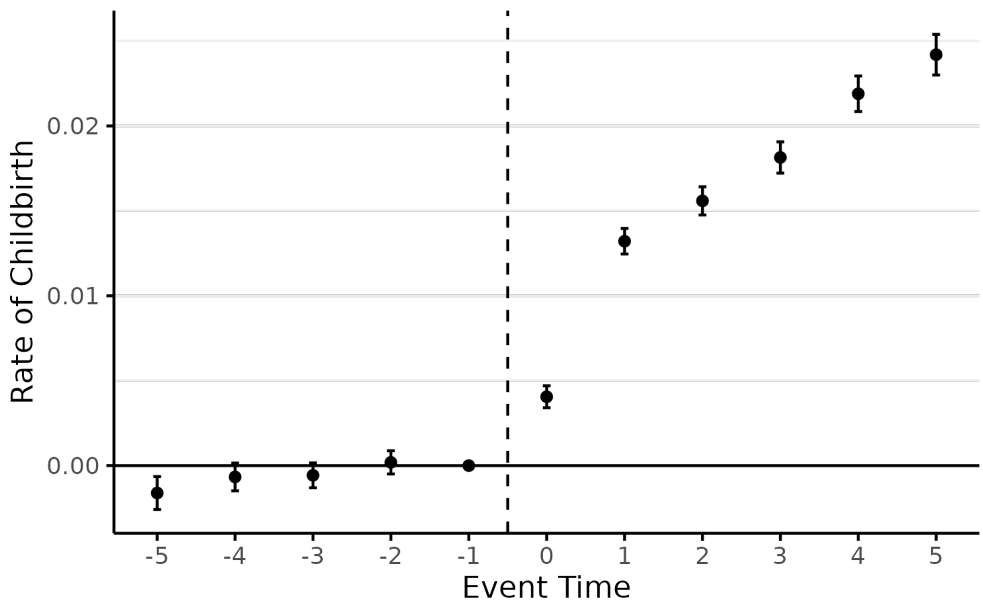

Figure 49: Event Study by Income (No Income): Childbearing Around Dog Acquisition

Note: Event-time coefficients for the probability of having a newborn child among individuals with no reported income, aligned on the year of first dog acquisition. The comparison group consists of later dog acquirers within the same income group. The x-axis shows years relative to dog acquisition; the y-axis shows differences in the probability of having a newborn child relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

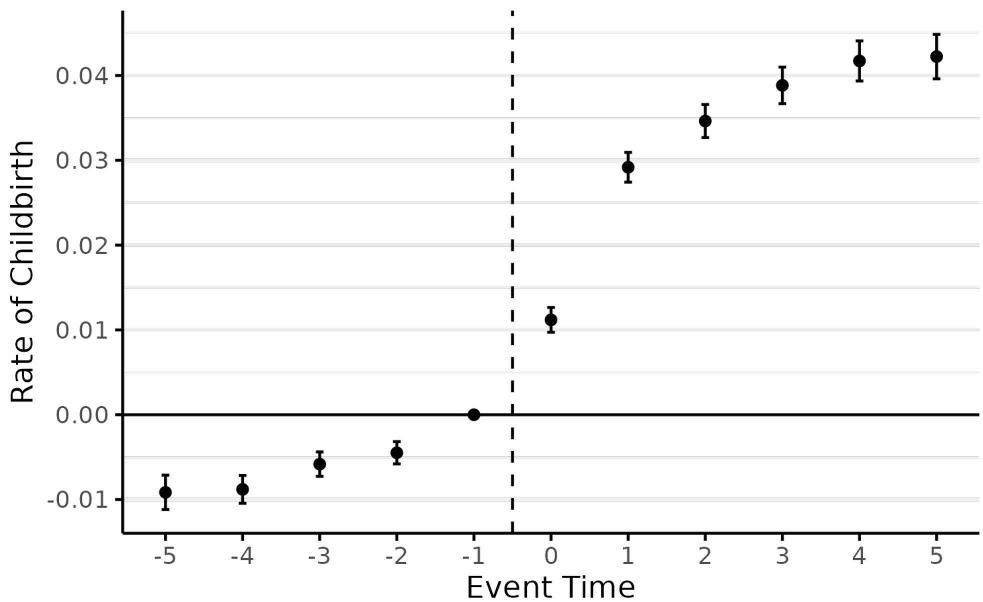

Figure 50: Event Study by Income (Top Quartile): Childbearing Around Dog Acquisition

Note: Event-time coefficients for the probability of having a newborn child among individuals in the highest income quartile, aligned on the year of first dog acquisition. The comparison group consists of later dog acquirers within the same income group. The x-axis shows years relative to dog acquisition; the y-axis shows differences in the probability of having a newborn child relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

G.3 Heterogeneity by Homeownership

We also assess heterogeneity by homeownership status at baseline. Figures 51 and 52 present event-study coefficients for dog acquisition around childbirth for non-owners (estate0) and homeowners (estate1), respectively. Figures 53 and 54 present the corresponding coefficients for childbearing around first dog acquisition in the same housing strata.

In each panel, event time is centered on the relevant event and effects are shown relative to the omitted pre-event period. The comparison group consists of later-treated units within the same ownership stratum, and standard errors are clustered at the individual level. Together these figures facilitate side-by-side comparisons across non-owners and owners while keeping identification and scaling consistent.

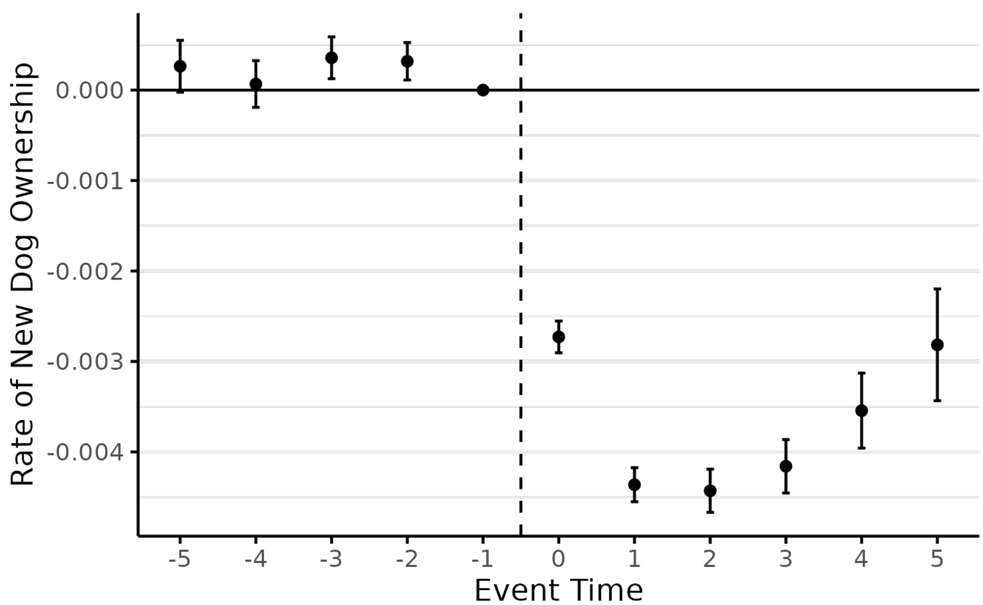

Figure 51: Event Study by Housing (Non-Owners): Dog Acquisition Around Childbirth

Note: Event-time coefficients for the probability of acquiring a new dog among individuals who do not own a home, aligned on the year of childbirth. The comparison group consists of those who give birth in later years within the same housing group. The x-axis shows years relative to childbirth; the y-axis shows differences in the probability of acquiring a dog relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

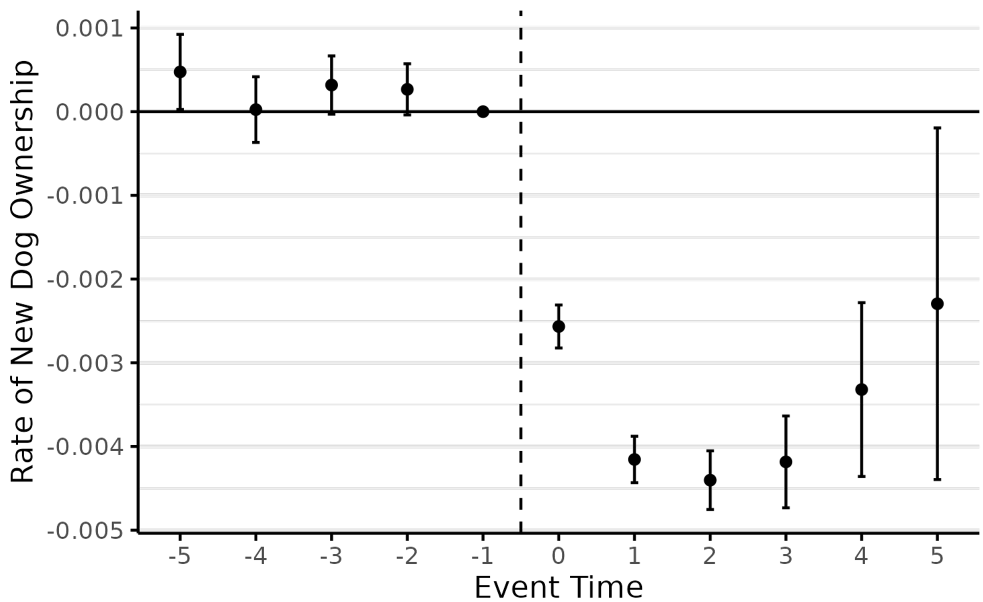

Figure 52: Event Study by Housing (Homeowners): Dog Acquisition Around Childbirth

Note: Event-time coefficients for the probability of acquiring a new dog among homeowners, aligned on the year of childbirth. The comparison group consists of those who give birth in later years within the same housing group. The x-axis shows years relative to childbirth; the y-axis shows differences in the probability of acquiring a dog relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

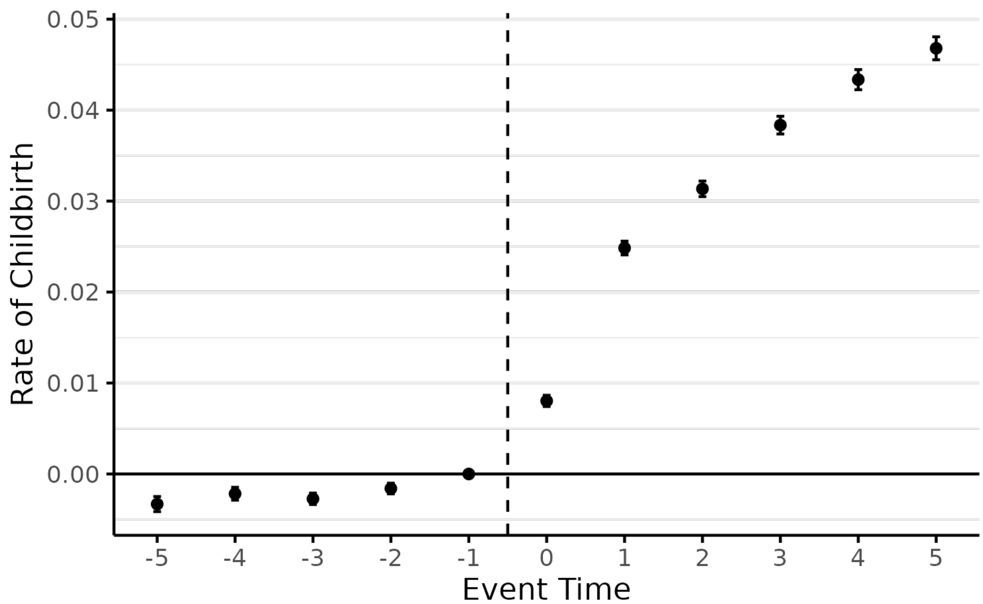

Figure 53: Event Study by Housing (Non-Owners): Childbearing Around Dog Acquisition

Note: Event-time coefficients for the probability of having a newborn child among individuals who do not own a home, aligned on the year of first dog acquisition. The comparison group consists of later dog acquirers within the same housing group. The x-axis shows years relative to dog acquisition; the y-axis shows differences in the probability of having a newborn child relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.

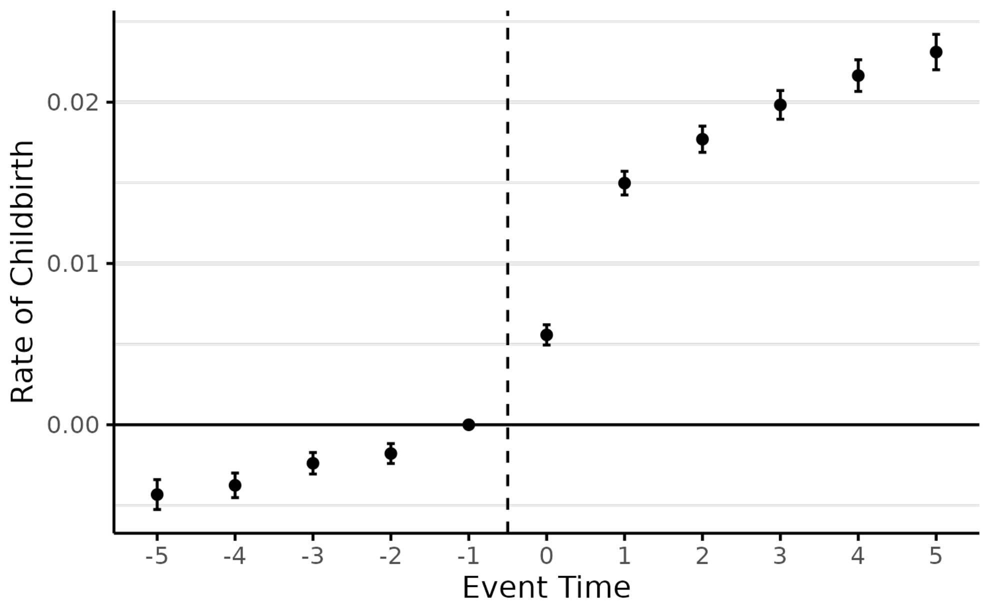

Figure 54: Event Study by Housing (Homeowners): Childbearing Around Dog Acquisition

Note: Event-time coefficients for the probability of having a newborn child among homeowners, aligned on the year of first dog acquisition. The comparison group consists of later dog acquirers within the same housing group. The x-axis shows years relative to dog acquisition; the y-axis shows differences in the probability of having a newborn child relative to the omitted pre-period. Standard errors are clustered at the individual level and 95% confidence intervals are shown.