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Abstract*

This paper estimates the effect of childcare availability on parents' employment probability using the timing of death of grandmothers–the primary childcare providers in Mexico–as identifying variation. I use a triple-difference to disentangle the effect of coinhabiting grandmothers' deaths due to their impact on childcare from their effects due to alternative mechanisms. Through their impact on childcare availability, grandmothers' deaths reduce mothers' employment rate by 12 percentage points (27 percent) and do not affect fathers' employment rate. The negative effect on mothers' employment is smaller where public daycare is more available, or private daycare or schools are more affordable.

JEL classifications: D10, J22, J16, J24
Keywords: Gender gap, Triple-difference, Motherhood penalty, Childcare, Mexico

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The gender gap in employment rate is a core issue in labor markets. This gap widens when women bear children, reflecting the fact that motherhood plays a significant role in its formation (Angrist and Evans, 1998; Waldfogel, 1998; Bertrand, Goldin and Katz, 2010; Kleven, Landais and Søgaard, 2019). Decision-makers can more efficiently guide policy to reduce the gender gap when they understand the role of each motherhood-related mechanism affecting employment. These mechanisms include specialization (Becker, 1991), gender roles (O'Neill, 2003; Dhar, Jain and Jayachandran, 2019), personal preferences (Daymont and Andrisani, 1984), and labor market discriminatory demand (Correll, Benard and Paik, 2007).

This paper focuses on the specific mechanism of childcare availability. Parental employment and the amount of nonparental-provided childcare are likely decided simultaneously; hence, estimating the causal relationship between childcare availability and employment is challenging. To overcome this challenge, I use a natural experiment based on the plausibly exogenous timing of death of coinhabiting grandmothers and a stacked triple-difference to disentangle the effect of these deaths due to their impact on childcare availability from their effects through alternative mechanisms. The first difference is a within-individual comparison of employment status quarters before and after the death. The second difference compares those who suffered the loss with those who did not. The third difference exploits the discontinuity in childcare need generated by eligibility to attend elementary school by comparing the double difference effect on parents who need more childcare (oldest child not eligible to attend elementary school, less than 6 years old) with that of parents who need it less (oldest child old enough to attend elementary school, 6 years old or older). The triple-difference captures the effect of grandmothers' deaths through their impact on childcare by canceling out mechanisms that impact households irrespectively of the oldest child's eligibility to attend elementary school.

The natural experiment and each of the differences in the triple-difference strategy addresses a class of issues that threaten identification. The effect of household characteristics, such as values, that might affect the likelihood of women being employed (both mother and grandmother) cancel out with the first difference that compares the same parent quarters before and after the death. Mechanisms that are present for both parents who suffered a death and those who did not (e.g., an economic recession) cancel out with the second difference. The death of the grandmother affecting the labor force participation through alternative forms of home production, such as taking care of

the house, cancels out with the third difference that compares mothers whose oldest child is not eligible to attend elementary school to mothers whose oldest child is.[1]

Grandmothers are one of the most important sources of childcare across the globe. For example, in the United States, grandparents look after 24% of children on a regular basis,[2] and in Europe, between 50 and 70% of grandmothers provide childcare in some form within a year.[3] In Mexico, grandmothers are the primary childcare providers. They take care of almost 40 percent of children up to six years old - as much as schools and daycare combined.[4] The availability of grandmother-provided childcare and mothers' employment are positively correlated. In three-generation households, the grandmother is more likely to provide childcare and the mother is more likely to be employed.[5] This paper uses the timing of death of the grandmother to explore whether the relationship between grandmother-provided childcare and mother's employment is causal.

While grandmothers are the primary childcare provider in Mexico, grandfathers rarely provide it.[6] In contrast to the null effect of grandfathers' deaths, grandmothers' deaths, through their impact on childcare, reduce mothers' employment rate by 12 percentage points (27 percent) on average. This effect is not present for fathers. These findings suggest that it is not only differences across genders in dimensions that remain unchanged with the death of grandmothers (such as preferences, education, experience, or gender roles) that lead to the gender gap in employment.

The evidence suggests that households substitute grandmother-provided childcare with public and private alternatives when public daycares are more available or when private daycares or schools are more affordable. The negative effect of the grandmother's death on mothers' employment is 9 pp smaller if public daycare is one standard deviation more available, 8 pp smaller if private daycare is one standard deviation cheaper, and 9 pp smaller if private schools are one standard deviation cheaper. These heterogeneous effects suggest that even without reducing differences across genders in education, experience, or roles, increasing childcare availability and affordability can significantly reduce the gender gap in employment.

[1] The discontinuity in childcare availability generated by eligibility of the oldest child to attend elementary school is unlikely to be correlated with the home production of the grandmother. The discontinuity of the double difference effect at exactly 6 years of age of the oldest child is shown in Figure 3.

[2] Source: U.S. Census Bureau (2013)

[3] Figure 1 in Hank and Buber (2009) displays the averages for Spain, Italy, Switzerland, Austria, Greece, Germany, Sweden, France, Netherlands, and Denmark.

[4] See top of Figure A.1 of the Online Appendix. All exhibits with the "A" prefix are in the Online Appendix.

[5] See bottom of Figure A.1 and Table A.1

[6] See Figure A.1

This paper has several advantages over the existing literature that studies the relationship between childcare availability and parental employment: (i) it provides evidence of households substituting the grandmother-provided childcare with private daycare when it is affordable and public daycare when it is available, (ii) quarterly data require a significantly weaker assumption for causal interpretation (the timing of death of the grandmother being as good as random), (iii) the panel structure of the data allows us to control for both observed and unobserved time-invariant characteristics at the individual level, (iv) the triple-difference disentangles the effect through childcare from the effect through alternative mechanisms (e.g., inheritance, lost income, or household labor), (v) documents that most of the reduction in earned income and hours worked for mothers is driven by a reduction on the extensive margin, and (vi) compares the effect on mothers and fathers. The related literature section discusses the existing literature and the contributions of this paper in more detail.

1 Related Literature

Abundant research documents the gender gap in employment and its relationship with motherhood.[7] There has also been progress in identifying the mechanisms through which the gender gap is formed, such as employer discrimination (Correll, Benard and Paik, 2007) and marital status (Fernandez and Wong, 2014*a*,*b*). Within the literature that studies the effect through the childcare mechanism, Jaumotte (2003) uses variation across OECD countries in childcare subsidies, Givord and Marbot (2015) uses a French reform in family allowance, and Lefebvre and Merrigan (2008) uses a new childcare policy implemented in Quebec to estimate the effect of childcare availability on parental employment. While policy changes create variation across time for all households simultaneously, using the timing of death of grandmothers poses an identification advantage because it generates variation across time specific to the household that is improbably correlated with changes in societal values that may drive policy changes.[8]

Within the papers that study the relationship between childcare availability and labor supply, there are several papers that use the availability of grandparents as variation in childcare. Zanella

[7] See, for example, Kühn, Horne and Yoon (2017); Bertrand, Goldin and Katz (2010); Waldfogel (1998); Kleven, Landais and Søgaard (2019); Cristia (2008); Agüero and Marks (2008); Jérôme, Dustmann and Stevens (2017); Angelov, Johansson and Lindahl (2016); Fernández-Kranz, Lacuesta and Rodríguez-Planas (2013)

[8] If, for example, a policy reform occurs at the same time as debate regarding the policy or gender roles, the event study estimates will include the effect of the policy change as well as the possible effect the debate could have on gender attitudes.

(2017) contains a literature review on the relationship between grandparent availability and parental labor force participation, and concludes that some of the limitations of the existing literature are the lack of studies that are able to address causal identification and whether the results extend to developing countries. Moving forward, I first discuss the papers that use grandparent availability as an instrument for grandparent-provided childcare, then I proceed to those that directly estimate the relationship between grandparent availability and mother's employment.

Posadas and Vidal-Fernandez (2013) (PVF2013) and Arpino, Pronzato and Tavares (2014) (APT2014) use an instrumental variable (IV) based on whether the grandmother is alive or not, and Aparicio-Fenoll and Vidal-Fernandez (2015) (AFVF2015) and Aparicio Fenoll (2019) use retirement eligibility of grandmothers in Italy and in Europe to instrument for grandparent-provided childcare. The triple-difference estimation used in this paper presents an advantage over these IVs because (i) it leverages on individual fixed effects to control for time-invariant characteristics at the individual and household level,[9] (ii) if the death or the retirement of the grandmother affects mothers' employment rate through a mechanism other than childcare (e.g., income effect from lost grandmother's income or grandmother's household labor), the exclusion restriction would be violated; instead, the triple-difference disentangles the effect through childcare by exploiting the discontinuity in childcare availability generated by eligibility to attend elementary school,[10] and (iii) it relies on a weaker identification assumption than PVF2013 and APT2014: while the IV requires the grandmother being alive or dead to be random, the triple difference only requires the timing (quarter) of death to be random. If household characteristics such as habits, income, or education affect the probability of the grandmother being dead (longevity) and also affect mother's employment probability (Hughes et al., 2007; Chen and Liu, 2011; Di Gessa, Glaser and Tinker, 2016), the IV estimate would be biased.[11]

PVF2013 also has a fixed effects (FE) specification where the independent variable is whether the grandmother provides childcare. The main advantage of this paper over the direct estimation of

[9]Footnote 6 in PVF2013 discusses how the IV with fixed effects would account for both endogeneity and time-varying heterogeneity, but because their estimates are imprecise, these results are only available upon request.

[10]The third difference compares the effect on mothers whose oldest child is eligible to attend elementary school to mothers of those too young to attend. Effects that are common for both groups, such as inheritance, cancel out.

[11]For example, in PVF2013 sample, families with deceased maternal grandmothers seem to be more disadvantaged than their counterparts. On the other hand, the first difference of the triple-difference, compares the quarters before the death of the grandmother to the quarters after (within individual variation). Hence, only requiring the timing to be random.

the effect of grandmother-provided childcare on mothers' employment with FE in PVF2013 is that the interpretation of the natural experiment and triple-difference is causal, while the interpretation of the FE in PVF2013 is not. As PVF2013 mention, FE by themselves cannot address reverse causality (whether the grandmother provides childcare because the daughter works or vice versa).

Bratti, Frattini and Scervini (2018) (BTS2018) further discusses disadvantages of using the IVs in PVF2013, APT2014, AFVF2015, and Maurer-Fazio et al. (2011)[12] to estimate the causal relationship between grandmother-provided childcare and parental employment. Instead, BTS2018 directly estimates the relationship between female labor force participation and availability of mothers, mothers-in-law, fathers, and fathers-in-law using pension reform-induced changes in retirement eligibility in Italy. While the exclusion restriction is not a concern for BTS2018, the triple-difference advantages (i) and (iii) over PVF2013, APT2014, AFVF2015, and AF2019 are also advantages over BTS2018. If any household characteristic such as education, habits (e.g., nutrition), or income affect both mother's employment and grandmother's longevity, the estimate would be biased. While BTS2018 requires longevity or retirement eligibility to be random,[13] this paper only requires the time (quarter) of death to be random. Moreover, the effect captured by BTS2018 does not need to be through the childcare mechanism and might include effects through inheritance or grandmothers' household production. Compton and Pollak (2013) finds a positive correlation between geographical proximity to grandmothers and mothers' labor supply in the United States. The timing of a death represents endogeneity of lesser concern than distance to grandparents: while households can choose where to live, they cannot choose the grandmother's time of death.

The effects of childcare availability on mothers' employment are of special interest in developing countries, where the severity of the gender gap is exacerbated due to less progressive attitudes about women in the labor force, gender-based violence, and women having less decision-making power (Jayachandran, 2015).[14] As discussed in more detail by Jayachandran (2021), changing gender

[12]They instrument the presence of grandparents using the mother's and father's age and provincial dummies. The exclusion restriction would be violated if the mother's age affects her employment by a mechanism other than the presence of the grandmother in the household (e.g., experience being correlated with salary and age, and salary affecting labor force participation).

[13]The omitted category in the empirical estimation is when the potential provider is dead. Hence, for a causal interpretation of the coefficients, longevity would need to be random. For the difference in coefficients of (i) alive and eligible and (ii) alive and ineligible, randomness in eligibility is required for a causal interpretation.

[14]Moreover, gender inequality, by itself, is considered a barrier to development; in the words of Amartya Sen, "[t]he changing agency of women is one of the major mediators of economic and social change, and its determination as well as consequences closely relate to many of the central features of the development process" (Sen, 1999, p. 202).

norms regarding who is responsible for household work and childcare is one way of freeing up women to participate in the labor market, but other alternatives that free up women's time could help as well. For example, childcare availability can enable women to join the labor market despite gender norms that place the burden of childcare on women.

In the context of developing countries, Barros et al. (2013) use a lottery for city daycare in Rio de Janeiro to estimate the effect of childcare availability on mothers' employment. Martínez A. and Perticará (2017) use a randomization on offering after-school care in Chile. Hojman and Lopez Boo (2019) use random assignment of childcare centers across Nicaragua's poorest neighborhoods, and Clark et al. (2019) use randomization of subsidized daycare in a settlement in Nairobi. This paper further contributes to this literature by studying differences across genders, using variation in the primary source of childcare, using a natural experiment on a national scale, and testing whether the availability and affordability of daycare can mitigate the negative effect of the loss of family-provided childcare.

Khanna and Pandey (2021) estimate the net effect of the death of the coinhabiting mother-in-law on the daughter-in-law labor force participation using a two-wave survey conducted in India in 2005 and 2012. There are several advantages of this paper over Khanna and Pandey (2021): i) the triple difference estimates the effect through childcare instead of the net effect of the death (which includes household labor, inheritance, and other mechanisms), ii) quarterly data allow testing for pretrends, and iii) this paper documents substitution between private and public daycare alternatives and grandmother-provided childcare.

Finally, this paper is also related to existing work studying the gender gap and the motherhood penalty in the Mexican labor market. For example, Aguilar Gomez, Arceo-Gomez and Toledo (2019) show that relative to four quarters before the birth of a child, mothers relative to fathers are 12.5 pp less likely to be in the workforce one quarter before the birth, 20 pp less likely to be in the workforce the first quarter after the birth, and 15 pp less likely to be in the workforce four quarters after the birth. Arceo-Gómez and Campos-Vázquez (2014) analyze the gender wage gap in Mexico from 1990 to 2010, finding that while the gap has decreased, it is still 6% in 2010. Calderón (2014) studies the effect of a child care program (Estancias Infantiles para Apoyar a Madres Trabajadoras) on easing burdens on working women, finding that the program increased women's probability of working, reduced the time they devoted to child-rearing and increased their labor incomes.

2 Data, the Gender Gap, and the Motherhood Penalty

The main data source is the Mexican National Survey of Occupation and Employment (ENOE). The ENOE is the largest household survey conducted in Mexico, and it is superior to administrative data in this context because it includes both the formal and informal sectors of the economy.[15] Its data collection occurs every quarter in a rotating panel format with five observations per household. The ENOE data used in this paper spans Q1 2005 to Q1 of 2020, a total of 61 surveys (one per quarter). Each survey visits approximately 120,000 households. The survey's demographics section includes information on every member of the household, such as their relationship to the head of household, gender, education, marital status, reason for not living in the household any more (after first survey), access to health care, employment, income, and hours worked.[16]

I map households across surveys using the household ID to create a panel with five observations per household. To map individuals across surveys and create an individual-level panel, I use the the line number and validate using date of birth, age, and gender.[17] I focus on three-generation households, because the data provides grandparents' information only if they live in the same household.[18] Within three-generation households, the generation to which each individual belongs to is identified only in terms of their relationship to the household head, but not in terms of their relationship to other family members.[19] For women, mothers are identified by belonging to the second generation and having children. For men, fathers are identified by belonging to the second generation and being married or coinhabiting with their partner.[20] The death of a coinhabiting grandparent is revealed whenever the respondent answers that the grandparent is not present

[15] Sixty percent of the workers in Mexico work in the informal sector (OIT, 2014). This paper uses the classification of informality used by the Mexican Statistical authority (INEGI): subordinate employees with pay belong to the informal sector if they do not have access to Mexican Social Security. Access to Social Security in Mexico is achieved by being affiliated with the Mexican Social Security Institute or an equivalent. This affiliation guarantees access to benefits, such as health care, disability insurance, housing credit, and a pension plan. INEGI (2014).

[16] The head of household is the individual who is highest in the hierarchy due to being the main economic contributor, the eldest, or the main decision-maker (INEGI, 1997).

[17] The line number is generally a within household identifier. Validating using date of birth, age, and gender, 99.9% of observations appear to be correctly identified. I exclude the remaining 0.1% where at least one member of the household is not identified from the analysis.

[18] I consider all first-generation individuals to be grandparents, although they are not necessarily grandparents. They could be, for example, siblings of the grandparents.

[19] For example, suppose the grandfather (first generation) is the head of the household. His children and their spouses are the second generation, and his grandchildren are the third generation. The relationships between the individuals in the second and third generations are not identified; a second-generation individual could thus be either a father or an uncle of the third generation.

[20] There is no question on having children for men.

because he or she passed away.[21]

On average, three-generation households represent 27 million Mexicans and 4.7 million households in Mexico—23 percent of the total population and 15 percent of households. Mothers in three-generation households are not identical to those in other households. Mothers in three-generation households are 1.5 pp (2.6%) more likely to live in a large city (population $\geq$ 100,000) and 2.9pp (17%) less likely to be rural (population $\leq$ 2,500) (Table A.1, columns 1 and 2). The lower housing costs in less populated areas may be why three-generation households are less common. In three-generation households, grandmothers are 30pp (80%) more likely to provide childcare, and mothers are 12 pp (34%) more likely to be employed (Figure A.1 and column 3 of Table A.1). Three-generation households' income is 23% higher, but their income per capita is 27% lower (Columns 4 and 5). Mothers in three-generation households are 2.2 years younger (8%), and controlling for age, they have 14% fewer children, have 2% more years of schooling, are 8% more likely to be high school graduates, and 7% more likely to be college graduates (Columns 6-10). Finally, mothers in three-generation households have 12% higher average income and work 35% more hours, but conditioning on being employed, they earn 12% less and work 10% more hours (Columns 11-14).

Because of these differences between mothers in three-generation households and other households, the findings for three-generation households cannot be directly extended to other households. The subsection Bounds for the Average Effect of Grandmothers' Death on Women in the Results Section uses the estimates for three-generation households and two sets of assumptions to bound the average effect of the grandmother's death on women's employment rate in Mexico.

I add additional restrictions to construct the primary estimation sample of three-generation households. To reduce noise in the data, I do not include households where the oldest grandchild is 30 or older, where grandparents are less than forty years old, or more than one grandmother or grandfather died. This restriction reduces the sample by 6%, but ensures that the three-generation households are more standard in their composition. There are three additional more meaningful restrictions i) at most one grandfather and one grandmother (further reduces the sample by 0.7%), ii) at most one mother and one father (further reduces the sample by 21%), and iii) balanced panel with five observations per individual (further reduces the sample by 15%). The robustness section

[21] Figure A.2 shows the frequency distribution of the grandparents' ages and Figure A.3 shows the frequency distribution of the age at which the grandparents died.

shows that the results are consistent and very similar if lifting any of these restrictions on the sample. The main reason for restrictions i) and ii) is to avoid situations in which the childcare provided by the grandmother who died is replaced by that of another coinhabiting grandmother after the death. Table A.2 compares mothers in the base sample and mothers in samples after lifting these restrictions. Lifting the restrictions has little influence on the composition of mothers.

To construct measures of childcare availability, I use the National Economic Units Statistical Directory (DENUE) of 2015 and the Population Census of 2020.[22] The DENUE lists all the public and private daycare facilities, and the population census provides the number of children up to five years of age living in each municipality. I construct of measure of the availability of public and private daycare at the municipality level by dividing the number of daycare facilities of each type by the number of children up to five years of age. I use this measure for 1,479 municipalities that are also covered by the ENOE.

To construct measures of childcare affordability, I use data from the Employment and National Security Survey (ENESS) from 2009, 2013, and 2017. The ENESS is a joint project between the Mexican National Statistics Institute (INEGI) and the Mexican Institute of Social Security (IMSS). The survey has been conducted every four or five years since 1996 to provide statistical information regarding the coverage and characteristics of social security and health care services in Mexico. As an accompanying module of the ENOE, it covers all the households covered by the ENOE for two out of the three months in the quarter.[23] Hence the ENESS covers roughly two-thirds of the ENOE sample for the quarter.[24] Both ENOE and ENESS are designed to be representative at the state and country level.

The ENESS data includes responses for 209,266 households. These households use public and private daycare providers for 3,991 and 1,177 children under seven years old. The ENESS asks how much the household paid for the service and the number of hours. I use this information to compute the cost per hour of daycare for each child.[25] Then I average at the locality level and by whether the service was public or private.[26] The result is a proxy for the private cost of daycare

[22] I use the 2015 DENUE because it is the first one that is available, and the 2020 population census because it is the first population census available after the 2015 DENUE.

[23] It covers households covered by the ENOE during July and August of 2013 and 2017 and households covered by the ENOE during May and June of 2009.

[24] Specifically, 66.63%, 67.87%, and 62.4%, respectively, for 2017, 2013, and 2009.

[25] I cap the total hours at 12 hours per day.

[26] I first demean by year to remove year specific variation, such as inflation. I compute two averages: simple average

for 231 localities and the public cost of daycare for 527 localities.[27]

2.1 Grandparents, Children, and Childcare

The ENESS asks households that are not using a public or private daycare service about their reason for not doing so.[28] Approximately 40 percent responded that they had no need for public or private daycare services, and almost 40 percent responded that either they had no access, they could not afford it, or it was not possible to take or pick up their child (see Figure A.4). Of those who responded that they did not need daycare, more than 90 percent relied on a family member to provide childcare; and specifically, more than 60 percent relied on grandmothers to provide childcare (see Figure A.5).

According to Mexican law, education from preschool to middle school is compulsory, and kids should attend school starting from 3-4 years of age. However, *de facto*, school becomes a relevant "childcare" provider only when kids turn 5-6 and they start elementary school. This may be because even if they go to kindergarten, the parents still consider the grandmother the primary provider. The bottom of Figure A.1 shows parents' response to who takes care of the child when the mother goes to work by the child's age from the ENESS. Until the children are four years old, grandmothers look after 44% of the children while schools look after 6%. However, by the time they are six years old, grandmothers only look after 24% of them while schools look after 52% of them.

2.2 The Gender Gap and the Motherhood Penalty

The motherhood penalty in employment, the difference in employment rate between women with children and women without them, forms between the ages of twenty and thirty and remains thereafter.[29] The top of Figure 1 displays the motherhood penalty and gender gap in three-

and weighted average using the ENESS probability weights. The results using probability weights are available upon request and very similar in magnitude and statistical significance to those without weights.

[27]The analysis only uses the localities where grandmothers' deaths in three-generation households are observed: 209 and 483 localities to estimate heterogeneous effects by the cost of private and public daycare.

[28]The question limits the respondent to one answer.

[29]The ENOE classifies the employed into four categories: (i) subordinate workers with pay, (ii) employers, (iii) self-employed, and (iv) workers without pay. This paper considers an individual as employed if he or she is a subordinate worker with pay. This classification includes people who worked at least one hour the previous week and those who did not work but have a job. For the second group, they may not have worked while employed because of, for example, a strike, suspension, training, vacations, or personal days. The robustness section repeats the main analyses considering working as any of the first three categories of the employed according to the ENOE; the findings are consistent.

generation households (left) and in Mexico (right). The pattern is similar, but the gaps are narrower in three-generation households because of a higher employment rate of women with children between the ages of twenty and forty. This is consistent with the findings discussed in the Related Literature section for other countries: the availability of the grandmother is positively correlated with mother's employment. The next section explains how the triple-difference estimation addresses whether this correlation is causal.

3 Empirical Strategy

The timing of death of grandmothers provides variation to childcare availability that identifies its effect on mothers' labor supply. The first empirical specification is a triple-difference. The first difference compares mothers' employment status before and after the death of the grandmother. The second difference compares mothers that suffered a loss to those who did not. Since the death of the grandmother may affect the labor supply through several mechanisms, the third difference disentangles the effect of the death due to its impact on childcare from its effect through alternative mechanisms by comparing the double-difference effect for mothers whose oldest child is eligible to attend elementary school to those whose oldest child is not. Childcare is scarcer and needed more when children cannot attend elementary school; the triple-difference captures the effect that the death of the grandmother has on mothers of young children but not on mothers of older children, the childcare mechanism.

I use individual fixed effects to control for both observable and unobservable mother-grandmother-household time invariant characteristics that could correlate with both the timing of death of the grandmother and the mother's labor supply. Locality-year-quarter fixed effects control for locality-specific shocks to the labor market, for example a city-specific boost in government spending. Young child-year-quarter fixed effects control for shocks that are specific to children's age, for example, a nationwide education reform or a new public daycare policy. Grandmother died-year-quarter fixed effects control for pre-existing differences between households where the grandmother will die during the survey period and those where she will not. Ten alternative specifications gradually reducing what the fixed effects control for are also reported in Table 1. Equation 1 is the main specification and β_2, the triple-difference estimate, is the parameter of interest:

$$Employed_{i,l,t} = \beta_1 Post_{i,l,t} \times Death^{GM}_{i,l} + \beta_2 Post_{i,l,t} \times Death^{GM}_{i,l} \times YoungChild_{i,l} + \phi_i + \zeta_{l,t} + \gamma_{t,YoungChild} + \eta_{t,DeathGM} + \varepsilon_{i,l,t} \quad (1)$$

Where $Employed_{i,l,t}$ takes the value of 1 if mother i living in locality l is employed at time (year-quarter) t and 0 otherwise, $Death^{GM}_{i,l}$ is a dummy variable that takes the value of 1 if the mother suffered the death of the grandmother at any point through the span of the surveys and 0 otherwise, $Post_{i,l,t}$ takes the value of 1 for every period after the death of the grandmother and 0 otherwise, $YoungChild_{i,l}$ indicates that the oldest child in the household is young, ϕ_i is the individual fixed effect, $\zeta_{l,t}$ is the year-quarter-locality fixed effect, $\gamma_{t,YoungChild}$ is the year-quarter-young child fixed effect, $\eta_{t,DeathGM}$ is the year-quarter-grandmother died fixed effect. All the lower-level interactions are captured by the fixed effects.

The main specification uses an age cutoff of the oldest child of at most 5 years old to be considered a young child.[30] The three main reasons to use the 5-years-old cutoff are that: (i) it exploits a discontinuity of childcare availability by separating children that can, and by law should, attend primary schools from younger children, (ii) it is consistent with governmental classification of children by age, and (iii) it presents an advantage over using a cutoff at a younger age by increasing the size of the "treatment" group.[31]

One of the most common concerns in the literature is the grandmother affecting labor force participation of the mother through alternative mechanisms such as inheritance, sickness, or household labor. For example, the income effect of inheritance may increase leisure consumption. I use the discontinuity in childcare availability generated by eligibility to attend elementary school to disentangle the childcare mechanism from these other mechanisms that are unlikely discontinuous at exactly the age of 6. As long as mothers whose oldest child is 4 years old and those whose oldest child is 6 years old are as likely to receive an inheritance, or the grandmother is as likely to supply household labor or to be sick, then these effects will cancel out with the third difference and the remaining effect is the effect through the childcare mechanism.

[30] An alternative cutoff could be at most 1 year, because many childcare facilities do not accept children younger than 2 (Profeco, 2004). This cutoff reduces the number of observation too much.

[31] In governmental classification, 0-2 years is initial education and 3-5 is preschool (Profeco, 2004).

To test the discontinuity generated by the availability of elementary school, I estimate the triple-difference effect by age bracket of the oldest child. In this specification, the dummy variable for having a young child in the household, $YoungChild_i$, is replaced by three dummy variables indicating the age bracket of the oldest child in the household: (i) at most 3 years old, $YoungChild_{i,l,1}$, (ii) between 4-5, $YoungChild_{i,l,2}$, (iii) between 6-10, $YoungChild_{i,l,3}$. The omitted category is when the oldest grandchild is older than 10 and it is captured by β_1. The estimated equation is:

$$\begin{aligned} Employed_{i,l,t} \;=\; \beta_1 Post_{i,l,t} \times Death^{GM}_{i,l} \;+\; \sum_{k=1}^{k=3} \beta_{2,k} Post_{i,l,t} \times Death^{GM}_{i,l} \times YoungChild_{i,l,k} \\ +\; \phi_i \;+\; \zeta_{l,t} \;+\; \gamma_{t,YoungChild} \;+\; \eta_{t,DeathGM} \;+\; \varepsilon_{i,l,t} \end{aligned} \tag{2}$$

I use an event study design to test for common trends in employment prior to the grandmother's death in households with young children and in households with older children. This design also measures the persistence of the effect by including an estimate for each period after the death. The event study equation is built from equation 1, but adds a time index s, which is the time relative to the death of the grandmother. Since each individual is observed for five periods, $s \in \{-4, -3, -2, -1, 1, 2, 3, 4\}$. Period s=-1 is the last period before the death and period s=1 is the first period after the death. The period $s = -1$ is the omitted category in the estimation. The estimated equation is the following:

$$\begin{aligned} Employed_{i,l,t,s} \;=\; \sum_{s=-4}^{s=4} \Big(\beta_{1,s} Post_{i,l,t,s} \times Death^{GM}_{i,l} \;+\; \beta_{2,s} Post_{i,l,t,s} \times Death^{GM}_{i,l} \times YoungChild_{i,l} \Big) \\ +\; \phi_i \;+\; \zeta_{l,t} \;+\; \gamma_{t,YoungChild} \;+\; \eta_{t,DeathGM} \;+\; \varepsilon_{i,l,t} \end{aligned} \tag{3}$$

If childcare availability and gender roles jointly contribute to the formation and persistence of the gender gap, the triple-difference negative effect on employment probability would be larger for mothers than for fathers. Equations 1 and 3 are modified to include a quadruple difference resulting in equations 4 and 5, where $Mother_{i,l}$, takes a value of 1 if the second-generation individual is a mother. All fixed effects, except individual, are interacted with gender of the parent.

$$Employed_{i,l,t} = \beta_1 Post_{i,l,t} \times Death^{GM}_{i,l} + \beta_2 Post_{i,l,t} \times Death^{GM}_{i,l} \times YoungChild_{i,l} + \beta_3 Post_{i,l,t} \times Death^{GM}_{i,l} \times Mother_{i,l} + \beta_4 Post_{i,l,t} \times Death^{GM}_{i,l} \times YoungChild_{i,l} \times Mother_{i,l} + \phi_i + \zeta_{l,t,Gender} + \gamma_{t,YoungChild,Gender} + \eta_{t,DeathGM,Gender} + \varepsilon_{i,l,t} \quad (4)$$

$$Employed_{i,l,t,s} = \sum_{s=-4}^{s=4} (\beta_{1,s} Post_{i,l,t,s} \times Death^{GM}_{i,l} + \beta_{2,s} Post_{i,l,t,s} \times Death^{GM}_{i,l} \times YoungChild_{i,l} + \beta_{3,s} Post_{i,l,t,s} \times Death^{GM}_{i,l} \times Mother_{i,l} + \beta_{4,s} Post_{i,l,t,s} \times Death^{GM}_{i,l} \times YoungChild_{i,l} \times Mother_{i,l}) + \phi_i + \zeta_{l,t,Gender} + \gamma_{t,YoungChild,Gender} + \eta_{t,DeathGM,Gender} + \varepsilon_{i,l,t,s} \quad (5)$$

Grandfathers are significantly less likely to provide childcare than grandmothers. While grandmothers provide almost 40 percent of total childcare, grandfathers are not even an explicit option in the ENESS and fall in the category of other family members. Other family members provide in total close to 20 percent of childcare (see Figure A.1). The death of a grandfather is used as a placebo in the Robustness Section, where the specifications described in this section for the death of the grandmother are estimated for the death of a grandfather. If the triple-difference is indeed capturing the childcare availability mechanism, the triple-difference effect should not be present (or be smaller) when a grandfather dies, because a grandfather does not provide childcare as much or as often as the grandmother.

The main specification of the empirical strategy uses the age of the oldest child in the triple difference to separate households that need more childcare from those that need it less. Previous literature has estimated the effect of childcare availability on mothers' employment rate and heterogeneous effects based on cutoffs built using the age of the youngest child (Posadas and Vidal-Fernandez, 2013; Arpino, Pronzato and Tavares, 2014; Bratti, Frattini and Scervini, 2018; Compton and Pollak, 2013). Other papers look at the time of birth of the first child (Kleven, Landais and Søgaard, 2019). I use the age of the oldest instead of the youngest child because the Mexican context is different than that of developed countries that have been the focus of previous literature.

In Mexico, it is widespread for children to provide care for other children in the household. Based on time allocation from the ENOE, when there is a child up to five years old in the household,

26% of 17-years-olds spend some time exclusively providing care without pay.[32] This is true even for younger children; 16% of 12-year-olds provide care when there is a child up to 5 years old in the household. The time allocation question is only available for 12-year-olds and older, but even younger children are likely to provide care. Based on the ENESS question, who takes care of the child when the mother goes to work, more than 1% of 6-year-olds are left alone when their mothers go to work.[33] Hence, the split between households that need more childcare and those that need it less is more reasonable when using the age of the oldest grandchild because the households classified as those that need more childcare do not have older siblings who can provide care. However, specifications using the age of the youngest child are also valid, and I present these estimates in the Robustness Section.

4 Results

This section has three subsections. The first subsection presents the estimates for the sample of mothers belonging to the second generation in three-generation households. This section documents that (i) the death of the grandmother, through its impact on childcare (second difference), reduces the probability of being employed of mothers by 12 percentage points (27%), (ii) the effect is economically and statistically significant as long as the oldest child is not old enough to attend elementary school, (iii) the effect is persistent for at least 4 quarters after the death, (iv) mothers' income decreases 53% and hours worked decrease 30%—driven mostly by a reduction in the extensive margin, and (v) the death of the grandmother, through its impact on childcare (second difference), reduces the probability of being employed for mothers by 15 percentage points more than for fathers (quadruple difference).

The second subsection uses the estimate of the average effect of the grandmother's death in three-generation households and two sets of assumptions to create bounds on the average effect of the grandmother's death on women in Mexico. This exercise implies that the average effect of the grandmother's death on women's employment in Mexico ranges between 1.8pp and 5.3pp (4.6% - 13.5%).

The third subsection presents heterogeneous effects of the grandmother's death on mothers'

[32]Source: Author calculations using ENOE Q1 2005 to Q1 2020 based on the following question: During last week, how much time did you spend exclusively taking care without pay of children, elderly, sick, or disabled?

[33]This question is only available for children up to 6 years old.

employment. The negative effect of the grandmother's death on mothers' employment is 9 pp smaller if public daycare is one standard deviation more available, 8 pp smaller if private daycare is one standard deviation cheaper, and 9 pp smaller if private schools are one standard deviation cheaper. This section also shows that the negative effect of the grandmother's death is larger when the maternal grandmother dies, increasing in the hours the grandmother used to provide care, and significantly smaller if there are male grandchildren.

4.1 The Effect on Employment, Hours Worked, and Earned Income

The estimates of equation 1 are displayed in Panel A of Table 1. The results of the main specification, with individual, locality-year-quarter, young child-year-quarter, and grandmother died-year-quarter fixed effects (FE), are in column one: the death of the grandmother, through its impact on childcare, reduces mothers' employment rate by 12.4 pp (p-value = .00005). Columns 2-11 display alternative specifications gradually reducing what the fixed effects control for. The triple-difference estimates of the reduction in employment rate with the different combinations of FE range between 7.5 and 12.4 pp.

For the four quarters before the death of the grandmother, both mothers of children at most five years old and mothers of children older than five have a similar flat trend in their employment rate, which is not statistically different from its level in the quarter just before the grandmother's death (see bottom of Figure 2). After the death of the grandmother, while there is no effect on mothers of older children, the employment rate of mothers of children five years old or younger declines between 11 and 17 percentage points for the next four quarters after the death. The difference between these two groups of mothers—the triple-difference effect—is statistically significant for the four periods after the death of the grandmother (see top of Figure 2). In the triple-difference figure (top of Figure 2), the omitted category is $t = -1$, hence this coefficient is not estimated. Similarly, plotting the two double differences (bottom of Figure 2), $t = -1$ is the omitted category and there is one additional coefficient for the older children households that is captured by the grandmother died-year-quarter fixed effect.[34]

Relative to mothers of children older than 10 years, the death of the grandmother, through its

[34]If the triple-difference was not staggered (if all grandmothers had died in the same quarter), all the coefficients for the older children households would be captured by the grandmother died-year-quarter fixed effect (instead of one of them, when it is staggered).

impact on childcare, reduces the probability of being employed for mothers whose oldest child is at most 3 years old or between 4 and 5 years old by 15 and 12 percentage points, respectively (see Figure 3). The negative effect of the death of the grandmother fades away if the oldest child is old enough to attend elementary school or older. This exercise documents a clear discontinuity in the effect of the grandmothers' death at the time when the oldest child is eligible, and by law required, to attend elementary school.

The effect on the probability of being employed is the net effect from transitions across full-time employment, part-time employment, and unemployment. In the sample, 43% of mothers are employed, 34% work full-time (more than 30 hours per week), and 9% work part-time (less than 30 hours per week). Columns 1 and 2 of Table 2 display the effect of grandmothers' death on the full-time and part-time employment rates of mothers. Through its impact on childcare availability, the grandmother's death reduces the probability of being employed full time by 8.5 pp (25%) and the probability of being employed part time employed by 3.9 pp (40%).

Even though more mothers employed full-time leave the labor force than part-time employed ones, they are not more likely to do so. The reduction in the probability of being full-time employed is 8.5pp and 3.9pp for part-time employed. However, in relative terms, the latter is larger because 34.4% of women are full-time employees and 9.6% of women are part-time employees. Moreover, mothers employed full-time left their jobs instead of switching to part-time employment. Column 5 shows the effect on the probability of part-time employment for the subsample of mothers employed full-time in the first survey wave. These mothers do not transition from full-time employment to part-time employment. Their probability of being part-time employees decreases by 5.8pp (not statistically significant at conventional levels).

The shock to childcare availability also affects hours worked and earned income. The grandmother's death, through its impact on childcare, reduces weekly hours worked for mothers by 30% and earned income by 53% (see columns 3 and 5 of Table 2). These effects include both the extensive and intensive margin. The extensive margin is from mothers that went from employed to unemployed, and the intensive margin is from mothers who continue to be employed but for fewer hours or with a lower wage. Columns 4 and 6 display the results for the intensive margin, restricting to the sample of mothers with strictly positive income and hours worked. The effect through the intensive margin is a reduction in hours worked by 12% and in earned income by 26%,

but both of these effects are not statistically significant. The results are consistent with a lack of flexibility in the labor market and mothers being pushed out of the labor market when losing grandmother-provided childcare.

The motherhood penalty in Mexico, the difference in employment rate between women with children and without children, is 17, 22, and 14 percentage points at ages of twenties, thirties and forties, respectively (see top of Figure 1). This section's estimate of the effect of the grandmother's death, through its impact on childcare, is a 12 percentage points reduction in employment rate. Keeping preferences, socioeconomic constraints, gender roles, and discriminatory demand fixed, a reduction to childcare availability results in a reduction of mothers' employment by a magnitude larger than half the entire motherhood penalty.

If a lack of childcare availability and a parent-gender component are jointly contributing to the formation of the gender gap in employment, the death of the grandmother, through its impact on childcare, would have a larger negative effect on mothers' employment than on fathers'. Panel B of Table 1 compares the triple-difference effect for fathers to that of mothers using a quadruple difference. The effect of the grandmother's death, through the childcare mechanism, is 14.7 pp larger reduction in employment rate for mothers than for fathers. Columns 2-11 contain estimates Columns 2-11 display alternative specifications gradually reducing what the fixed effects control for; the estimates of the coefficient of interest are consistent across specifications and the quadruple difference estimate ranges between 7.4 and 14.8 pp. For the four quarters before the death of the grandmother, the employment rate of each of the four subgroups (men and women in households with young and with older children) has a flat trend and is not statistically different from its level in the last period before the death; see Figure 4). After the death of the grandmother, only mothers in households where the oldest child is less than five years have an economically and statistically significant drop in employment rate.

The findings are consistent with mothers having a greater share of the responsibility for childcare provision. The Mexican National Bureau of Statistics implicitly acknowledged these asymmetries. For example, in the ENESS, question 22 reads, "[w]hen the mother of [name of child] goes to work, the child stays with?" There is no equivalent question for when the father goes to work. Moreover, for the possible answers to this question, the grandmother is an explicit option, but it was not until the 2013 survey that the father was included as an explicit possible answer. Grandfathers have

never been included as an explicit option (INEGI, 2009, 2013).

The gender gap in employment in Mexico, the difference in employment rate between women and men, is at its maximum size during ages twenties, thirties, and forties, ranging between 24 and 30 percentage points (see Figure 1). This section's estimate of the differential effect on employment across genders of the grandmother's death, through its impact on childcare, is 15 percentage points.

4.2 Bounds for the Average Effect of Grandmothers' Death on Women

The estimated 12pp decrease in mothers' employment rate after the grandmother's death is based on three-generation households. Using two sets of assumptions, I create bounds for the average effect for women in Mexico. The average effect is a weighted average of the effect on one, two, three, and more than three generations households. The following equation denotes this weighted average, where i denotes the number of generations in a household and Share_i is the share of households with i generations:[35]

$$\text{Average Effect} = \sum_{i=1}^{4} \text{Effect}_i \times \text{Share}_i \tag{6}$$

The effect is only known for three-generation households (i=3). I use two sets of assumptions to determine the effect on other households. For the lower bound, I assume that grandmothers' deaths only affect three-generation households. Hence the lower bound is 0 x 23% + 0 x 61% + 12 x 15% + 0 x 1% = 1.8pp. For the upper bound, I use two assumptions: i) conditionally on the grandmother providing childcare, the negative effect of grandmothers' deaths through childcare is the same for mothers in two- and three-generation households; and ii) there is no effect through childcare when grandmothers do not provide childcare. The effect on mothers of three-generation households where the grandmother provides childcare is given by the average effect on three-generation households divided by the share of households where the grandmother provides childcare (12pp/57% = 21pp). The average effect on mothers of two-generation households is the effect on mothers of three-generation households where the grandmother provides childcare times the probability of the grandmother providing childcare in two-generation households (21pp x 27% = 5.7pp). Hence the upper bound of the average effect is 5.27pp (0 x 23% + 5.7 x 61% + 12 x

[35] Households with four or more generations are represented by i=4.

15% + 0 x 1%). This exercise implies that the average effect of grandmothers' death on women's employment in Mexico ranges between 1.8pp and 5.3pp (4.6% - 13.5%).[36]

4.3 Heterogeneous Effect of the Grandmother's Death

To measure heterogeneous effects, two additional coefficients are estimated. These coefficients are those on the interaction between the variable for which heterogeneous effects are estimated, $Z_{i,l}$, and the variables of equation 1. The estimating equation is the following:

$$\begin{aligned} Employed_{i,l,t} \;=\; & \beta_1 Post_{i,l,t} \times Death^{GM}_{i,l} \;+\; \beta_2 Post_{i,l,t} \times Death^{GM}_{i,l} \times YoungChild_{i,l} \\ & + \beta_3 Post_{i,l,t} \times Death^{GM}_{i,l} \times Z_{i,l} \;+\; \beta_4 Post_{i,l,t} \times Death^{GM}_{i,l} \times YoungChild_{i,l} \times Z_{i,l} \\ & + \phi_i \;+\; \zeta_{l,t} \;+\; \gamma_{t,YoungChild} \;+\; \eta_{t,DeathGM} \;+\; \varepsilon_{i,l,t} \end{aligned} \tag{7}$$

4.3.1 Heterogeneity by Availability of Daycare

To create a measure of public and private daycare availability, I divide the number of public and private daycares in the municipality (from DENUE) by the number of children up to five years old (from the Population Census). I use this measure for 1,479 municipalities for which the ENOE also has data. If the availability of daycare is correlated with other variables, such as income, there is a risk that I capture heterogeneity by income instead of capturing heterogeneity by the availability of daycare. I address this concern by using an additional measure of daycare availability not driven by the average income, size, or share of working mothers. To construct this measure, I regress the average cost of daycare (either public or private) on the share of employed mothers, dummies for quintiles of average income, and dummies for quintiles of population, using the following estimating equation:

$$Availability_l = \beta_0 + \beta_1 ShareEmpMothers_l + \sum_{j=1}^{4} \psi_j Income_l^j + \sum_{j=1}^{4} \Gamma_j Population_l^j + \epsilon_l \tag{8}$$

[36]The estimation of the range includes mothers and women in general, not including women in one-generation households (non-mothers) would imply a range of 2.3pp - 6.8pp (the share of two- and three-generations households would increase by a factor of 1.29).

The residual of the previous estimation is the measure of daycare availability that is not explained by mothers' employment rate, income, and population.

The negative effect of the grandmother's death on mothers' employment is 9 pp smaller if public daycare is one standard deviation more available (Table 3, columns 2 and 3). Using the observed measure of daycare availability instead of the residual one leads to very similar results (columns 5 and 6). This finding is consistent with substitutability between the grandmother-provided childcare and public daycare if public daycare is available enough. At least two mechanisms could drive this substitution: i) when the grandmother dies, mothers in locations where public daycare is more available substitute grandmother-provided childcare with public daycares to continue to be employed, or ii) mothers in locations where public daycare is more available use public daycare more and grandmother-provided childcare less, hence the smaller effect. There is no heterogeneity by the availability of private daycare (columns 1, 3, 4, and 6). This finding suggests that increasing the availability of public daycare, can, as a stand-alone policy, significantly increase female employment and contribute to closing the gender gap.

4.3.2 Heterogeneity by Affordability of Daycare

To create a measure of daycare affordability, I average the hourly cost and total cost of daycare in the locality using data from the ENESS.[37] The ENESS includes the childcare alternative that households use, how much they pay, and for how many hours. The implicit assumptions of using these average total price and price per hour are that: i) the price paid by households that use private and public daycare is representative of the price that households that do not use these alternatives would pay, and ii) that the average computed from the ENESS respondents is informative of the cost level of daycare alternatives in the locality. To avoid issues related to the measure of daycare affordability capturing income, population, or share of mothers working, I also use a residualized measure estimated using equation 8. This measure is equivalent to the one used for childcare availability in the previous section.

The negative effect of the grandmother's death on mothers' employment is 8 pp smaller if

[37] A locality in Mexico is any place in the country with one or more dwellings, inhabited or not; this place must be recognized by a name given by law or custom (INEGI, 2018). According to the 2010 Population Census, there are 3,647 urban localities (more than 2,500 inhabitants), with an average number of inhabitants of 23,656. Localities are the smallest geographical unit for which daycare costs are available.

private daycare is one standard deviation cheaper (Table 4, columns 1 and 3). This heterogeneity is robust to using the residual and the actual affordability measures (columns 7 and 9). The result is also robust to using the hourly and total costs (columns 4, 6, 10, and 12). Public daycare has no equivalent heterogeneity (columns 2, 3, 5, 6, 8, 9, 11, and 12). There are two considerations with the public daycare cost measure: lack of price variation and capacity constraints (no vacancies) (Huerta, 2011). Public daycare is mostly free: more than one-fourth of the localities have an average cost of 0, and 96 percent have an average hourly cost below 0.33 USD.[38] Moreover, even if there was price variation for public daycare, it might not necessarily be a measure of how accessible it is because there are no vacancies. On the other hand, private daycare price varies more because it is unregulated.[39]

The average cost of daycare may also capture the overall level of childcare costs in the locality, not only daycares. If this is the case, the heterogeneity that I find in the cost of daycare should also exist in other childcare alternatives. A common response to who takes care of children up to six years old when the mother goes to work in the ENESS is that the children go to school (21%, see Figure A.1). These schools may be public or private, but the ENESS keeps them in the same category when asking about the price paid. To create measures of affordability of schools and separate the cost of private ones, I compute two averages. The first one is the average cost paid for schools in the locality. This average includes both public and private schools. Since public schools are primarily free and private schools cost, I also use the average conditional on reporting a strictly positive price. This average will not capture free public schools, but rather the cost of private schools.

I find that the negative effect of the grandmother's death on mothers' employment is 9 pp smaller if private schools are one standard deviation cheaper. This result stands irrespective of using the total or hourly cost (Table A.3, columns 2 and 4) and of using the residual or observed cost measure (columns 6 and 8). This heterogeneity is smaller and not statistically significant when using the school cost that includes both public and private schools (columns 1, 3, 5, and 7).[40] These

[38]The exchange rate used to calculate is: 1USD = 15 MXN

[39]There were less than 8 percent of localities with an average private daycare cost of 0, and 70 percent have an average hourly cost above 0.33 USD.

[40]I also estimated heterogeneity by the availability of daycares from the Estancias Infantiles para Apoyar a Madres Trabajadoras Program. I found that one standard deviation increase in the availability of these daycares (measured as estancias infantiles / number of children up to five years old) is associated with a 1-2pp smaller negative effect of grandmothers' death on mothers' employment. However, this result is measured imprecisely and is not statistically

results are consistent with those using daycare prices and share the same conclusion: the negative effect of the grandmother's death is smaller in locations with lower private childcare costs.

These estimates are consistent with those in the literature of other developing countries. Barros et al. (2013) finds that winning a child care slot in Rio de Janeiro increases the mother's employment probability by 10pp (27%). Hojman and Lopez Boo (2019) find that mothers' probability of working outside the household increases by 14 pp when receiving access to subsidized day care, and Halim, Johnson and Perova (2017) find that the expansion of public preschools in Indonesia increased the employment rate for women with preschool-age children.

4.3.3 Heterogeneity by the Grandmother's Side

Figure 5 shows that the negative effect of the grandmother's death is significantly larger if the maternal grandmother dies rather than the paternal one.[41] The total effect of the death of the paternal grandmother is a reduction in mothers' employment by 6pp. However, the impact through childcare is only 3 pp and not statistically significant. On the other hand, the maternal grandmother's death reduces mothers' employment by 21pp. The effect through childcare is a reduction by 17pp (difference between the effect when the oldest is at most 5 years old vs. when the oldest is older), 14pp larger than the effect of the paternal grandmother's death. This result is consistent with previous results in the development literature. For example, Duflo (2003) finds that there is an effect of grandmother's pension eligibility on weight for height of South African granddaughters only if the mother's mother is the person who becomes eligible.

4.3.4 Other Heterogeneity

This section presents a heterogeneity analysis of the effect of the grandmother's death on mothers' employment probability by the number of hours the grandmother provided care, the number of children the mom has, the number of grandchildren in the household, the number of grandchildren under 6 years old, the number of male grandchildren, household income, mothers' income, mothers' hours worked, employment type (formal/informal), and mothers' education. I use the responses

significant. This analysis is available upon request.

[41] Within the household, I identify the maternal grandmother relative to the household head as follows: i) the mother-in-law of a dad (household head), ii) the spouse of the grandfather (household head) who has a daughter that is a mother, iii) grandmother (household head) who had a daughter that is a mother, and iv) the mother of a mother (household head).

from the first wave so that the heterogeneity analysis can be interpreted as heterogeneity by ex ante characteristics.

If childcare and not other forms of home production indeed drive the negative effect that I estimate, then the effect should increase as the grandmother's hours exclusively providing care increase. The ENOE contains a question regarding time allocated to care for others: "During the last week, how much time did you spend exclusively taking care without pay of children, elderly, sick, or handicapped?" I use this question to present heterogeneity results in Column 1 of Table 5 by the time the grandmother provided care. One standard deviation increase in the number of hours the grandmother provided care (10.8 hrs) in the first survey wave is associated with a further reduction of mothers' employment rate by 9 pp, almost doubling the negative effect of the grandmother's death on mothers. This heterogeneity is not present in households where the oldest grandchild is older than 5 years.

I also present heterogeneity analysis for the number of children the mother has, the number of grandchildren in the household, and the number of grandchildren under 6 years of age. There is no statistically significant heterogeneity in all of these measures (Table 5, columns 2-4). However, there is significant heterogeneity in the gender composition of the grandchildren. If there are no male grandchildren, the grandmother's death, through its impact on childcare, reduces the mother's employment rate by 18.3pp, but for each male grandchild, this negative effect declines on average by 9pp (Column 5). Column 6 presents an alternative to measure the same heterogeneity: when there are no male grandchildren, the negative effect of the grandmother's death is 20.9pp, but if there is at least one male, this negative effect declines to 5.7pp. While fully characterizing the heterogeneity by gender of grandchildren is beyond the scope of this paper, this result is consistent with a society in which protecting and looking after girls is more important than protecting boys.

I find no heterogeneity by household income, mothers' income, and mothers' hours worked (Columns 7-9). However, there is economically significant heterogeneity by whether the mother was employed in the formal sector or not conditionally on being employed in the first survey wave. In the sample of mothers employed in the first survey wave, the grandmother's death, through its impact on childcare, reduces mothers' employment probability by 34.5pp for those in the informal sector (Column 10). However, this negative effect is 21.8pp smaller for those in the formal sector (yet this difference is not statistically significant, p-value = .15).

In terms of education, Columns 11 and 12 show that in absolute terms, the negative effect is much more extensive for more educated mothers. However, relative terms may be more informative because more educated mothers are more likely to be employed. In particular, the grandmother's death reduces the employment rate for mothers without high school by 5.8pp (17%) and for those without college by 10.6pp (27%). The negative effect for those with high school is a reduction in employment rate by 19.1pp (36%) and for those with college by 19.3pp (31.4%). The grandmother's death reduces mothers' employment probability irrespective of their education level.

5 Robustness

This section is divided into two subsections: (i) alternative specifications, and (ii) the grandfather's death. The first subsection includes variations to the main specification: using an unbalanced panel, not restricting the maximum number of grandparents or parents in the household, broadening the definition of employment, using only the deaths of young grandmothers, using the age of the youngest child instead of the oldest, and estimating a double-difference only with the sample of parents who lived in a household where the grandmother died. The results are robust to all these alternative specifications. Since a grandfather is significantly less likely to provide childcare, the effect of a grandfather's death, through its impact on childcare, should be smaller (if any); this is documented empirically in the second subsection.

5.1 Alternative Specifications

Table 6 contains the main specification and 10 alternative specifications. The results are robust to all these alternative specifications. The triple difference effect for the death of the grandmother on mothers, through childcare, ranges between a reduction of 8.7 to 16.3 percentage points in the employment rate, and the quadruple difference effect (the additional effect on mothers relative to fathers) ranges between an additional reduction of 6.0 to 21.2 percentage points.[42] Column 2 presents the estimates for the unbalanced panel, which includes households that responded to the ENOE less than five times. Instead of only including households with at most one grandmother and one grandfather, Column 3 allows for any number of first-generation individuals. Instead of only including households with at most one mother and one father, Column 4 allows for any number

[42]The ranges are for all specifications where the age of the oldest child is used as cutoff.

of fathers and mothers in the household. Column 5 broadens the definition of employed to also include employers, working on your own, and unpaid jobs. Column 6 broadens the definition of employed to also include employers and working on your own.

Throughout the paper, all the observed deaths of grandmothers are used to identify the effect of childcare availability on parents' employment rate. Alternatively, I could use only the deaths of young grandmothers, whose death might be more unexpected. Columns 7 and 8 replicate the main estimation but using only the deaths of grandmothers at most 60 and 70 years old.

Column 9 repeats the estimation but using ENOE's probability weights that account, among many other things, for non-response. The estimates of interest are very similar in magnitude (within one standard error) and significance. I do not use this specification as the main one because INEGI designed these weights to make the survey representative at that quarter's state and country level. These weights are not necessarily representative of subsamples (three-generation households and three-generation households where the grandmother died). Moreover, the weights were designed to provide quarter-by-quarter snapshots of the labor market and not average effects on subsamples across years.

To disentangle the effect that the grandmother's death has through its impact on childcare from alternative mechanisms, the empirical strategy splits parents by the age of the oldest child. Alternatively, it is possible to use the age of the youngest child. One disadvantage of using the age of the youngest child is that the analysis would not restrict the presence of older children, who could provide childcare. Column 10 replicates the analysis but using the age of the youngest child instead of the oldest. The results are robust to using the oldest or youngest child's age, but as expected, since the specification of the youngest child allows for an additional childcare alternative (siblings), the effects are smaller. To show that older siblings providing care are substitutes for grandmother-provided care, Table A.4 presents the effect of the death of the grandmother on the amount of time that older grandchildren spend providing care. I estimate this effect for children ages 12 to 15, 12 to 18, and 12 to 21 in households where the youngest child is at most 5 years old, and the grandmother is less than 70.[43] The reason to estimate for grandmothers less than 70 is to avoid, to some extent, grandchildren providing care for the elderly.[44] The grandmother's death

[43] INEGI only asks the question for the population 12 years old and older.

[44] The question adds up the time spent providing care for children, the elderly, the sick, and the disabled.

increases the amount of time older grandchildren spend providing care between 94 and 112%, and the probability of them providing care by 6 to 7pp (58 to 65%).

One of the three differences used in the triple-difference estimation, is comparing parents in households where the grandmother died vs. households where she did not. Alternatively, I could estimate a double-difference in the sample where the grandmother died (before vs after the death and young vs. old children). A disadvantage of this alternative is the loss of precision from not estimating as precisely the time effects. Column 11 contains the double-difference estimations; the results are consistent with the estimates from the main specification.

5.2 The Grandfather's Death

Since a grandfather is less likely to provide childcare, the effect of the death of a grandfather, through its impact on childcare, should be smaller, if any. Top of Figure 6 displays the triple-difference estimates of Equation 3, but using a grandfather's death instead of the grandmother's. The death of a grandfather has no effect, through the childcare mechanism, on the employment rate of mothers.

6 Conclusion

Reducing the gender gap and the motherhood penalty in employment is a critical challenge in labor markets across the globe. Even though the gaps and their relationship with motherhood are well documented, we know less about the relative importance of each mechanism and its causal effect on employment. Innovative identification strategies, including natural experiments, allow researchers to disentangle the role of individual mechanisms in the formation of the gender gap.

This paper uses panel data, a natural experiment, and both a triple and a quadruple difference to estimate the effect of childcare availability on parents' employment rate. The evidence is consistent with the main driver of the gender gap and the motherhood penalty in labor force participation in Mexico being the combination of the lack of childcare availability and gender-asymmetric responsibility for childcare provision. A coinhabiting grandmother's death, through its impact on childcare availability, reduces the employment rate by 15 percentage points more for mothers than for fathers. This magnitude accounts for more than a half of the gender gap in employment in Mexico. Moreover, the death of the grandmother, through its impact on childcare, reduces the

employment rate of mothers by 12 percentage points (27 percent); the effect accounts for more than half the entire motherhood penalty in Mexico. Even without changing preferences, socioeconomic constraints, and gender roles, increasing childcare availability can drastically reduce both the motherhood penalty and the gender gap.

In the short term, increasing the availability of childcare can have a significant effect on increasing mothers' labor force participation, which in turn can contribute to reshaping gender roles in the long term. Working women today can increase the opportunities for working women tomorrow by changing societal gender attitudes and perceptions, and by increasing the aspirations and educational attainment for girls.[45]

[45] Beaman et al. (2009) finds that exposure to a female chief councilor improves perceptions of female effectiveness as leaders and weakens gender-roles stereotypes in the public and domestic spheres. Beaman et al. (2012) finds that female leadership in village councils raises the aspirations and educational attainment for girls in India.

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7 FIGURES

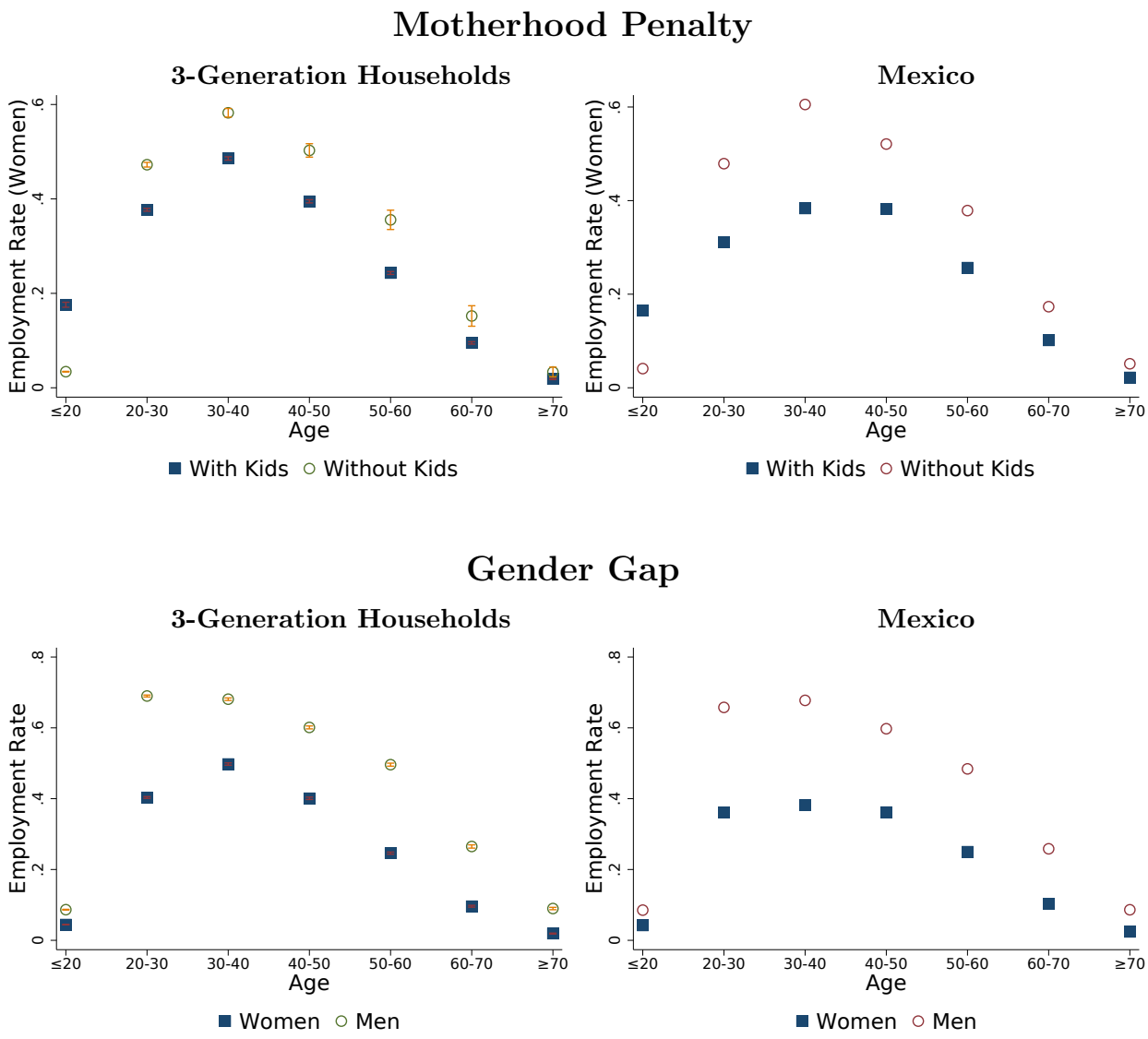

Figure 1: The Motherhood Penalty and the Gender Gap

Source: ENOE (Q1 2005 - Q1 2020)

Note: The graph displays the employment rate by age. The figures on the left include only three-generation households. The figures on the right include the full sample and use probability weights to obtain country-level representation. The figures on the top compare women with children to women without them. The figures on the bottom compare men to women.

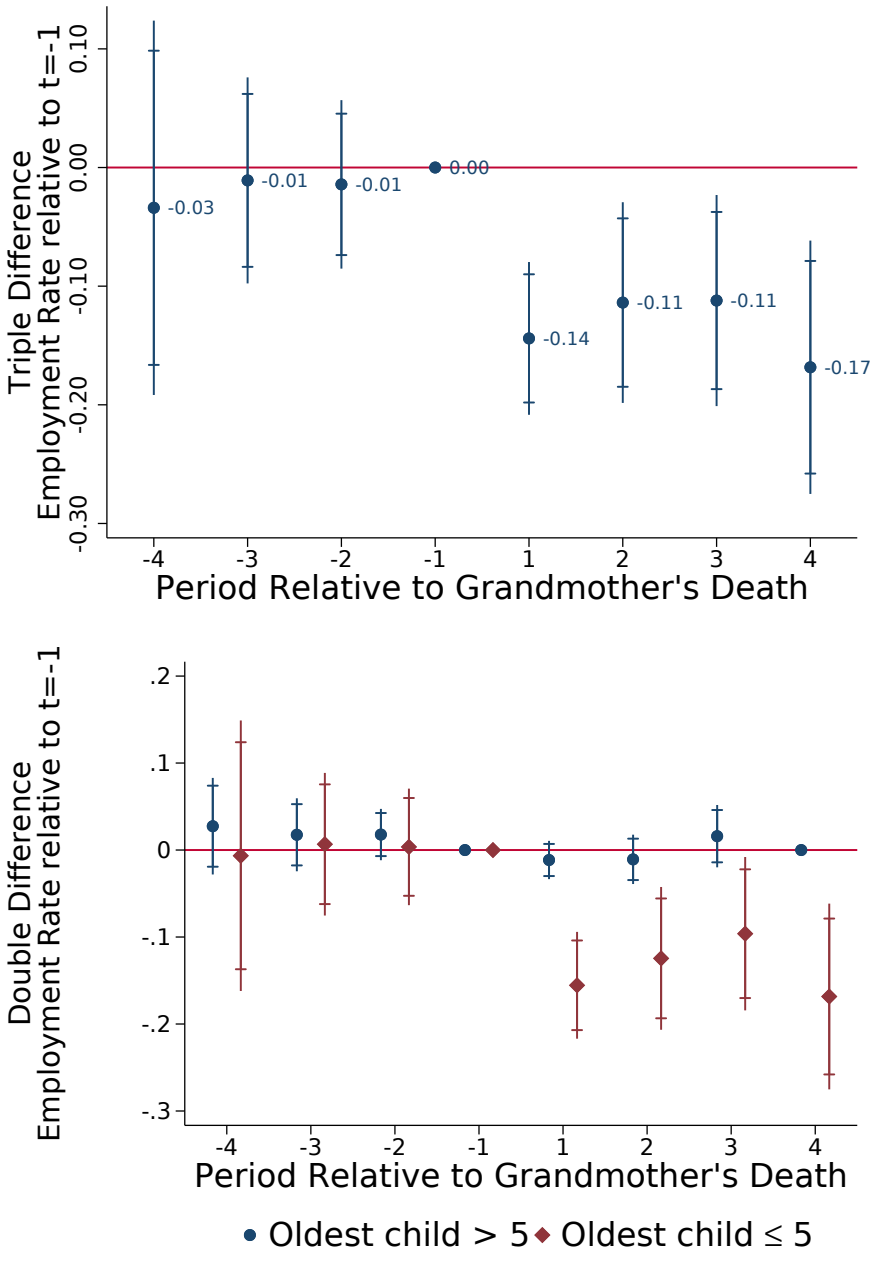

Figure 2: Event Study: Grandmother's Death and Mothers' Employment

Note: The graph displays the point estimate and the 90% and 95% confidence interval of the effect of the death of a grandmother on employment for mothers by quarter relative to the quarter just before the death, estimated using equation 3. A household with young children is a household where the oldest child is at most 5 years old. The chart on the top is the double difference estimate, and the chart on the bottom is the first difference estimate. The sample includes mothers between 20 and 50 years old and living in three-generation household with five observations in the panel, one grandmother or one grandfather or both, the grandmother is at least 40 years old, the oldest grandchild is at most 30 years old, the first generation is weakly older than the second generation, and the second generation is weakly older than the third generation. Standard errors are clustered at the household level.

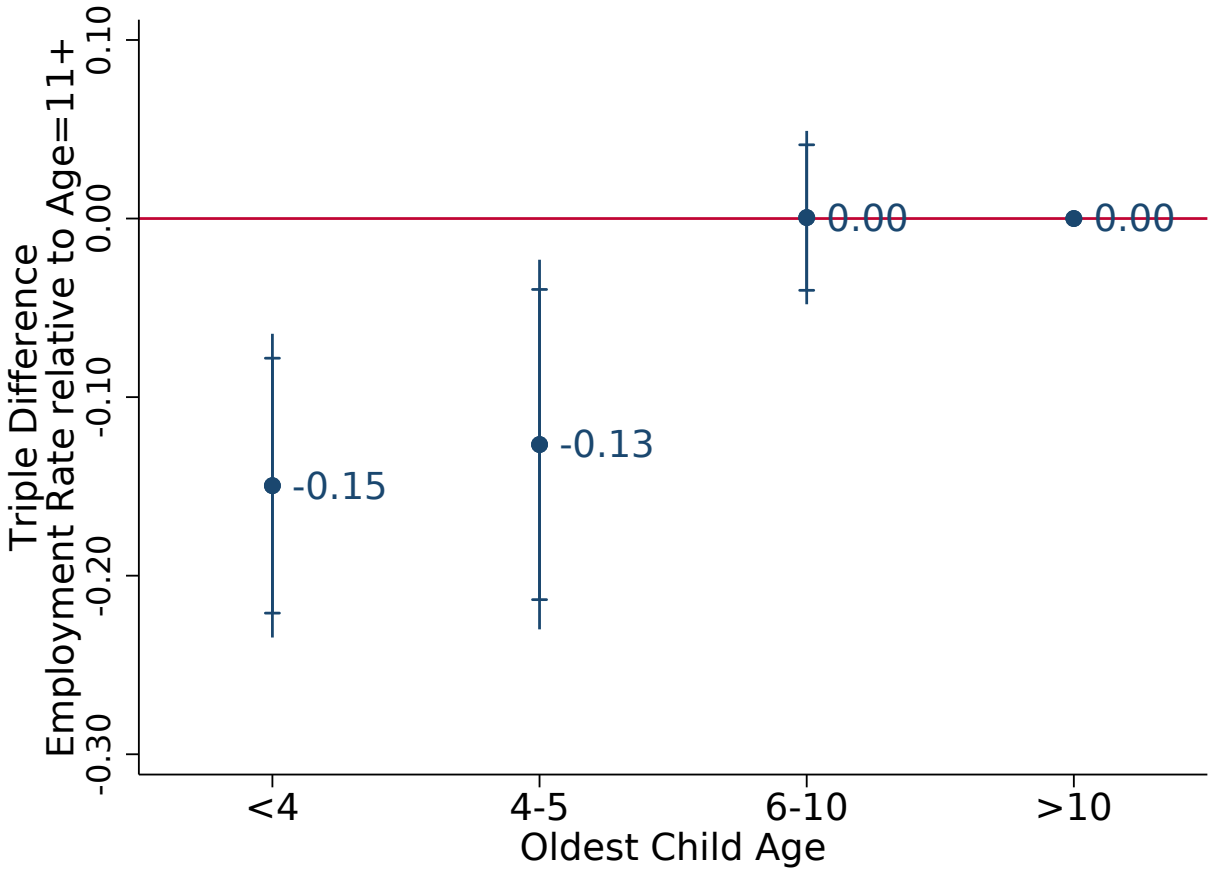

Figure 3: Grandmother's Death and Mothers' Employment by Age of the Oldest Child

Note: The graph displays the point estimate and the 90% and 95% confidence intervals of the additional effect that the death of a grandmother has on mothers' employment rate by age of the oldest child in the household relative to when the oldest child in the household is older than 10. The plotted coefficients are $\beta_{2,1}$, $\beta_{2,2}$, $\beta_{2,3}$ of Equation 2. The same sample as in Figure 2 is used. Standard errors are clustered at the household level.

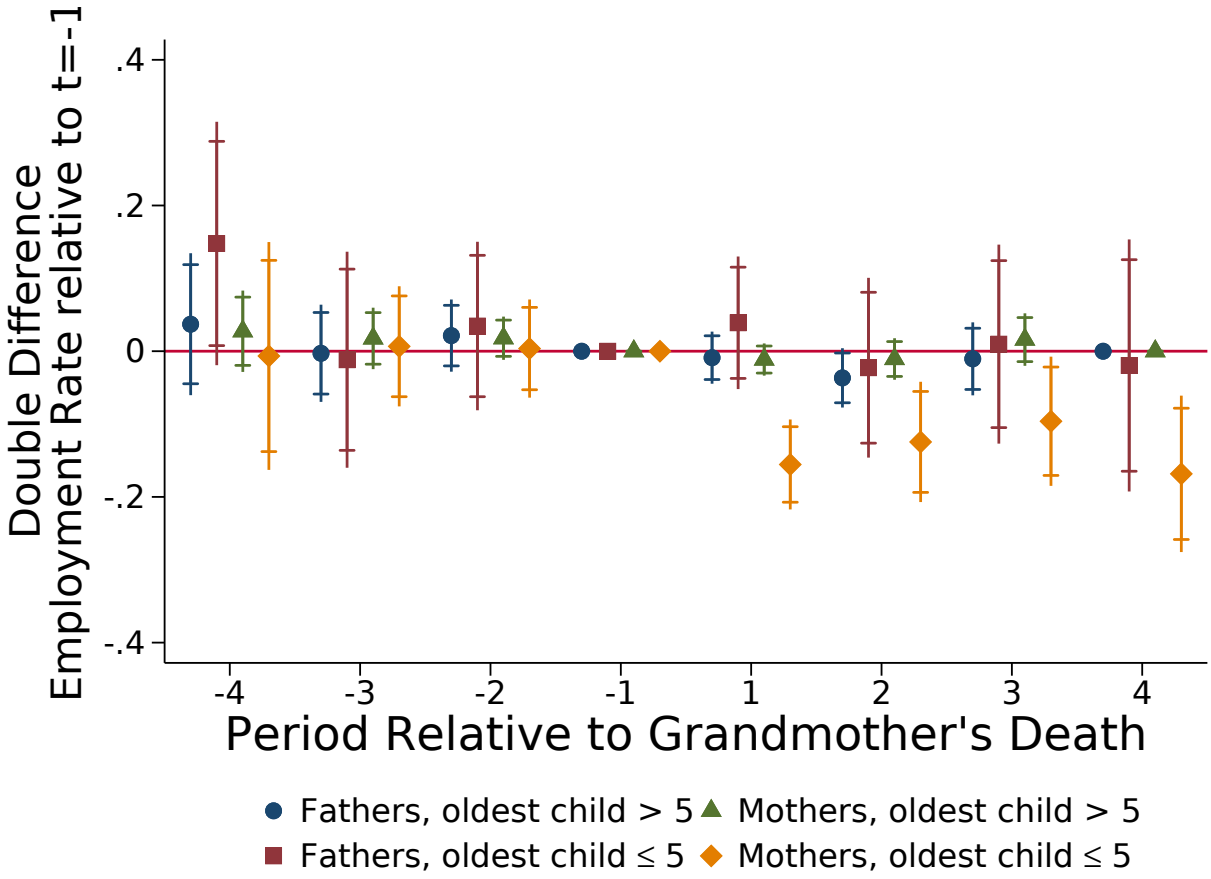

Figure 4: Event Study of Grandmother's Death (Mothers) for Mothers and Fathers

Note: The graph displays the point estimate and the 90 and 95% confidence interval of the effect that the death of a grandmother has on the employment rate for mothers and fathers estimated using Equation 5. A household with a young children is a household where the oldest child is at most 5 years old. The confidence intervals are computed using standard errors clustered at the household-level. The sample includes mothers and fathers between 20 and 50 years old and living in three-generation household with five observations in the panel, one grandmother or one grandfather or both, the grandmother is at least forty years old, the oldest grandchild is at most thirty years old, the first generation is weakly older than the second generation, and the second generation is weakly older than the third generation. Mothers are identified by belonging to the second generation and having children, and fathers are identified by belonging to the second generation and being married or coinhabiting with their spouse.

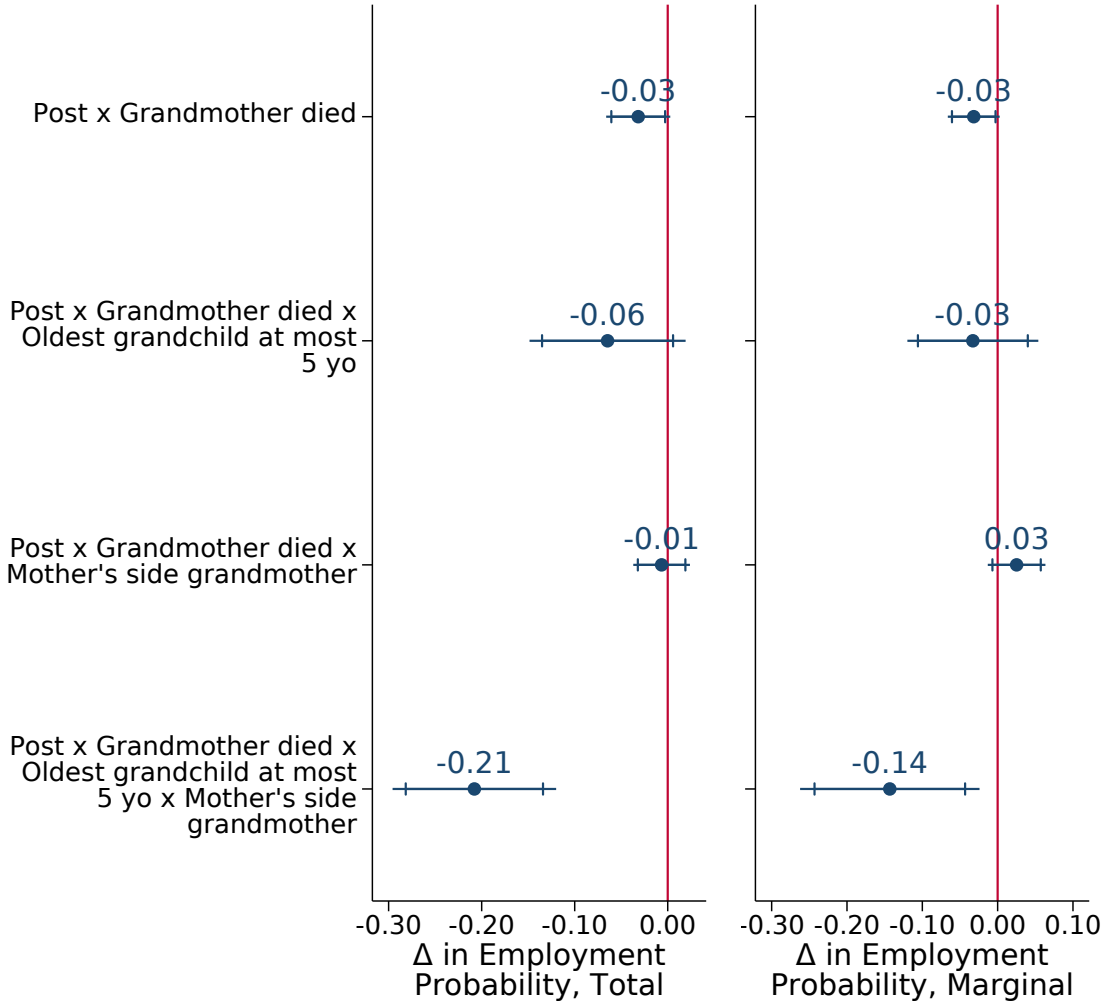

Figure 5: Heterogeneity by Grandmother's Side (Maternal vs. Paternal)

Note: The figure displays the total and marginal effect of the death of grandmothers on mothers' employment probability. The coefficients are estimated using equation 1, but adding an interaction of the first two terms with a dummy that indicates whether the grandmother who died was on the mother's side.

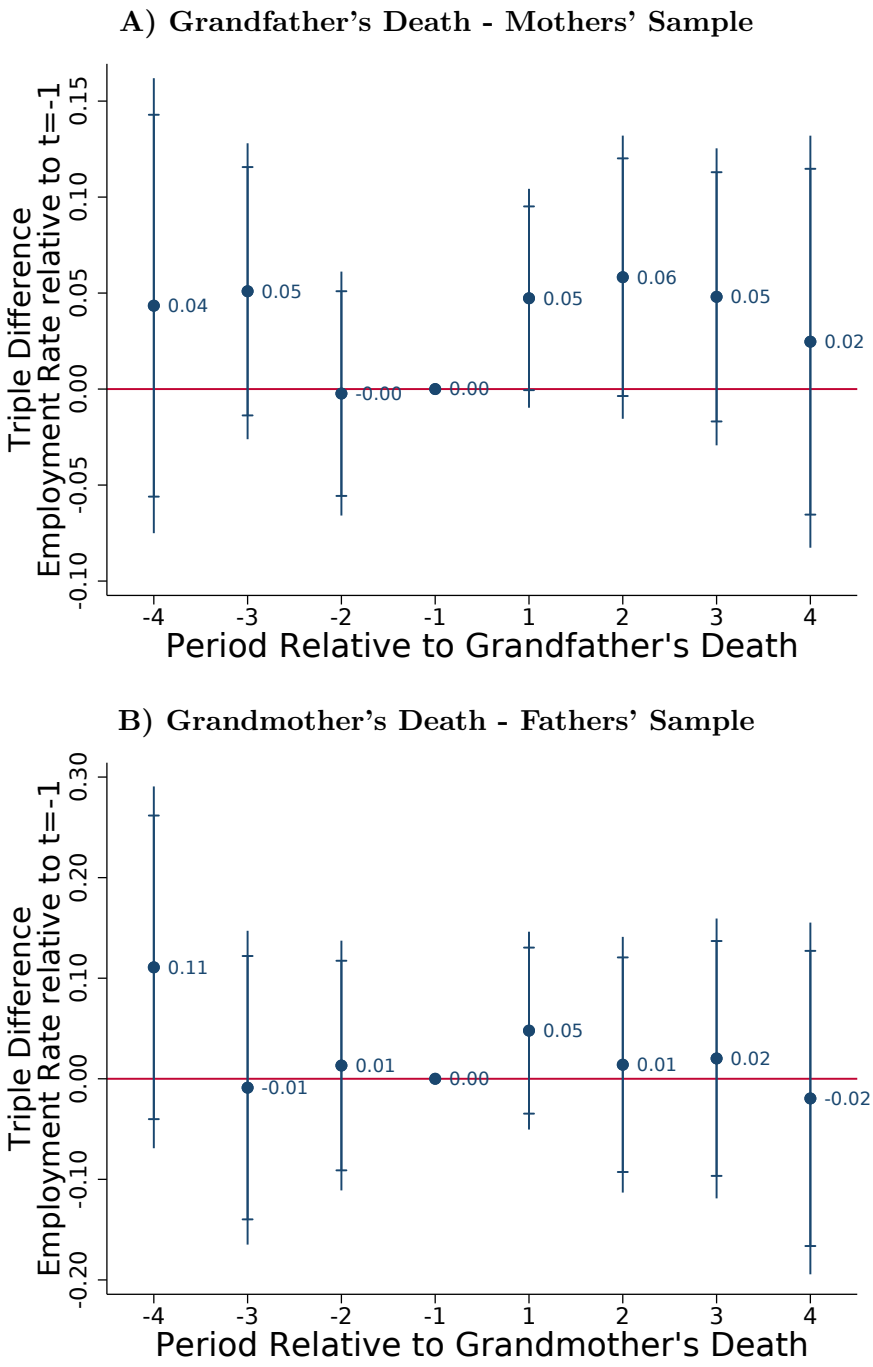

Figure 6: Event Study of Grandfather's Death (Mothers) and Grandmother's Death (Fathers)

Note: The top (bottom) graph displays the point estimate and the 90 and 95% confidence interval of the effect that the death of a grandfather (grandmother) has on the employment rate of mothers (fathers) by period relative to the period just before the death. A household with a young children is a household where the oldest child is at most 5 years old. Standard errors are clustered at the household level. The same sample as in Figure 4 is used.

8 TABLES

Table 1: Grandmother's Death and Employment Rate

	Panel A) Mothers										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Post x Grandmother died	-0.0154	-0.0223*	-0.0159	0.00740	-0.0172	0.00642	-0.0175	0.00355	-0.00990	-0.0290**	-0.0307**
	(0.0133)	(0.0123)	(0.0133)	(0.00960)	(0.0120)	(0.00959)	(0.0120)	(0.00852)	(0.00848)	(0.0140)	(0.0151)
Post x Grandmother died x Oldest grandchild at most 5 years old	-0.124***	-0.107***	-0.121***	-0.122***	-0.0916***	-0.118***	-0.0888***	-0.0905***	-0.0870***	-0.0798**	-0.0754*
	(0.0307)	(0.0278)	(0.0307)	(0.0313)	(0.0279)	(0.0312)	(0.0278)	(0.0281)	(0.0280)	(0.0401)	(0.0427)
N	484,464	484,464	484,464	484,464	484,464	484,464	484,464	484,464	484,464	484,244	484,464
	Panel B) Mothers and Fathers										
Post x Grandmother died	-0.00971	-0.00930	-0.00428	0.0201	-0.0104	0.0318**	-0.00519	0.0161	-0.0221	-0.00131	0.00266
	(0.0219)	(0.0211)	(0.0219)	(0.0153)	(0.0204)	(0.0153)	(0.0204)	(0.0137)		(0.0186)	(0.0189)
Post x Grandmother died x Oldest grandchild at most 5 years old	0.0232	0.0267	-0.0116	0.0265	0.0381	-0.00869	0.00567	0.0412	0.0102	-0.00233	-0.00179
	(0.0418)	(0.0371)	(0.0416)	(0.0423)	(0.0344)	(0.0422)	(0.0344)	(0.0354)	(0.0353)	(0.0475)	(0.0474)
Post x Grandmother died x Mother	-0.00569	-0.0130	-0.0116	-0.0127	-0.00682	-0.0254	-0.0123	-0.0125	0.0122	-0.0277	-0.0333
	(0.0252)	(0.0243)	(0.0252)	(0.0183)	(0.0234)	(0.0183)	(0.0234)	(0.0163)	(0.0162)	(0.0234)	(0.0244)
Post x Grandmother died x Oldest grandchild at most 5 x Mother	-0.147***	-0.134***	-0.109**	-0.148***	-0.130***	-0.110**	-0.0945**	-0.132***	-0.0973**	-0.0774	-0.0736
	(0.0489)	(0.0431)	(0.0486)	(0.0492)	(0.0405)	(0.0490)	(0.0404)	(0.0413)	(0.0411)	(0.0595)	(0.0625)
N	743,733	743,733	743,733	743,733	743,733	743,733	743,733	743,733	743,733	743,215	743,733
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	-
Year - Quarter - Locality - Gender FE	Y	-	Y	Y	-	Y	-	-	-	Y	Y
Year - Quarter - Young Child - Gender FE	Y	Y	-	Y	Y	-	-	Y	-	-	-
Year - Quarter - Grandmother Died - Gender FE	Y	Y	Y	-	Y	-	Y	-	-	-	-
Year - Locality - Gender FE	-	Y	-	-	-	-	-	-	-	-	-
Age - Gender FE	-	-	-	-	-	-	-	-	-	Y	-
Household composition - Gender FE	-	-	-	-	-	-	-	-	-	Y	-
Household income - Gender FE	-	-	-	-	-	-	-	-	-	Y	-
Education - Gender FE	-	-	-	-	-	-	-	-	-	Y	-

Note: All models estimate the coefficients of lower level interactions if they are not captured by the fixed effects. The sample includes "mothers" and "fathers" of the second generation between 20 and 50 years of age living in three-generation households: females with children are classified as mothers and males that are married or coinhabiting are classified as fathers. In panel B) the fixed effects are interacted with the gender of the parent (Panel A only has mothers). The Age x Gender fixed effect (FE) uses 5-year age brackets. The HH Composition FE is the interaction of the number of members in the second generation, in the third generation, and in the household. GF age and GM age are the Grandfather and Grandmother age FE. Income FE is the decile of per capita family income. The Education x Gender FE is the maximum level of education interacted by gender. Households included in the sample have 5 observations, one grandmother or one grandfather or both, the grandmother is at least 40 years old, the oldest grandchild is at most 30 years old, the first generation is weakly older than the second generation, and the second generation is weakly older than the third generation. Standard errors are clustered at the household level. The number of asterisks indicates the significance level at which the coefficient is statistically significant: .01, .05, and .1 for three, two, and one asterisks, respectively. Correia (2016) is used to estimate high-dimensional FE.

Table 2: Grandmother's Death, Employment, Hours Worked, and Earned Income

	Employment					Hours Worked		Earned Income	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variable:	Full-time	Part-time	Part-time	Part-time	Part-time	Intensive + Extensive	Intensive	Intensive + Extensive	Intensive
Post grandmother death	-0.0253*	0.00989	0.0316	-0.0266	0.0440	0.00306	0.0357	0.0145	0.132
	(0.0151)	(0.0131)	(0.0287)	(0.0851)	(0.0297)	(0.0718)	(0.0578)	(0.151)	(0.107)
Post grandmother death x	-0.0850***	-0.0391*	-0.126*	-0.339**	-0.0575	-0.355**	-0.127	-0.763**	-0.296
oldest grandchild at most 5	(0.0289)	(0.0233)	(0.0647)	(0.152)	(0.0499)	(0.164)	(0.106)	(0.339)	(0.180)
Sample	Full	Full	Employed First Wave	Part-time First Wave	Full-time First Wave	Income and Hours Avail.	Employed	Income and Hours Avail.	Employed
N	484,454	484,454	196,376	35,894	148,905	393,456	123,942	393,456	123,942

Note: The table displays the marginal effect of the grandmother's death on the probability of being full-time employed, half-time employed, and the inverse hyperbolic sine of earned income and hours worked. For columns 6 and 8 only observations with either both strictly positive hours worked and earned income or both hours worked and earned income equal to zero are included. Columns 7 and 9 include observations with strictly positive hours worked and earned income. Hours worked and income are winsorized at the 5% level from each tail. Standard errors clustered at the household level. Part-time employment is 30 hours or less per week, and full-time employment is more than 30 hours a week.

Table 3: Heterogeneity by Daycare Availability

	Residual			Observed		
	(1)	(2)	(3)	(4)	(5)	(6)
Post grandmother death	-0.0155	-0.0155	-0.0156	-0.0160	-0.0156	-0.0161
	(0.0133)	(0.0133)	(0.0133)	(0.0132)	(0.0133)	(0.0132)
Post x Grandmother Died x Oldest Grandchild at most 5 years old	-0.125***	-0.123***	-0.122***	-0.123***	-0.121***	-0.120***
	(0.0312)	(0.0304)	(0.0307)	(0.0306)	(0.0301)	(0.0299)
Post x Grandmother Died x Private Daycares per Child	0.0153		0.0151	0.00870		0.00820
	(0.00968)		(0.00969)	(0.0095)		(0.00955)
Post x Grandmother Died x Oldest Grandchild at most 5 years old x Private Daycares per Child	-0.0120		-0.0237	-0.0163		-0.0352
	(0.0305)		(0.0309)	(0.029)		(0.0302)
Post x Grandmother Died x Public Daycares per Child		0.00353	0.00198		0.00435	0.00325
		(0.00737)	(0.00698)		(0.00771)	(0.0074)
Post x Grandmother Died x Oldest Grandchild at most 5 years old x Public Daycares per Child		0.0860**	0.0910**		0.0781**	0.0948**
		(0.039)	(0.0401)		(0.0376)	(0.0408)
N	483,425	483,425	483,425	484,454	484,454	484,454
Individual FE	Y	Y	Y	Y	Y	Y
Year - Quarter - Locality FE	Y	Y	Y	Y	Y	Y
Year - Quarter - Young Child FE	Y	Y	Y	Y	Y	Y
Year - Quarter - Grandmother Died FE	Y	Y	Y	Y	Y	Y

Note: The table displays heterogeneity of the marginal effect of the grandmother's death on mother's employment by daycare availability, estimated using Equation 7. Daycare per child is calculated by dividing the number of daycare facilities by the number of children up to five years old in the municipality. Daycares per child are standardized. The number of stars indicates the significance level at which the coefficient is statistically significant: .01, .05, and .1 for three, two, and one asterisks, respectively. Standard errors are clustered at the household level.

Table 4: Heterogeneity by Daycare Affordability

	Residual						Observed					
	Hourly Cost			Total Cost			Hourly Cost			Total Cost		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post grandmother death	-0.0161	-0.0141	-0.0133	-0.0158	-0.0141	-0.0130	-0.0164	-0.0145	-0.0137	-0.0159	-0.0144	-0.0132
	(0.0156)	(0.0149)	(0.0156)	(0.0156)	(0.0149)	(0.0156)	(0.0156)	(0.0149)	(0.0156)	(0.0156)	(0.0149)	(0.0157)
Post x Grandmother Died x Oldest Grandchild at most 5 years old	-0.110***	-0.122***	-0.110***	-0.112***	-0.122***	-0.112***	-0.111***	-0.123***	-0.112***	-0.113***	-0.123***	-0.114***
	(0.0371)	(0.0371)	(0.0375)	(0.0385)	(0.0370)	(0.0388)	(0.0380)	(0.0374)	(0.0386)	(0.0390)	(0.0374)	(0.0398)
Post x Grandmother Died x Cost of Public Daycare		0.00592	0.0105		0.00316	0.00562		0.00198	0.00362		0.00372	0.00501
		(0.0111)	(0.0138)		(0.0106)	(0.0132)		(0.0113)	(0.0139)		(0.0108)	(0.0134)
Post x Grandmother Died x Oldest Grandchild at most 5 years old x Cost of Public Daycare		-0.00684	-0.00512		-0.00631	-0.00190		0.000515	0.00781		0.00480	0.0132
		(0.0332)	(0.0371)		(0.0299)	(0.0326)		(0.0359)	(0.0396)		(0.0328)	(0.0357)
Post x Grandmother Died x Cost of Private Daycare	-0.00813		-0.00627	0.000904		0.00308	-0.000468		0.00266	0.00498		0.00761
	(0.0114)		(0.0115)	(0.0118)		(0.0121)	(0.0115)		(0.0116)	(0.0123)		(0.0127)
Post x Grandmother Died x Oldest Grandchild at most 5 years old x Cost of Private Daycare	-0.0767**		-0.0790**	-0.0648**		-0.0676**	-0.0601*		-0.0649*	-0.0508		-0.0563*
	(0.0370)		(0.0370)	(0.0330)		(0.0327)	(0.0352)		(0.0354)	(0.0344)		(0.0340)
N	316,832	354,865	312,892	316,832	354,865	312,892	317,239	355,928	313,279	317,239	355,928	313,279
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year - Quarter - Locality FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year - Quarter - Young Child FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year - Quarter - Grandmother Died FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: The table displays heterogeneity of the marginal effect of the grandmother's death on mother's employment by daycare affordability, estimated using Equation 7.. Public and private daycare costs are standardized. The number of asterisks indicates the significance level at which the coefficient is statistically significant: .01, .05, and .1 for three, two, and one asterisks, respectively. Standard errors are clustered at the household level.

Table 5: Other Heterogeneity

Heterogenous Effect on Employment Probability by:	(1) Hours Grandmother Provided Care†	(2) # of Kids	(3) # of Grandkids	(4) # of Grandkids < 6	(5) # of Male Grandkids	(6) 1+ Male Grandkids	(7) Household Income†	(8) Income†	(9) Hours†	(10) Formal Employment	(11) High School +	(12) College +
Post grandmother death	-0.0197	-0.0286	-0.0148	-0.0196	-0.0111	0.00472	-0.0164	-0.0199	-0.0187	-0.0879**	-0.0360**	-0.0161
	(0.0158)	(0.0228)	(0.022)	(0.0143)	(0.0172)	(0.02)	(0.0133)	(0.0241)	(0.0239)	(0.0361)	(0.0157)	(0.0139)
Post x Grandmother Died x Oldest Grandchild at most 5 years old	-0.122***	-0.134**	-0.172**	-0.167**	-0.183***	-0.209***	-0.129***	-0.200**	-0.201**	-0.345***	-0.0581	-0.106***
	(0.0305)	(0.062)	(0.0678)	(0.0659)	(0.0436)	(0.0493)	(0.0316)	(0.0822)	(0.0828)	(0.125)	(0.0409)	(0.0332)
Post x Grandmother Died x Z	-0.0126	0.00529	-0.000279	0.0116	-0.00391	-0.0270	-0.00912	0.0204	-0.00697	0.0814**	0.0490***	0.00488
	(0.0205)	(0.00768)	(0.00796)	(0.0155)	(0.00936)	(0.021)	(0.00882)	(0.0128)	(0.0187)	(0.0368)	(0.0189)	(0.0272)
Post x Grandmother Died x Oldest Grandchild at most 5 years old x Z	-0.0904**	0.0117	0.0363	0.0243	0.0897**	0.152**	-0.0319	0.0277	-0.0189	0.218	-0.133**	-0.0866
	(0.0446)	(0.0362)	(0.0447)	(0.0466)	(0.0369)	(0.0621)	(0.04)	(0.0512)	(0.0867)	(0.15)	(0.0605)	(0.0823)
N	484,454	484,454	484,454	484,454	484,454	484,454	484,454	175,210	175,210	196,376	484,454	484,454
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Y - Q - Locality FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Y - Q - Young Child FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Y - Q - Grandmother Died FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: The table displays heterogeneity of the marginal effect of the grandmother's death on mother's employment by the variable on the column header, estimated using Equation 7. Variables with a † at the end are standardized. The number of asterisks indicates the significance level at which the coefficient is statistically significant: .01, .05, and .1 for three, two, and one asterisks, respectively. Standard errors are clustered at the household level. Y-Q stands for Year-Quarter.

Table 6: Effect on Employment Probability: Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Base	Unbalanced	Any # of grandparents	Any # of parents	Any type of work	Any paid work	Grandmother ≤ 60	Grandmother ≤ 70	ENOE weights	Youngest ≤ 5	DiD
Panel A) Mothers											
Post x Grandmother died	-0.0154	-0.0216*	-0.0150	-0.0270**	0.00309	0.00317	-0.0263	-0.0303*	-0.0366*	-0.0131	0.0131
	(0.0133)	(0.0126)	(0.0130)	(0.0123)	(0.0163)	(0.0158)	(0.0290)	(0.0172)	(0.0201)	(0.0146)	(0.0283)
Post x Grandmother died x Oldest	-0.124***	-0.0986***	-0.129***	-0.100***	-0.0909**	-0.101***	-0.163***	-0.137***	-0.147***	-0.0440**	-0.161**
grandchild at most 5 years old	(0.0307)	(0.0273)	(0.0306)	(0.0285)	(0.0371)	(0.0356)	(0.0548)	(0.0369)	(0.0447)	(0.0191)	(0.0672)
N	484,454	561,119	487,651	620,172	484,454	484,454	484,454	484,454	484,454	484,454	2,561
Panel B) Mothers and Fathers											
Post x Grandmother died	-0.00971	0.00449	-0.00520	-0.00313	0.000665	-0.00409	-0.0308	-0.0237	0.0531*	-0.0353	-0.000486
	(0.0219)	(0.0208)	(0.0218)	(0.0215)	(0.0170)	(0.0180)	(0.0396)	(0.0260)	(0.0298)	(0.0242)	(0.0433)
Post x Grandmother died x Oldest	0.0232	0.0200	0.0244	0.0337	0.0198	0.00551	0.00390	0.0754	0.0374	0.0589**	0.0298
grandchild at most 5 years old	(0.0418)	(0.0395)	(0.0422)	(0.0383)	(0.0341)	(0.0356)	(0.0739)	(0.0478)	(0.0563)	(0.0285)	(0.0957)
Post x Grandmother died x Mother	-0.00569	-0.0261	-0.00985	-0.0239	0.00242	0.00726	0.00449	-0.00656	-0.0898**	0.0222	0.0136
	(0.0252)	(0.0240)	(0.0251)	(0.0242)	(0.0232)	(0.0238)	(0.0507)	(0.0315)	(0.0354)	(0.0284)	(0.0507)
Post x Grandmother died x Oldest	-0.147***	-0.119***	-0.154***	-0.134***	-0.111**	-0.107**	-0.167*	-0.212***	-0.185***	-0.103***	-0.190*
grandchild at most 5 x Mother	(0.0489)	(0.0454)	(0.0499)	(0.0451)	(0.0487)	(0.0495)	(0.0862)	(0.0568)	(0.0697)	(0.0341)	(0.103)
N	743,723	861,568	749,231	933,821	743,723	743,723	743,723	743,723	743,723	743,723	3,591
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year-Quarter-Young Child-Gender FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Year-Quarter-GM Died-Gender FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Year-Quarter-Locality-Gender FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: The table displays the marginal effect of the grandmother's death on the employment rate of mothers (Panel A) and the employment rate of mothers and fathers (Panel B). Column 1 is the main specification. Column 2, Unbalanced, the restriction of observing the household for five surveys is dropped. Column 3, Any number of grandparents, allows for any number of members of the first generation of the household. Column 4, any number of parents, allows for any number of members of the second generation of the household. In Column 5, Any Work, the dependent variable takes the value of one if the individual is a subordinate and paid employee, an employer, works on his/her own, or works without pay. In Column 6, Any paid Work, the dependent variable takes the value of one if the individual is a subordinate and paid employee, an employer, or works on his/her own. In Column 7 and 8, the Grandmother died dummy takes the value of 1 only if the grandmother that died was under 60 or 70 years old. In Column 9, ENOE weights, the estimation uses the probability weights available in the ENOE. In Column 10, Youngest ≤ 5, the dummy Young Children takes the value of 1 in the youngest child in the household is at most 5 years old. The number of asterisks indicates the significance level at which the coefficient is statistically significant: .01, .05, and .1 for three, two, and one asterisks, respectively. The numbers in parenthesis are the standard errors clustered at the household-level.

9 Online Appendix

Table A.1: Mothers in 2 vs 3-Generation Households

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
					HH Income		# of	Years of	Highschool		Earned	Earned	Hours	Hours
Dependent Variable	Large City	Rural	Employed	HH Income	(pc)	Age	Children	Schooling	+	College+	Income	Income	Worked	Worked
3-Generation Household	0.0147**	-0.0289***	0.117***	1729.9***	-483.2***	-2.201***	-0.261***	0.266***	0.0416***	0.0159***	238.7***	-646.7***	5.513***	3.609***
	(0.00646)	(0.00350)	(0.00334)	(101.7)	(20.87)	(0.0425)	(0.00531)	(0.0490)	(0.00600)	(0.00450)	(23.99)	(48.08)	(0.161)	(0.204)
Mean Dependent Variable	0.57	0.17	0.35	7,550	1,787	28.7	1.8	10.7	0.51	0.22	1,956	5,441	14.9	40.0
Sample Size	267,593	267,593	260,416	260,416	260,416	260,416	260,416	260,162	260,416	260,416	231,267	63,211	231,267	63,211
Sample	All	All	All	All	All	All	All	All	All	All	All	Employed	All	Employed
Quarter FE	Y	Y												
Quarter x Locality FE			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Age FE							Y	Y	Y	Y	Y	Y	Y	Y

Note: The table displays the differences between mothers that live in two-generation households and those that live in three-generation households. Mothers of ages between 20 and 50 living in households where the oldest member of the youngest generation is less than 10 years old is included. The employed sample includes only mothers that are employed and have strictly positive income and hours worked. Standard errors clustered at the locality level.

Table A.2: 3-Generation Households Alternative Samples

	(1)	(2)	(3)	(4)
Sample	Base	Unbalanced	Any # of grandparents	Any # of parents
Observations	484,454	561,119	488,286	620,172
Employed	0.44	0.44	0.44	0.44
Any work	0.56	0.56	0.56	0.56
Any paid work	0.53	0.53	0.53	0.53
Age	32.0	31.9	32.0	31.6
Number of Kids	1.91	1.91	1.91	1.88
Hours Employed	21.75	21.79	21.75	21.76
Income x Hour	11.62	11.74	11.62	11.20
Income	1,822	1,843	1,823	1,770
Formal Employment	0.31	0.31	0.31	0.30
Household Size	5.76	5.73	5.76	6.48

Note: The table displays descriptive statistics of alternative samples of 3-generation households. Column 1 is the main specification. Column 2, Unbalanced, lifts the restriction of observing the individual for five surveys. Column 3, Any number of grandparents, allows for any number of members of the first generation of the household. Column 4, any number of parents, allows for any number of members of the second generation of the household.

Table A.3: Heterogeneity by School Affordability

	Residual				Observed			
	Hourly Cost		Total Cost		Hourly Cost		Total Cost	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post grandmother death	-0.0171	-0.0211	-0.0173	-0.0210	-0.0185	-0.0209	-0.0186	-0.0207
	(0.0140)	(0.0148)	(0.0140)	(0.0148)	(0.0140)	(0.0148)	(0.0140)	(0.0148)
Post x Grandmother Died x Oldest Grandchild at most 5 years old	-0.127***	-0.121***	-0.124***	-0.113***	-0.125***	-0.118***	-0.123***	-0.111***
	(0.0340)	(0.0373)	(0.0333)	(0.0367)	(0.0338)	(0.0371)	(0.0333)	(0.0370)
Post x Grandmother Died x Cost of School	-0.0202**		-0.0227**		-0.0136		-0.0153	
	(0.00951)		(0.0102)		(0.00971)		(0.0102)	
Post x Grandmother Died x Oldest Grandchild at most 5 years old x Cost of School	-0.0355		-0.0273		-0.0258		-0.0283	
	(0.0528)		(0.0431)		(0.0515)		(0.0425)	
Post x Grandmother Died x Cost of Private School		0.00105		0.00333		0.00444		0.00764
		(0.0115)		(0.0121)		(0.0116)		(0.0122)
Post x Grandmother Died x Oldest Grandchild at most 5 years old x Cost of Private School		-0.0892***		-0.0914***		-0.0838**		-0.0863***
		(0.0337)		(0.0304)		(0.0363)		(0.0319)
N	421,099	353,526	421,144	353,526	423,961	354,556	424,006	354,556
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y
Year - Quarter - Locality FE	Y	Y	Y	Y	Y	Y	Y	Y
Year - Quarter - Young Child FE	Y	Y	Y	Y	Y	Y	Y	Y
Year - Quarter - Grandmother Died FE	Y	Y	Y	Y	Y	Y	Y	Y
# of localities to estimate residuals	1758	615	1761	615	-	-	-	-

Note: The table displays heterogeneity of the marginal effect of the grandmother's death on mother's employment by school affordability, estimated using equation 7. School costs are standardized. The number of stars indicates the significance level at which the coefficient is statistically significant: .01, .05, and .1 for three, two, and one asterisks, respectively. Standard errors are clustered at the household level.

Table A.4: Grandmother's Death and Older Grandchildren's Time Spent Providing Care

Dependent Variable:	Time Spent Providing Care			𝟙[Spent Time Providing Care]		
	(1)	(2)	(3)	(4)	(5)	(6)
	12-15 Years Old	12-18 Years Old	12-21 Years Old	12-15 Years Old	12-18 Years Old	12-21 Years Old
Post x Grandmother Died	0.756**	0.718**	0.663**	0.0713**	0.0680**	0.0614**
	(0.348)	(0.328)	(0.326)	(0.0328)	(0.0308)	(0.031)
N	46,639	62,366	67,896	46,639	62,366	67,896
Individual FE	Y	Y	Y	Y	Y	Y
Locality FE	Y	Y	Y	Y	Y	Y
Year - Quarter FE	Y	Y	Y	Y	Y	Y

Note: The table displays the effect of the grandmother's death on the inverse hyperbolic sine of the time older grandchildren spend providing care. The sample is grandchildren 12-15, 12-18, or 12-21 years old in households where the youngest grandchild is up to 5 years old. Time allocation providing is the response to the following question from ENOE Q1 2005 to Q1 2020: During last week, how much time did you spend exclusively taking care without pay of children, elderly, sick, or handicapped? Columns 1-3 further restrict the sample to households where the grandmother was up to 70 years old. The number of asterisks indicates the significance level at which the coefficient is statistically significant: .01, .05, and .1 for three, two, and one asterisks, respectively. Standard errors are clustered at the household level.

9.1 Online Appendix Figures

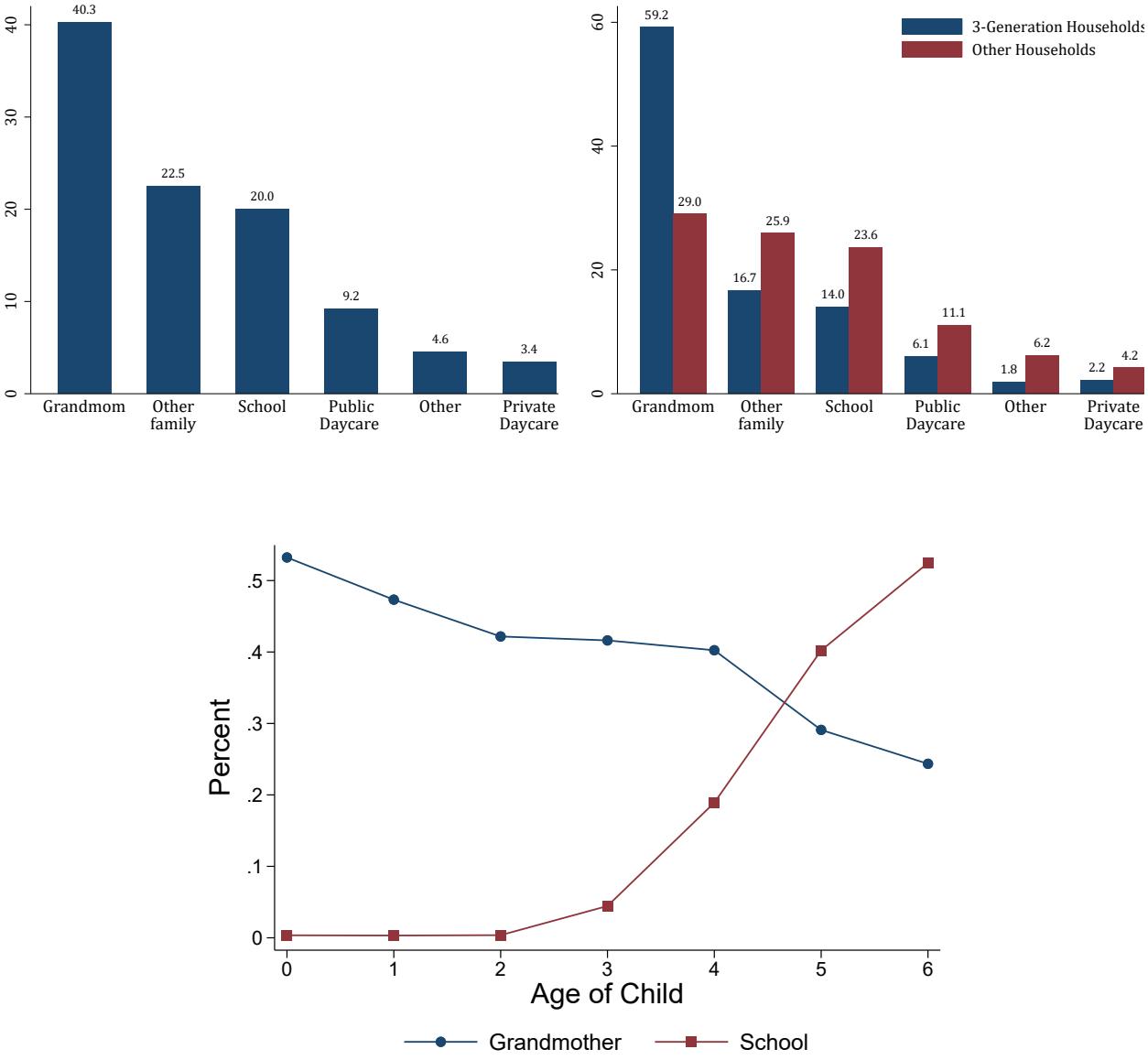

Figure A.1: When the mother goes to work, who takes care of the child?

Source: ENESS 2009, 2013
Note: The surveys include responses for children between age 0 and 6 years. Other includes non-family members and leaving the child alone. Children who go with their mothers to work or whose mothers do not work are not included. ENESS 2017 is not included because the grandmother option was replaced by grandparents.

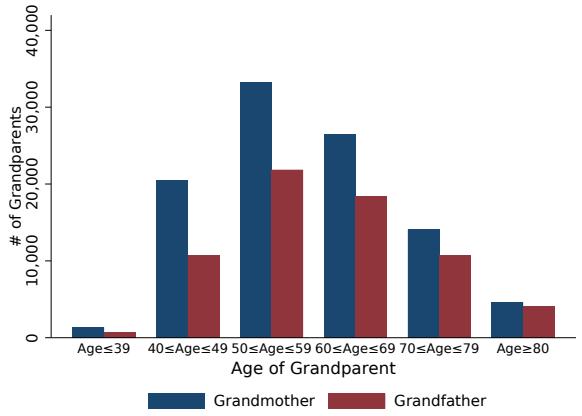

Figure A.2: Age of Grandparents
Source: ENOE (Q1 2005 - Q1 2020)
Note: The sample includes three-generation households.

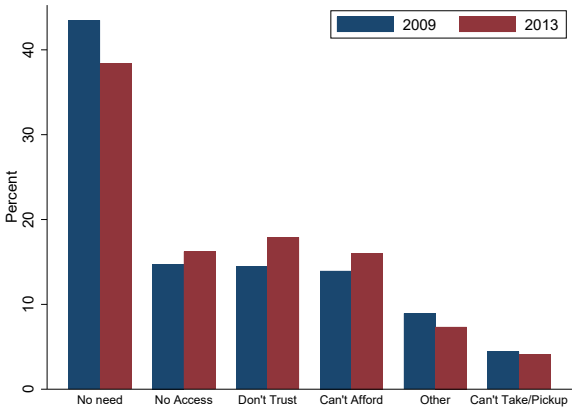

Figure A.4: Why are you not using daycare?
Source: ENESS (2009, 2013)

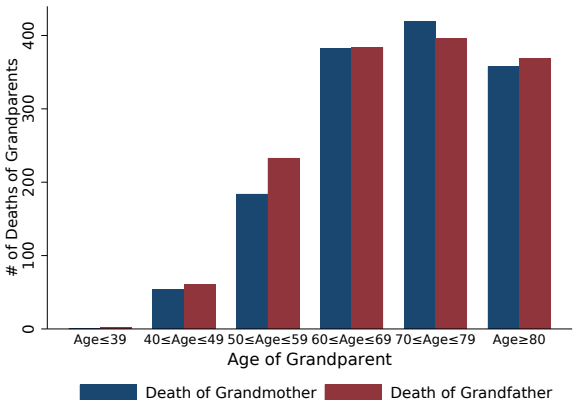

Figure A.3: Deaths of Grandparents
Source: ENOE (Q1 2005 - Q1 2020)
The sample includes three-generation households.

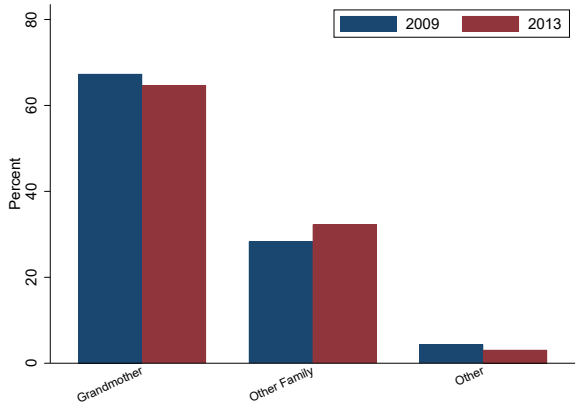

Figure A.5: If there is no need for daycare, who takes care of the child?
Source: ENESS 2009, ENESS 2013

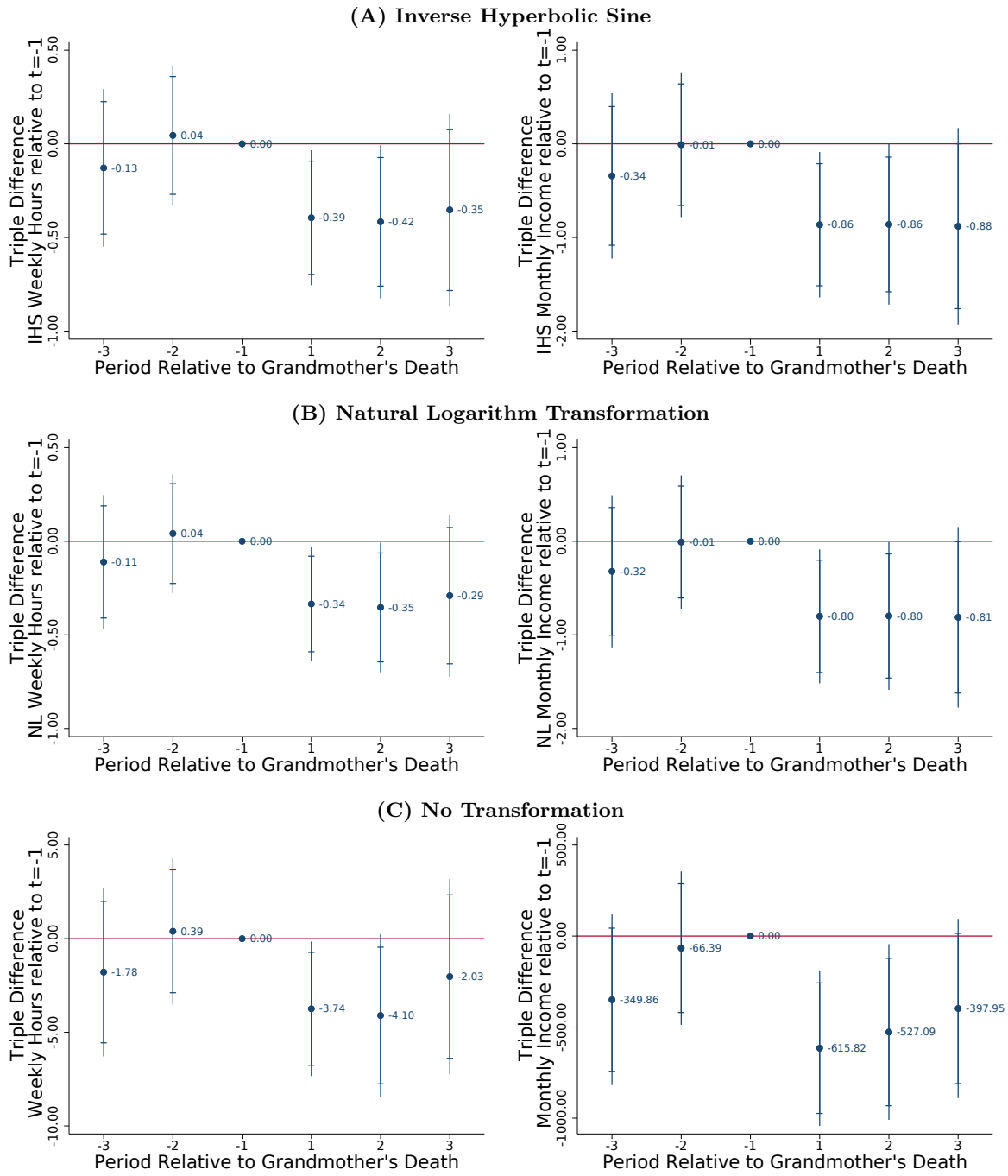

Figure A.6: Earned Income and Hours Worked - Mothers Sample

Note: The graphs display the point estimate and the 90% and 95% confidence interval of the effect that the death of the grandmother has on earned income and hours worked of mothers. The estimation is based on equation 3 but replaces the dependent variable with earned income or hours worked. Income is winsorized at a 5% level from each tail, excluding 0's. Hours worked is winsorized at a 5% level from the right tail. Only observation where both earned income and hours worked are positive or both are zero are included. Panel A) presents results for the inverse hyperbolic sine transformation, Panel B) the natural logarithm, and Panel C) no transformation. The confidence intervals are computed using standard errors clustered at the household-level.