Affording expensive ceremonies: Evidence from quinceañeras in Mexico

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Abstract

Despite their limited resources, low-income households in developing countries spend a considerable amount of resources on festivals and ceremonies. How do they afford such expensive events and how do the events affect their economic lives? I address these questions using a coming-of-age ceremony in Latin culture called a quinceañera. To overcome the endogeneity associated with the timings of ceremonies, I exploit a unique feature of quinceañeras that only households with a 15-year-old girl have the ceremony. With repeated cross-section data from Mexico, I show that households afford quinceañeras through savings, transfers from other households, and more labor supply of mothers. Furthermore, I find that quinceañeras increase the probability of households shutting down their non-agricultural businesses. My study provides insights into how households facing incomplete credit markets in developing countries manage large expenditures.

1 Introduction

It has been extensively documented that low-income households in developing countries make large expenditures on festivals and ceremonies. In Udaipur in India, for example, more than

99 percent of the poor households spend on festivals, and their median expenditures on festivals are 10 percent of their annual household consumption (Banerjee and Duflo, 2007). Conditional on having a ceremony, the significance of its cost in household budget becomes more evident. Bloch et al. (2004) document that the average wedding celebration cost, excluding dowry payments, was around 30% of GPD per capita in their study areas in India in 1994. In South Africa, Case and Menendez (2011) report that the average funeral cost amounts to 40 percent of the average annual household budget. Considering low-income households' limited resources, liquidity constraints, and missed opportunities for productive investment, these events can impose substantial financial stresses on the households and, in turn, affect their economic activities.

Despite its potential economic importance, there are almost no quantitative studies on this issue, such as how households afford large expenditures on festivals and ceremonies and how they affect households' lives. The lack of such studies could be partly attributed to the endogenous timing of ceremonies:[1] households may decide the timing of marriage based on the available resources (Corno et al., 2020; Hankins and Hoekstra, 2011; Salisbury, 2017), or the death of a household member could be caused by income shocks to the household (Evans and Moore, 2011; Lindahl, 2005). If factors affecting the timing of festivals or ceremonies are directly correlated with the outcome of interest, it is impossible to identify the causal impact of such events.

This paper overcomes this endogeneity issue and conducts a quantitative analysis of ceremony expenditures in a developing country. For this purpose, I use a traditional ceremony in Latin culture called a quinceañera. One advantage of using quinceañeras over other festivals or ceremonies is its fixed timing: quinceañeras are held when a girl turns 15 years old. This rules out the issue of endogenous timing and allows me to assess the impact of ceremonies quantitatively.

Specifically, I investigate the following three questions. First, I will explore how households afford large expenditures on ceremonies. The answer to this question will provide insights into how households in developing countries manage large expenditures. For example, liquidity constraints households face can affect measures they take, and behavioral bias such as present bias can affect how they prepare for future expenses through savings. Secondly, I analyze the effect of quinceañeras on household businesses. Self-employment is an important income source for many low-income households in developing countries. There-

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[1]Other potential reasons for the lack of such studies include the endogeneity of ceremony sizes and the difficulty in measuring ceremony timings and expenses.

fore, answering the question makes an important contribution to understanding the welfare impact of the ceremonies. Finally, to explore the potential benefits of expensive ceremonies in developing countries, I examine how quinceañeras affect the strength of social networks among households. By addressing these questions, I aim to advance the understandings of the economic lives of the poor, especially in the dimension of festivals and ceremonies.

To answer these questions, I exploit the unique feature of quinceañeras: only households with girls turning 15 years old have ceremonies. With this feature, for identification, I use a difference-in-differences method. The first difference is in the outcomes between households with girls of age 15 and households with girls of other ages such as 14 or 16. However, just comparing their differences can capture other confounding factors affecting outcomes. Hence, I use the second difference between households with girls and households with boys of the same age. This allows me to rule out the differences due to different ages of children and identify the effect of having quinceañeras on outcomes of interest.

With repeated cross-section data from Mexico, I obtain three main empirical results. First, I find that to afford quinceañera expenditures, households save in advance, receive monetary and in-kind transfers from other households, and increase work hours by mothers around the year of quinceañeras. In particular, the results show that households save resources one year before the quinceañeras and use the resources for the ceremonies. This means that households use an intertemporal consumption smoothing method for the large expenditures on ceremonies. The use of savings for large expenses on a traditional cultural institution is also found by Anukriti et al. (2020) for dowry in India.

The fact that households start storing resources just before their ceremonies suggests that they are present-biased and procrastinate costly behavior until just before the "deadline" (Ashraf et al., 2006; Duflo et al., 2011b; Kaur et al., 2015; O'Donoghue and Rabin, 1999, 2001). Also, the use of transfers from other households for ceremony expenditures offers insights into the function of risk-sharing in this context. Previous studies have pointed out the role of risk-sharing networks for households in developing countries to deal with economic shocks (Angelucci and De Giorgi, 2009; Ligon and Schechter, 2020; Ligon et al., 2002; Townsend, 1994). My finding suggests that risk-sharing networks help households cope with large expenditures for quinceañera ceremonies.

The increase in labor supply to afford large expenditures is observed in India by Anukriti et al. (2020). Whereas they report the increase in fathers' labor supply to prepare for future dowry payments, I find that mothers increase work hours for quinceañera ceremonies. This difference could be born out of the difference in labor markets for women: since Mexico has a

substantially higher female labor force participation rate than India, Mexican women could flexibly adjust their work hours according to their needs.

Secondly, households are more likely to shut down their non-agricultural businesses (manufacturing, retail, or service) in the year of quinceañeras. This could be because households with credit constraints cannot pay upfront fixed costs for business operations, which force them to quit their businesses. In other words, expenditures for business operations could be crowded out due to quinceañera ceremonies. This is consistent with the previous findings that small and medium enterprises in developing countries are likely to close down in response to economic shocks (Davies and Kerr, 2018; De Mel et al., 2012; McKenzie and Paffhausen, 2019).

Finally, I do not find any evidence that the strength of households' social networks is affected by quinceañeras. There are several possible explanations for this finding. First, rather than just having a ceremony, the actual size of the quinceañera ceremony could be crucial in changing households' connections with neighbors. Second, the questions in the survey may not sufficiently capture the strength of social networks, and detailed network data may be required to investigate the change in social networks. Exploring these possibilities is left for future research.

I conduct a series of robustness checks to confirm that my findings do not change by altering sample restriction rules and the definition of the main variables of interest. Furthermore, I explore several potential determinants of ceremony sizes. First, I investigate if there is any difference in quinceañera ceremony sizes by the birth order of girls for whom the ceremonies are held. The result shows that the quinceañera ceremonies on the first girls are not larger than on later girls. Secondly, I analyze the effects of permanent and transitory income on quinceañera ceremony sizes. I obtain suggestive evidence that, while households with larger permanent income spend more on quinceañeras, transitory income shocks have little impact on quinceañera expenditures. This suggests that the sizes of the quinceañera ceremonies are not determined by how much resource is available to households. Rather, they can be determined by other factors such as how large the ceremonies are *expected* to be given the households' wealth.

This paper mainly contributes to the literature on ceremony expenditures and, more broadly, conspicuous consumption. Previous theoretical work has assumed that households gain utility from their social status and they use conspicuous consumption to signal it (Bloch et al., 2004; Moav and Neeman, 2010). Empirical studies have primarily focused on determinants of spending on ceremonies and conspicuous consumption. For example, Bloch et al.

(2004) examine the determinants of expenditures on wedding ceremonies in India. They find suggestive evidence that brides' households spend more on wedding ceremonies to signal to their communities the social characteristics of grooms' households. Brown et al. (2011) analyze the festival expenditures in rural Chinese villages, and their results suggest that people spend on ceremonies to keep up with their neighbors. Grier et al. (2016) show that unmarried male consumers who face an unfavorable sex ratio purchase more expensive cars, which suggests that expensive cars play a signaling role for better marriage outcomes.

What is missing in the literature is an analysis of the causal impact of ceremony expenditures on economic outcomes. This is partly due to the endogeneity discussed above. My empirical design using quinceañeras allows me to overcome this problem and identify the causal impact of ceremonies. One of few studies on the causal impact of a festival in a developing country is Montero and Yang (2020). They explore how Catholic Saint Day festivals in Mexico affect agricultural production and economic development. For identification, they exploit an exogenous variation across municipalities in the timing of the festivals. They find that municipalities in which the festivals overlap with planting and harvest periods have worse economic performance. One potential channel argued in their paper is that festival expenditures crowd out productive investments. My study complements their research by investigating if a household-level ceremony similarly affects the operations of household businesses. Furthermore, to explore the potential benefits of large ceremony expenses in developing countries, I analyze the effect of quinceañeras on social networks among households.

Similar but distinct literature is on marriage payments such as dowry and brideprice; see Anderson (2007a) for a review. Whereas the literature has focused mainly on theoretical analyses behind marriage prices (Anderson, 2007b; Anderson and Bidner, 2015; Botticini and Siow, 2003) and empirical analyses on the change in dowries (Edlund, 2006; Rao, 1993), there are recent studies on the effect of marriage payments (Alfano, 2017; Anukriti et al., 2020; Bhalotra et al., 2020; Corno et al., 2020; Menon, 2020). Partly due to the endogenous timing of marriage payments, these causal studies explore the effect of the potential future expenses. For example, Alfano (2017) explores the effect of potential future dowry payments on fertility choices in India. On the other hand, the fixed timing of quinceañeras allows me to investigate the contemporaneous effect of large ceremonies.

Moreover, my study contributes to several other areas. First, the answer to how households cope with huge expenditure on quinceañeras is related to intertemporal consumption smoothing, which has been studied in Deaton (1991) and Zeldes (1989), for example. Ho-

rioka and Terada-Hagiwara (2017) show that in India and South Korea, when a marriage market is more competitive, households save more for dowries to be successful in the marriage market. Similarly, using the gender of the first-born child and the expected dowry amounts in marriage markets, Anukriti et al. (2020) find that households save to prepare for future marriage payments. These studies suggest that households use savings to prepare for a "shock" in advance, consistent with my empirical findings.

Secondly, the analysis of how a ceremony affects social networks has an implication on how households develop their social networks. In the literature on risk-sharing, ample works have been done on how effectively people share risks (Townsend, 1994, 1995; Udry, 1994) and what prevents people from fully sharing risks (Coate and Ravallion, 1993; De Weerdt et al., 2019; Doepke and Townsend, 2006; Kocherlakota, 1996; Ligon, 1998; Ligon et al., 2002). What has been understudied is how people develop their networks to share risks, with a few exceptions such as Attanasio et al. (2012), Fafchamps and Gubert (2007), and Fafchamps and Quinn (2018). I attempt to explore the possibility that having large ceremonies affects social networks. My empirical result shows that quinceañeras have a limited effect on the strength of social networks. This could be because, instead of just having quinceañeras, the size of the ceremony could be significant in changing social networks among households.

This study proceeds as follows. In Section 2, background of quinceañeras is introduced. Section 3 discusses the conceptual framework in this study, and data are introduced in Section 4. In Section 5, I present the empirical approach and Section 6 shows the results. Section 7 provides the results of robustness checks and additional analyses. Section 8 concludes.

2 Background

Many cultures, both in developed and developing countries, have coming-of-age ceremonies, and quinceañeras are one such ceremony: in the Latino culture, when girls turn 15 years old, households have ceremonies to celebrate the coming-of-age of the girls.[2] Quinceañeras are considered "the passage . . . from childhood to adulthood" of women (Tatum, 2014). While the size of the ceremony differs depending on various factors, such as the wealth of the households, many of them hold quinceañeras to celebrate this critical time of women's lives.

Historically, people in the Latino culture had quinceañeras to publicize girls' availability for marriage (Plummer, 2007). Napolitano (1997) provides an example of a family with a girl

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[2]The term quinceañeras is used both for a girl turning 15 years old and for a ceremony for the girl. In this paper, I use the term for the ceremony.

turning 15 living in an urban area. The family had a quinceañera ceremony in a rural village the parents are originally from, and they expressed their wish that the daughter marries someone in the village. Existing studies have also pointed out that quinceañeras play a role in sending various signals to the community. Quinceañeras are used to demonstrate family status and prestige (Napolitano, 1997) and families do everything to distinguish themselves within their group (Sarricolea Torres and Ortega Palma, 2009). This is partly why the cost of ceremonies of quinceañeras is often high, as seen below.

The ceremonies provide an opportunity for relatives and friends to interact. A ceremony of quinceañeras usually consists of two parts: the religious Mass and the party. The former is a blessing in church, and the latter includes catering, drinking, music, and dance, among other things. The party can be especially costly since households may rent a hall, invite a band for music, provide food and alcohol, purchase a dress for the daughter, and hire a private dance instructor. Moreover, since relatives and friends are invited, the party's size and cost can be enormous. Although data is scarce, according to Napolitano (1997), in Mexico, the cost of a quinceañeras was at least 1,500 Mexican Pesos in 1994 value, which was approximately 25% of GDP per capita at that time.

In this paper, I explore how households in developing countries afford large expenditures on ceremonies and how such expenditures affect households' economic lives. Quinceañeras are useful events to answer these questions for the following reasons. First, as documented in the previous anthropological and sociological studies, and as I will show later, quinceañeras are costly and hence potentially affect various aspects of households' lives. This makes it important and meaningful to answer how households in Mexico afford the ceremonies and what the consequences of quinceañeras are.

Second, the timing is fixed and clearly determined. This allows me to identify if a household had quinceañeras in the survey year based on the age of a girl in the household. Furthermore, as discussed in Section 1, the endogenous timing makes it difficult to obtain causal interpretations from other ceremonies such as funerals and weddings. Therefore, the fixed timing of quinceañeras helps me identify the effect of the ceremony on outcomes of interest.

Third, only households with a 15-year-old girl hold ceremonies, not those with a boy at the same age. This allows me to use households with boys as comparison groups and to control for the effect of just having a child at a certain age. For instance, having an additional adolescent, whether a boy or a girl, in a household can affect the social network with neighbors since interactions among children can help parents develop stronger connections. Since this has

nothing to do with having a quinceañera ceremony, I use households with a boy to control for such effect.

In summary, quinceañeras are expensive and provide a unique opportunity to answer my research questions. The next section will discuss my research questions and potential answers to them, which will be empirically tested in later sections.

3 Conceptual Framework

In this paper, I answer the following three questions. First, I investigate how households afford large expenditures for ceremonies. Despite the enormous expenditures on festivals and ceremonies in developing countries, it remains largely unknown how households deal with such large expenses. Answering this question provides an insight into the measures that households can take for large expenditures and the barriers they may face. Whereas households may attempt to use savings or borrowings to afford quinceañera ceremonies, liquidity constraints or lack of access to financial institutions may prevent them from taking these measures. Also, present bias can be an obstacle for the households to save in advance to prepare for the coming quinceañeras. Through the analyses of the measures taken by the households, I explore these possibilities. The answer to the question also has an implication to the impact of ceremonies on the economic lives of households. For example, if they save or borrow money for the expenditures on quinceañeras, the households may not need to reduce other spendings. On the other hand, failing such consumption smoothing, households might have to reduce business inputs or even shut down their businesses. Therefore, by exploring this question, I shed light on the potential effect of ceremonies on people's lives in developing countries.

Second, I analyze the effect of quinceañeras on household business operations. Households may reduce their business inputs to afford quinceañera ceremonies, and this can results in lower business revenues and profits. By investigating this possibility, I will provide an insight into the effect of quinceañeras on economic development. Furthermore, given that many low-income households financially rely on self-employment, this analysis contributes to the understandings of the impact of expensive ceremonies on households' welfare.

Third, as an attempt to explore benefits of expensive ceremonies in developing countries, I investigate the effect of quinceañeras on the strength of social networks between households. Due to the nature of the ceremonies, there are usually many participants, who may strengthen their connections through interactions. These connections may help the households, for

example, to borrow money to cope with economic needs. Using questions about the strength of social ties between households in the survey, I explore this possibility.

How do households afford large ceremony expenditures?

To investigate how households in Mexico afford quinceañera expenditures, I propose the following five possibilities. First, households may use savings to prepare for the expenditures on quinceañeras since households know in advance that they will need a vast payment for their daughters' ceremonies. It has been documented that poor households use various saving modes for large expenditures such as lumpy investment (Collins et al., 2009). Moreover, Anukriti et al. (2020) find the increase in savings after having a daughter in India to prepare for their dowry payments in the future. Hence, Mexican households may save resources and use them for large ceremonies.

Second, households can receive monetary or in-kind transfers from other households. In Mexico, "sponsors" called *padrinos* or *madrinas* are chosen from friends or neighbors to sponsor large events such as quinceañeras. These sponsors are expected to pay a part of expenditures for ceremonies (Davalos, 1996). Households may use aid from the sponsors to afford quinceañera ceremonies. Also, if I consider the ceremony of quinceañeras as an economic "shock," then I can think of such inter-household transfers as a form of risk-sharing. Given that risk-sharing behavior has been widely observed in various developing countries (Angelucci and De Giorgi, 2009; Ligon and Schechter, 2020; Ligon et al., 2002; Townsend, 1994), households may use transfers to deal with the expenditures on quinceañeras in my study context.

Third, households may increase their labor supply to earn more income. For example, Anukriti et al. (2020) find that in India, after having a daughter, her father increases his labor supply. On the other hand, they do not observe an increase in labor supply by a daughter's mother. The authors argue that this can be due to stagnant female labor force participation in India. The change in the father's labor supply is found more significant in areas where expected dowry payments are larger, suggesting that the household needs to increase income and save resources for future payment of dowries. In the context of my study, similarly, households may increase their labor supply to earn more income around the year of quinceañeras.

Fourth, households might reduce consumption in the year of quinceañeras or for some periods after the ceremony. If there is no change in available resources and no access to intertemporal consumption smoothing, then reducing consumption is the only thing house-

holds can do to afford quinceañeras.

Finally, they may borrow money from neighbors or financial institutes to afford their ceremonies. Previous studies have pointed out the importance of both informal and formal credit for people in developing countries (Collins et al., 2009; Udry, 1994). To deal with large expenditures for the ceremony, they may borrow money and repay the debt in later periods.

How do ceremonies in developing countries affect household businesses?

This paper also explores the effect of quinceañeras on the business operations of households. I analyze the effect on agricultural and non-agricultural production (manufacturing, retail, and service) separately. There are several considerations in this analysis. First, in addition to taking the measures considered above to afford the quinceañera ceremonies, households could reduce business inputs. This can result in lower business revenues as well.

Second, it is possible that households quit their businesses around the year of quinceañeras. For example, suppose that households need to pay the upfront fixed costs such as purchase of machine and equipment. With borrowing constraints, the ceremony expenditures can make it impossible for the households to pay the cost and force them to shut down their businesses. Also, without enough resources, the business may not reach efficient scale, and hence households stop their businesses.[3] The phenomena that small firms shut down after economic shocks have been widely observed (McKenzie and Paffhausen, 2019). Therefore, in addition to business inputs and outputs, I use an indicator for business operations as an outcome in the analysis.

How do the ceremonies affect the strength of social networks?

The last question this study addresses is how quinceañeras affect the social networks of households. Through this exercise, I investigate the potential benefit of such large ceremonies. Previous studies in development economics have found the unexploited opportunities of productive investment (De Mel et al., 2008, 2009; Fafchamps et al., 2014). If households decide to miss this opportunity and use their resources for ceremonies, such expenditures on ceremonies may provide some form of benefit to the households. I explore one such potential benefit: stronger social networks among households.

Quinceañera ceremonies, especially the party, usually have many participants. This can enable the host and guests to interact, which can strengthen their social connections. There

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[3]Eastwood et al. (2010) discuss factors affecting efficient scale in agricultural operations.

are findings in the previous studies that simple interactions can help establish social networks. For example, Fafchamps and Quinn (2018) find that if judges in a business competition are randomly assigned to the same committee to judge the participants, they are more likely to have connections afterward. Other studies have found that exogenously created interaction opportunities and social connections can affect various outcomes (Attanasio et al., 2012; Centola, 2010; Duflo et al., 2011a; Fafchamps and Mo, 2018; Sacerdote, 2001).

Also, observing who participates in the ceremonies, the participants can obtain information on the social networks of the host household. Previous studies have pointed out the roles of social networks to signal characteristics of individuals (Campbell, 2014), such as productivity of researchers (Ductor et al., 2014) and borrowers' quality in online peer-to-peer lending (Freedman and Jin, 2017). Moreover, anthropological and sociological studies have pointed out that quinceañera ceremonies are opportunities to signal households' economic and social status (Napolitano, 1997; Sarricolea Torres and Ortega Palma, 2009). Therefore, the wealth information conveyed through the ceremonies can help households establish social network links. Fafchamps and Gubert (2007) find that wealth is a crucial factor for households to be in a mutual insurance relationship. Moreover, if households' absolute risk aversion decreases with wealth, then the wealth signaled by the ceremonies can contain information on the risk aversion of the host household. It has been found that risk attitude plays an important role in risk-sharing network formation (Attanasio et al., 2012). For these reasons, it is possible that having a quinceañera ceremony changes the social networks of households, and I investigate this possibility.[4]

4   Data

In this study, the primary treatment variable is the number of 15-year-old girls in a household. However, only a small percentage of households have any such girls. In the data that I will use for analyses, only 4.2 percent of households have a girl at age 15. This can bring up a concern for the precision of the estimated effects of quinceañeras. To overcome this problem, I use data with a large sample size for estimation with precision.

The main dataset for analyses is the Mexican Household Income and Expenditure Survey (Encuesta Nacional de Ingresos y Gastos de los Hogares: ENIGH). This is a repeated cross-

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[4]The effect described in this paragraph may not be captured in the analysis below on how having quinceañeras affects the strength of social networks. Larger and smaller ceremonies than average can counteract each other and make the average effect small in magnitude. An analysis of the impact of the size of quinceañeras might be required to find this effect. This point will be discussed later in detail.

section data. The surveys are nationally representative and conducted by the National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía: INEGI) of Mexico. They collect detailed information on households' economic activities, such as consumption and income. In addition, socio-demographic information of household members such as gender and age is collected.

INEGI has initiated the survey in 1984, and since 1994, they have conducted surveys almost every two years with a few exceptions. In this study, I use 17 rounds of surveys between 1984 and 2018 for most analyses. If information about a variable is not collected in some periods, I use the subset of the 17 rounds of surveys where the information was collected. I restrict the sample to households with at least one child from 8 to 17 years old. This is to make the sample households relatively homogeneous in the sense that all the households in the analyses have at least one child of similar ages. ENIGH is complemented by the Annual Consumer Price Index (CPI) from the Federal Research Bank of St. Louis to convert monetary values to real terms.

In the analysis of how households afford quinceañera expenditures, I use the following outcomes: (i) net withdrawal (withdrawal minus deposit) from savings in bank accounts or stored at home and informal loan club (*tandas*),[5] (ii) net transfers from other households (in-transfers minus out-transfers, not including remittances from abroad and transfers through welfare programs), (iii) working hours of fathers and mothers for the past week, (iv) household consumption excluding expenditures on festivals and ceremonies, and (v) net borrowing from other households and financial institutes (received loan minus given loan).

In the analyses on the crowd-out effect of quinceañeras on business operation, I use inputs and outputs on agricultural or non-agricultural businesses separately. While these inputs include payment to labor inputs of non-household members, labor inputs by household members are not counted. Additionally, to analyze if households shut down their businesses around the year of quinceañeras, I also use an indicator for business operations, agriculture and non-agriculture separately, as outcomes.

Finally, for the information on the strength of social networks, I use the answers to questions on social networks in the survey. In particular, I conduct the principal component analysis (PCA) to these answers and obtain the first principal component, which will be used as a measure of the strength of social networks. The five questions are (i) "How difficult is it for you to get help to get a job?", (ii) "How difficult is it for you to get help to take care

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[5]This does not include the change in physical assets such as livestock and jewelry. Such information is not collected in ENIGH.

of you in an illness?", (iii) "How difficult is it for you to borrow the amount of money that you usually earn per month?", (iv) "How difficult is it for you to get help to accompany to go to the doctor?", and (v) "How difficult is it for you to get a cooperation to improve your neighborhood or community?"[6] Note that these questions ask about the availability of help in general, not from a specific type of person. Households' answers can take five values, where 1 is "impossible" and 5 is "very easy." To account for differences in the trend of answers in different years, the PCA is applied separately for each survey year. One potential problem of this approach is that the values only have ordinal meanings, and treating them as cardinal numbers can be inappropriate. To deal with this concern, I also use categorical PCA (Linting and van der Kooij, 2012) for summarizing the answers to the network-related questions. The weights used in PCAs are shown in Tables A.1 and A.2.

Table 1 shows the summary statistics of the main variables used in the analyses. For the net withdrawal and net loan variables, I use the information collected in surveys after 2000. For business-related variables and measures for the strength of social networks, the information in surveys after 2008 is used. For the working hours of fathers and mothers, I use data after 2010 and restrict the analyses to households in which children between 8 to 17 years old have the same father or mother.[7]

The table shows that households with a 15-year-old girl spend significantly more on ceremonies compared to households with such a girl. This means that nontrivial resources are spent on quinceañeras. The table also provides suggestive evidence on how the households afford quinceañeras. For example, the difference in net transfers from other households suggests that households use such transfers for ceremony expenses. Furthermore, while there is no significant difference in fathers' work hours, mothers work significantly longer hours if a household has a 15-year-old girl, which can increase resources for quinceañera ceremonies. However, these differences could be due to factors that have nothing to do with quinceañeras, such as the age and gender of a child in a household. In the empirical analyses below, I account for these potential confounding factors to identify the impact of quinceañeras to answer my research questions.

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[6]Households with children under 12 years old are also asked about the difficulty of asking for help to take care of their children. I do not include the answer to this sixth question in calculating PCA.

[7]Among households with at least one 8-17-year-old child, 32% and 14% do not have a unique father and mother of 8-17-year-old children, respectively.

Table 1: Summary Statistics

	All		HHs w/ 15yo girl		HHs w/o 15yo girl		
	Obs.	Mean (SD)	Obs.	Mean (SD)	Obs.	Mean (SD)	Diff. (SE)
Ceremony expenditures	187,358	0.15	16,191	0.69	171,167	0.10	0.59***
		(1.68)		(4.43)		(1.10)	(0.03)
Total income	187,358	41.20	16,191	41.73	171,167	41.15	0.58
		(55.13)		(69.67)		(53.55)	(0.56)
Total consumption (w/o ceremony)	187,358	28.36	16,191	29.23	171,167	28.27	0.96***
		(28.57)		(32.47)		(28.17)	(0.26)
Net transfer (in-transfer - out-tranfer)	187,300	0.54	16,186	0.68	171,114	0.52	0.16***
		(4.54)		(6.37)		(4.33)	(0.05)
Net withdraw (withdraw - deposit)	151,394	-0.98	12,616	-0.79	138,778	-0.99	0.21
		(21.34)		(13.08)		(21.94)	(0.13)
Net loan (borrow - lend)	151,394	0.47	12,616	0.52	138,778	0.46	0.05
		(6.77)		(4.97)		(6.91)	(0.05)
Any agriculture production	104,238	0.14	8,359	0.16	95,879	0.14	0.02***
		(0.35)		(0.37)		(0.35)	(0.00)
Agriculture cost	104,238	0.67	8,359	0.82	95,879	0.66	0.16
		(8.26)		(11.31)		(7.94)	(0.13)
Agriculture revenue	104,238	1.20	8,359	1.49	95,879	1.17	0.32
		(12.77)		(17.96)		(12.22)	(0.20)
Any non-agriculture production	104,238	0.25	8,359	0.25	95,879	0.25	-0.00
		(0.43)		(0.43)		(0.43)	(0.00)
Non-agriculture cost	104,238	5.53	8,359	5.13	95,879	5.56	-0.43
		(34.35)		(24.97)		(35.05)	(0.30)
Non-agriculture revenue	104,238	8.56	8,359	8.10	95,879	8.60	-0.49
		(45.34)		(32.42)		(46.29)	(0.38)
First principal component from PCA	104,229	0.33	8,359	0.56	95,870	0.30	0.26***
		(1.35)		(1.26)		(1.35)	(0.01)
First principal component from categorical PCA	104,229	0.22	8,359	0.37	95,870	0.21	0.16***
		(0.87)		(0.80)		(0.87)	(0.01)
Father work hours (last week)	58,537	48.65	4,436	48.29	54,101	48.68	-0.39
		(17.64)		(17.79)		(17.63)	(0.28)
Mother work hours (last week)	76,251	21.14	5,836	22.39	70,415	21.03	1.35***
		(23.02)		(23.14)		(23.01)	(0.32)

Notes: The monetary variables, represented by a thousand Mexican Peso, are converted to the real term (value in 2015). For the net withdrawal (withdrawal minus deposit) and net loan (received loan minus given loan) variables, I use the information collected in surveys after 2000. For business-related variables, the information in surveys after 2008 is used. For variables of fathers' and mothers' work hours, the information in surveys after 2010 is used and only households in which children between 8 to 17 years old have a unique father or mother are included. The columns "All" include households with at least one child from 8 to 17 years old. The columns "HHs w/ 15yo girl" include households with any girl at age 15. The columns "HHs w/o 15yo girl" include households without any girl at age 15. The last column shows the difference in variables between "HHs w/ 15yo girl" and "HHs w/o 15yo girl" (the former minus the latter) and the standard errors of the differences in parentheses. "Any agriculture production" is an indicator for engaging agricultural production. "Any non-agriculture production" is an indicator for engaging in non-agricultural businesses (manufacturing, retail, or service). The last column shows the difference in variables between households with and without a 15-year-old girl (the former minus the latter). *: 0.10, **: 0.05, ***: 0.01.

14

5 Empirical Strategy

In this study, I identify the effect of quinceañeras on various outcomes. One approach to this goal is to compare outcomes of households with a daughter before and after having a quinceañera. However, this comparison may reflect the difference between households having a younger and an older child. For instance, as a child gets older, his or her household experiences more interactions with other households, which may increase the size of transfers between them. To deal with this concern, I compare households with daughters and households with sons at the same age and then analyze how their differences change around the year of quinceañeras. In this sense, I use a difference-in-differences method as my identification strategy: I use the difference between households with a daughter versus a son, and I also use the difference between households with a child at different ages.

Based on this idea, I run the following regression equation:

$$E_{ijt} = \sum_{h=8}^{17} \alpha_h G_{ijt}^h + \sum_{h=8}^{17} \beta_h C_{ijt}^h + X_{ijt}\gamma + \mu_j + \tau_t + \epsilon_{ijt}, \tag{1}$$

where E_{ijt} is the outcome variable of a household i in a municipality j in year t and X_{ijt} is household-level controls. The main right-hand side variables are G_{ijt}^h, an indicator for having a h-year-old girl, and C_{ijt}^h, an indicator for having a h-year-old child (girl or boy).[8] I use children up to 17 years old since above that age range, they may get married and leave the household, which could cause a selection problem. The household characteristics include household size and the age of the household head. Fixed effects included in the regressions are municipality fixed effects (μ_j) and year fixed effects (τ_t). To account for correlations in ceremony expenditures and traditions in local communities, the standard errors are clustered at the municipality level.

The coefficients α_h capture the effect of having a girl at age h on the outcome above and beyond the effect of having a boy of the same age. In other words, the coefficients can be interpreted as the difference in the outcome between households with a girl and a boy at the same age. Since I am interested in how outcomes change before and after quinceañeras, I will investigate how the estimates of α_h change around the age of 15.

Note that strictly speaking, the coefficients demonstrate the effect of having a child of certain age and gender. In particular, α_{15} represents the difference in an outcome be-

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[8]In my data, 2.7% of the households have more than one child of the same age and gender, likely due to multiple birth. In a robustness check in Section 7.1, I use the numbers of h-year-old girls and children in a household instead of indicators in regressions.

tween households with a 15-year-old girl and boy, which could not necessarily be due to quinceañeras. However, for instance, if I obtain estimates for α_{14} and α_{16} which are close to 0 and a statistically significant estimate for α_{15}, this suggests that something significant occurs only to households with 15-year-old girls but not to others. Since I do not believe there is any such event other than quinceañeras, I interpret the coefficients as the effect of quinceañeras.

It also should be noted that not all households necessarily hold quinceañera ceremonies for girls turning 15. Therefore, the regression results should be interpreted as the intention-to-treat (ITT) effect: the effect of having an opportunity to hold a quinceañera ceremony.

One threat for identification is that some children may leave their households. In Mexico, children graduate from junior high schools (*Educación Secundaria*) at 15 years old, and they may leave households due to, for instance, marriage or migration to work after graduation. Since ENIGH does not contain information on who left the household, this can make household composition different before and after quinceañeras. The next section will show how the fraction of households with a boy or a girl changes by age and show that this does not seem to be a concern.

6   Results

6.1   Large expenditures on quinceañeras

Before diving into the main results, I show that expenditures on ceremonies increase when a girl of a household is 15 years old. In other words, I empirically demonstrate that quinceañera expenditures are significant for households. Figure 1 shows the regression results with ceremony expenditures as an outcome variable. Since there are many households who have zero expenditures on ceremonies[9] and the distribution of the expenditures is skewed, I use the inverse hyperbolic sine (IHS) transformation.

The figure shows the estimated coefficients α_h in Equation (1): the effect of having a girl at age h on the outcome above and beyond the effect of having a boy of the same age. The point estimates for ages other than 15 are small in magnitude and, in most cases, statistically insignificant. This means that there are no significant differences in general ceremony expenses between households with a boy and a girl. This is understandable since most ceremonies are not gender-specific, such as birthday parties or graduation ceremonies.

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[9]Only 5.0% of the households have positive expenditures.

On the other hand, the figure shows a clear jump in expenditures of households with a 15-year-old girl. That is, compared to households with a 15-year-old boy, those with a 15-year-old girl spend significantly more on ceremonies. This suggests that households with girls at 15 spend a significant amount of resources on quinceañera ceremonies. This finding of large ceremony expenditures resonates with the results by Banerjee and Duflo (2007). Below, I investigate how households afford such large expenditures and how they affect households' economic lives.

It should be noted that in my data, even of households with a 15-year-old girl, only 8.4% reported having spent positive ceremony expenditures, which seems low. There are mainly two potential reasons for this. First, the question in the survey asks about the ceremony expenditures for the past six months. Hence, if a 15-year-old girl in a household had her birthday more than six months before the survey, then the expenditures on quinceañeras may not be reported. Secondly, measurement errors due to misreporting in this variable can be severe. For these reasons, households who actually had quinceañeras might not report ceremony expenditures. Hence, this figure likely shows conservative estimates of the coefficients.

## 6.2 Identification threat: demographic composition of households

As discussed in the previous section, one threat for identification is the change in household composition. To explore if this is a concern, I investigate if household composition changes as a child gets older. Note that, since I use households with boys as a control group for households with girls at the same age, what should not change is the *difference* between shares of households with girls and boys of the same age, not the *absolute shares* of households with girls and boys.

Figure 2 shows the fraction of households with children by their age and gender, from ages 0 to 20. This figure shows no substantial demographic change around the age 15.[10] In particular, the *difference* between the fractions of households with a boy and a girl are stable. This suggests that the selection problem due to demographic changes is not a concern in the empirical analysis below.

I also conduct tests if such differences are statistically significantly different across ages. In Table 2, I show the p-values of equality tests for the differences in fractions of households with a boy and a girl for different ages. While the differences are statistically distinguishable

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[10]Starting at age 19, on the other hand, it seems children of both sexes are more likely to leave the household. This could be mainly due to marriage or labor migration.

Figure 1: IHS ceremony expenditures by children's age and gender
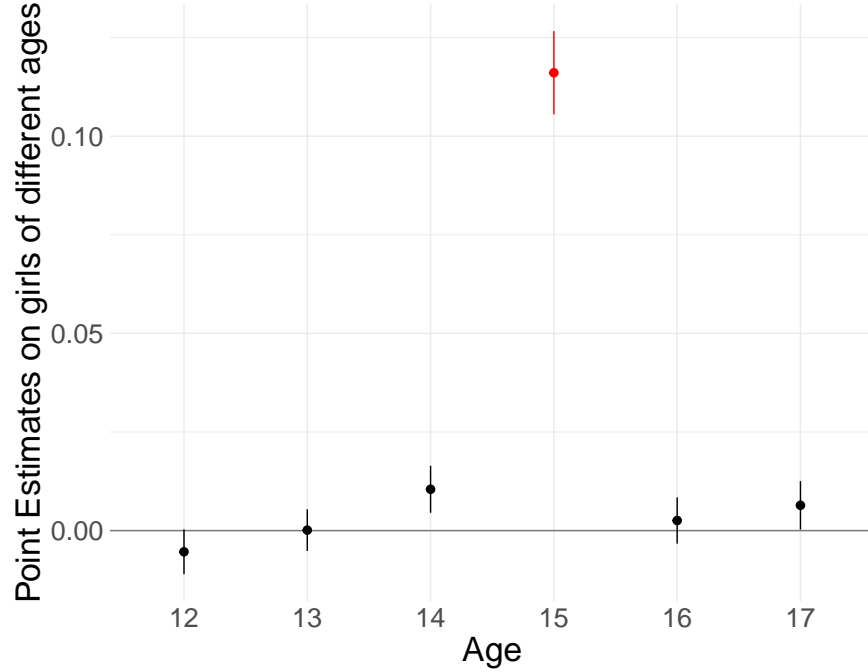
between younger ages (12 or 13 years old) and older ages (16 or 17 years old), I do not observe any statistical difference for adjacent ages (e.g., 14 versus 15 years old or 15 versus 16 years old). Therefore, if there is any discontinuous change in outcomes around the age of quinceañeras, it cannot be explained by demographic changes.

Another potential concern is the age heaping: it has been documented that round ages such as multiples of 5 are excessively frequent in various surveys, especially in the context with low human capital and numerical skills (Denic et al., 2004; Pardeshi, 2010; Tollnek and Baten, 2016). Whereas Figure 2 shows a mild age heaping at age 10 for boys, there is no irregularity at age 15. Hence, I consider that age heaping is not a concern in the analyses below.

6.3 How households afford quinceañera expenditures

Now that I have shown that the identification assumption for regression results seems to hold, I will discuss the regression results. First, I investigate how households afford quinceañera

Figure 2: Fraction of households with children by their age and gender
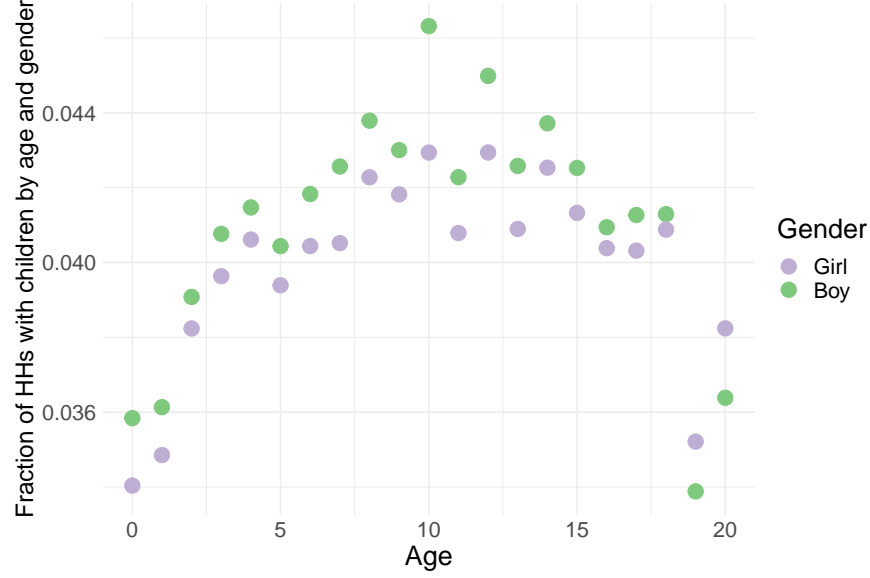
Notes: The dots indicate the fractions of households with children by their age and gender. Purple dots indicate households with a girl and green dots indicate households with a boy. In this figure, I use the full sample, not only the households with at least one 8-17-year-old child.

Table 2: Statistical tests of differences between fractions of households with boys and girls at different ages

	12	13	14	15	16	17
12						
13	0.58					
14	0.19	0.44				
15	0.20	0.46	0.98			
16	0.02**	0.08*	0.34	0.32		
17	0.09*	0.26	0.72	0.70	0.54	

Notes: The table shows the *p*-values from equality tests for the differences in fractions of households with a boy and a girl for different ages. I test if the difference in fractions of households with a boy and a girl at the age in the vertical axis is statistically distinguishable from the difference in fractions of households with a boy and a girl at the age in the horizontal axis. ***: p<0.01, **: p<0.05, *: p<0.1.

expenditures. For this, I run regression equation (1) with (i) net withdrawal from savings (withdrawal minus deposit), (ii) net transfers (in-transfers minus out-transfers), (iii) father's working hours for the past week, (iv) mother's working hours for the past week, (v) household consumption, and (vi) net borrowing (received loan minus given loan) as outcome variables. For monetary variables (i), (ii), (v), and (vi), in order to take into account their skewed distributions, I use their inverse hyperbolic sine (IHS) transformations as outcome variables in the regressions.

The results are shown in Figure 3. Panel A shows the regression result with IHS of net withdrawal from savings (withdrawal minus deposit) as an outcome. Notice that this measure reflects the flow of savings instead of stock, which is not recorded in ENIGH.[11] The panel shows the dip in the point estimate for households with 14-year-old girls, while the point estimate jumps up for those with 15-year-old girls. This means that when a daughter is 14 years old, the household accumulates money in its saving account through more deposit and less withdrawal and uses the resources when it has a quinceañera ceremony. I consider this as evidence that households use savings to prepare for quinceañeras.

Panel B shows the result with IHS of net in-transfers (in-transfers minus out-transfers) from other households. An upward discontinuous change is observed between households with 14-year-old girls and 15-year-old girls, and the point estimates remain higher even after quinceañeras. I interpret this as evidence that a household with quinceañeras receives transfers from other households to afford a large expenditure on the ceremony. Moreover, large point estimates after quinceañeras suggest that, since a household uses up its savings for quinceañeras, it keeps receiving transfers from other households to afford consumption.

In Panel C and D, I show how fathers' and mothers' work hours change. I find that, while fathers do not change their labor supply (Panel C), mothers work more ** around the year of quinceañeras (Panel D) **. This results in higher earnings by mothers as shown in Figure B.1. This is evidence that households increase resources for quinceañeras by increasing mothers' labor supply.

Panel E shows the regression result with IHS of household consumption. I exclude ceremony expenditures since the purpose of this analysis is to investigate if households reduce non-ceremony expenses to afford quinceañeras. The point estimate is tiny in magnitude, and any change in point estimates is not observed before and after quinceañeras.

Finally, in Panel F, the result with IHS of net received loan (received minus given) from

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[11] Anukriti et al. (2020) also use the flow of savings as an outcome variable in their main regressions to analyze how savings change in response to needs for future dowry payments.

Figure 3: How households afford quinceañeras
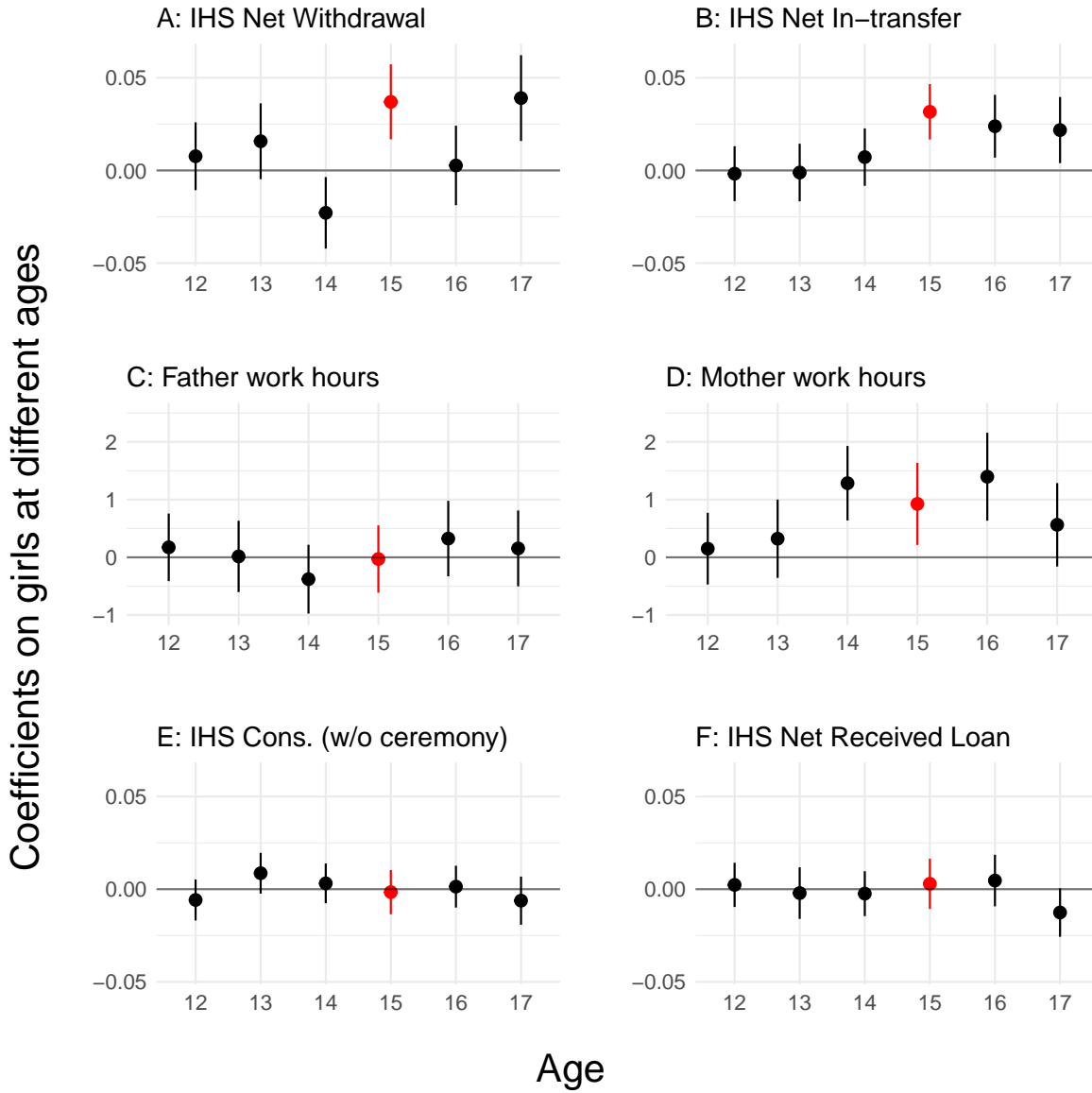
Notes: Points and lines indicate point estimates and 90% confidence intervals. The outcome variables are IHS of net-withdrawal (withdrawal − deposit) (Panel A), IHS of net in-transfers (in-transfers − out-transfers) (Panel B), father's work hours for the past week (Panel C), mother's work hours for the past week (Panel D), IHS of household consumption excluding ceremony expenditures (Panel E), and IHS of net received loan (received − given) (Panel F). The outcome variables in Panels A, B, E, and F, in 1,000 Mexican Pesos, are converted to real terms (value in 2015). For the analyses in Panels C and D, the information in surveys after 2010 is used and only households in which children between 8 to 17 years old have a unique father or mother are included. Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

other households or financial institutes is shown. The point estimates are small, and there is no change in estimates before and after quinceañeras. This suggests that households do not use borrowing to afford quinceañeras.

In summary, to afford large expenditures for quinceañeras, households save in advance, receive transfers from other households, and increase mother's labor supply. The finding that households use savings for ceremony expenditures is consistent with the result in Anukriti et al. (2020) that Indian households with girls save resources for future dowry payments. Procrastination may prevent households from saving until just one year before quinceañeras. It has been shown, both theoretically and empirically, that people with present bias procrastinate costly tasks (Ariely and Wertenbroch, 2002; O'Donoghue and Rabin, 1999, 2001). Previous studies have found evidence that there is present bias in the context of developing countries (Ashraf et al., 2006; Duflo et al., 2011b; Kaur et al., 2015).[12] Hence, the finding in Panel A in Figure 3 suggests that, with present bias, households in Mexico may procrastinate saving for quinceañeras until just before their ceremonies.

Furthermore, the finding that households receive more transfers from other households is consistent with the local tradition of the context. As mentioned in Section 3, in Mexico, sponsors called *padrinos* and *madrinas* are expected to support the payment for important events such as quinceañeras. Since these sponsors are usually chosen from friends or neighbors of the households, the supports from them can be captured in Panel B in Figure 3. This finding also suggests the function of risk-sharing networks in this context (Ligon and Schechter, 2020; Ligon et al., 2002; Townsend, 1994). Considering the expenditures for quinceañeras as negative economic "shocks," the inter-household transfers are thought of as risk-sharing.

The result that mothers work more around the year of quinceañeras but fathers do not is in contrast to the finding in India by Anukriti et al. (2020). They find that to prepare for future dowry payments, while fathers work more after a daughter is born, mothers do not change their work hours. This difference could be born out of the difference in female labor markets in India and Mexico. According to World Development Indicators, in 2018, while the female labor force participation in India was merely 20.7%, the number was 44.1% in Mexico. Hence, with more inclusive labor markets for women, Mexican mothers may change their work hours more flexibly compared to mothers in India. The increase in mothers' labor supply when daughters are 14 years old also explains how households finance savings before

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[12]Survey data collected by Wang et al. (2016) indicate the high degree of present bias among Mexican university students.

quinceañeras (Panel A).

On the other hand, I do not find any evidence that households reduce non-ceremony consumption or use borrowing to afford ceremony expenditures. One reason could be that the two measures above, saving and transfers, sufficiently work and hence other measures are unnecessary. Also, the fact that households do not use borrowing may suggest the difficulty of borrowing money in the study context.

6.4 Effects on business operation

Another possible measure that households can use to afford quinceañera ceremonies is to change inputs in household businesses. This can affect the output of the businesses and, if there are fixed costs for business operation, households may shut down their businesses. As documented by Montero and Yang (2020), festivals and ceremonies in developing countries could negatively affect economic activities, which could result in slower economic development. Here, I explore whether quinceañeras the affect business activities of households.

Figure 4 shows the regression results with business inputs, revenues, and indicators for business operations as outcomes. Panels A, B, and C show regression results for household farming. The point estimates in these regressions do not show any change around the year of quinceañeras. This suggests that households do not change agricultural business operations for the ceremonies.

In panels D to F, regression results for non-agricultural household business are shown. In contrast to the results for agricultural business, they show a distinctive decrease in inputs and revenues in the year of quinceañeras (Panels D and E). Furthermore, Panel F shows that when a girl of a household turns 15 years old, the household is more likely to shut down its non-agricultural business.

Why do households quit their non-agricultural businesses when they have quinceañera ceremonies? One explanation could be that the quinceañera expenditures crowd out available resources for business operations. For instance, households may need to pay the upfront fixed costs for their non-agricultural businesses. If they face credit constraints, the expenditures for quinceañeras could make it impossible for the households to finance the cost. In this case, the households are forced to close down their businesses.

Considering the payment for quinceañera ceremonies as economic "shocks," this finding is consistent with previous studies. For instance, using panel surveys from twelve developing countries, McKenzie and Paffhausen (2019) find that economic shocks (e.g., a reduction in product demand and increases in input prices) and household shocks (e.g., illness of

Figure 4: How quinceañeras affect business inputs and outputs
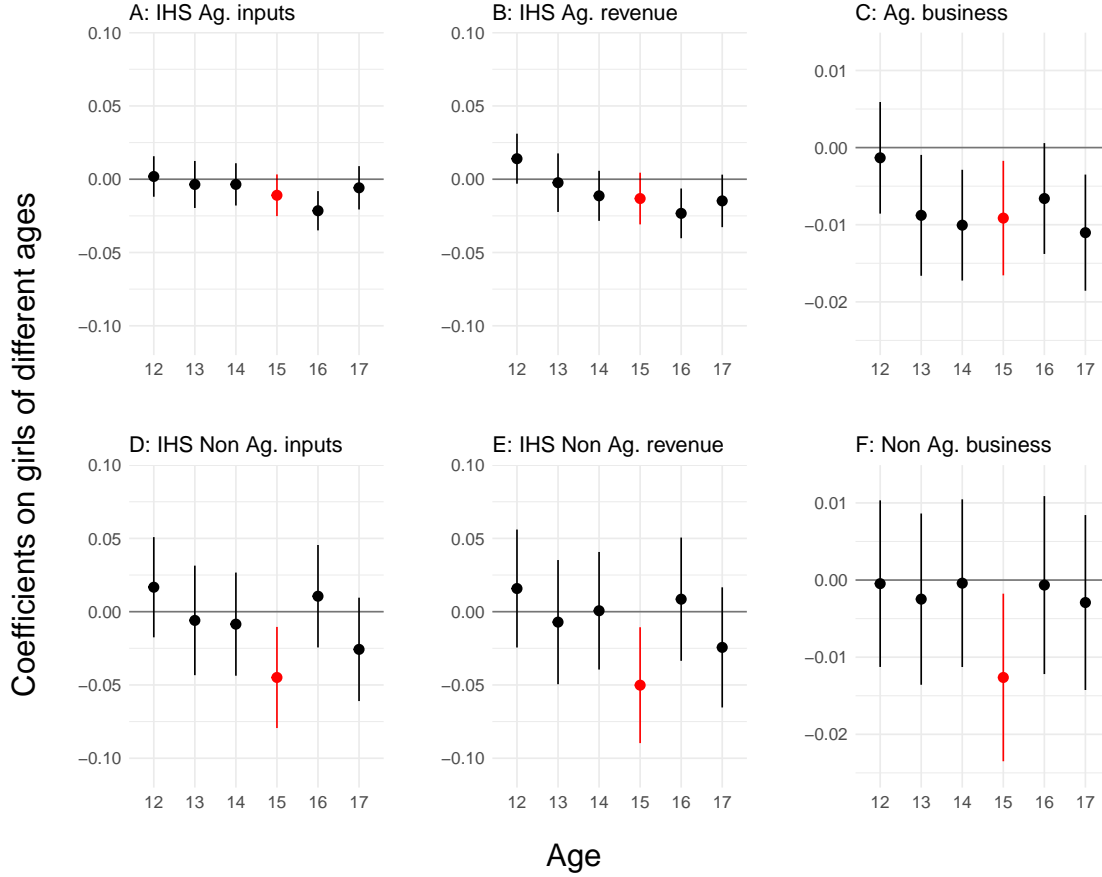
Notes: Points and lines indicate point estimates and 90% confidence intervals. The outcome variables are IHS of agricultural inputs (Panel A), IHS of agricultural revenues (Panel B), an indicator for engaging in agricultural production (Panel C), IHS of non-agricultural inputs (Panel D), IHS of non-agricultural revenues (Panel E), and an indicator for engaging in non-agricultural business (Panel F). The outcome variables in Panels A, B, D, and E, in 1,000 Mexican Pesos, are converted to real terms (value in 2015). In Panels A, B, D, and E, if a households does not engage in a business, the outcome values are recorded as 0. Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

household members) increase the probability that households close their non-agricultural businesses. They also find that such business shut-downs are not permanent: within a short period, households tend to restart their businesses again. This resonates with my finding that, after the year of quinceañeras, there is no difference in the probability of operating non-agricultural businesses between households with girls and boys.

Unlike non-agricultural businesses, agricultural businesses may require smaller fixed costs that households have to pay every year. Instead, they may mainly have to pay variable costs for agricultural production, such as fertilizers, pesticides, or seeds. This is likely to be the case, especially if they already own lands and equipment for farming. This could be a reason why Panel C in Figure 4 does not show any change in point estimates around the age of quinceañeras.

In summary, I find that quinceañeras crowd out resources for non-agricultural household businesses. Although the difference between households with a 15-year-old boy and girl is not statistically significant, Figure B.2 shows the decrease in non-agricultural business profits in the year of quinceañeras. This can significantly impact the lives of low-income households in developing countries since self-employment is an important income source for many of them. If quinceañeras impose high costs on households, why do they still have the expensive ceremonies? In particular, do they provide any benefit to the households? Next, I turn to this question and explore one such possibility that if quinceañeras make social networks among households tighter.

6.5 Effects on the strength of social networks

To explore if quinceañeras change the social networks of households, I use the answers to questions about the possibility of asking for help in various situations. I summarise these answers to one measure of "strength of social networks" with principal component analyses (PCAs). Since the answers are categorical (1: "impossible", ..., 5: "very easy"), I use both standard PCAs with the answers considered as continuous and categorical PCAs (Linting and van der Kooij, 2012). See Section 4 for more details on how I construct these outcome variables.

The regression results are shown in Figure 5. In Panel A, I use the first principal component from a standard PCA considering the answers to network questions are continuous, and in Panel B, the first principal component from a categorical PCA is used as the outcome. Regardless of the PCA calculation methods that I choose, I do not see any significant change

before or after quinceañeras.[13]
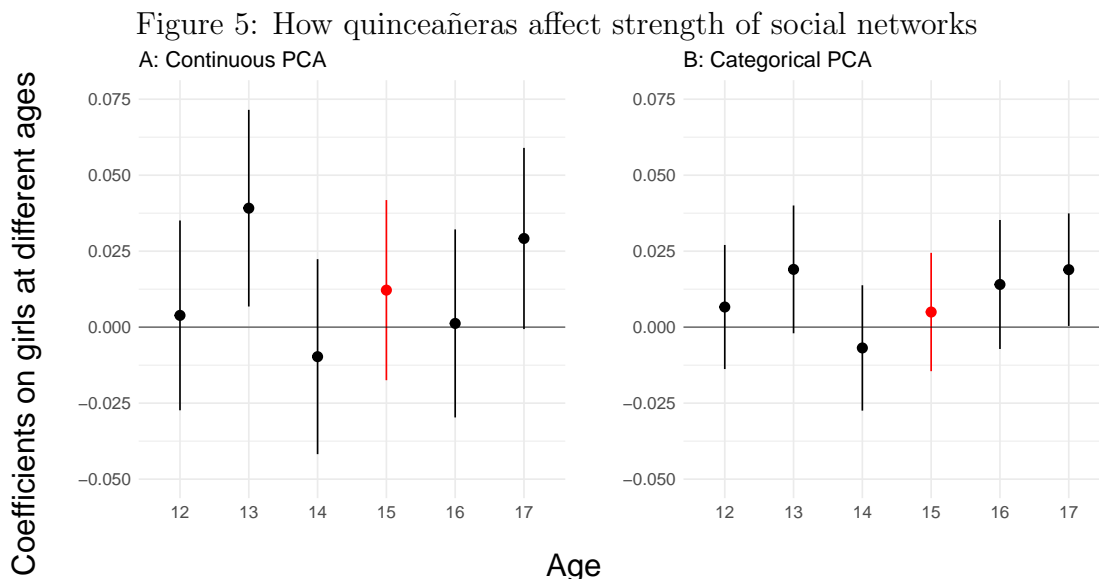
Figure 5: How quinceañeras affect strength of social networks

Notes: Points and lines indicate point estimates and 90% confidence intervals. The outcome variables are the first principal component from a PCA considering the answers to network questions are continuous (Panel A), and the first principal component from a PCA considering the answers to network questions are categorical (Panel B). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

There are several potential explanations of why I do not find any effects of quinceañeras on social networks. First of all, rather than just having a ceremony, the size of the quinceañera ceremony could be important in changing households' connections with others. Anthropological studies have pointed out that quinceañera ceremonies are opportunities for households to signal their social status to the community (Napolitano, 1997; Sarricolea Torres and Ortega Palma, 2009). Having a large ceremony can send positive signals to neighbors in terms of wealth and social status, which can help to strengthen connections with other households. On the other hand, if a household has a small quinceañera ceremony, it can signal other households that the household has low social and economic status. This may discourage neighbors from having close connections with the household for various benefits through risk-sharing or job referrals, for instance. Exploring this possibility requires exogenous factors affecting the size of quinceañera ceremonies and is left for future research.

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[13]Figure B.3 shows the regression results with answers to each social network question separately as outcomes. I do not find any consistent patterns in the effect of quinceañeras on the availability of help in different situations.

Secondly, only people who already have close connections, such as relatives and close friends, may participate in the ceremonies. If this is the case, then quinceañeras may not strengthen already strong networks with participants. Also, it is possible that, since households already have sufficient information on each other, the quinceañera ceremony may not update the beliefs of the neighbors in terms of the wealth level of the host household. This is consistent with the presumption in the literature that risk-sharing can work well in rural villages due to low barriers of information asymmetry (Townsend, 1994).

Thirdly, the questions in the survey may not sufficiently capture the strength of social networks. However, the ceremonies may provide opportunities (i) to expand the social networks or (ii) to strengthen initially weak connections. In this case, the questions in the survey are not appropriate to capture these effects of quinceañeras. The use of network data can solve these issues by, for example, looking at the change in network centralities of households having quinceañeras (Banerjee et al., 2013; Hahn et al., 2015).

7   Additional Analyses

7.1   Robustness Checks

I check the robustness of the results obtained above by changing the sample restriction rule and the definition of the main right-hand side variables. First, I run regressions using a different sample restriction rule. In the primary analyses in Section 6, I use households with at least one 8-17-year-old child. By this sample restriction, while maintaining a sufficient sample size for precise estimates, I intend to make the sample relatively homogeneous. To increase the homogeneity of the analyzed households, now I restrict the sample to households with at least one 12-17-year-old child. Whereas this alternative restriction decreases the sample size by around 30 percent, this allows comparisons across households with children at closer ages. The regression results in Figures B.4 to B.6 show the qualitatively and quantitatively similar results as the main results in Section 6, hence my findings are robust to the change in the analyzed sample.

Next, I explore if the main results change by altering the definition of the main variables of interest in the regressions. In regressions so far, I use the indicators for having any girl or child at a certain age as the main right-hand side variable (Equation (1)). This allows me to investigate the effect of having a girl at age h on the outcome above and beyond the effect of having a boy of the same age. This does not take into account the possibility of having more than one child of the same age and gender in a household due to, for example,

multiple births. To account for this effect, I use the number of girls and children at each age in the regressions instead of the indicators for living with any girl or child at each age. Now the estimates are interpreted as the impact of having an additional girl compared to the impact of having an additional boy at the same age. The results are shown in Figures B.7 to B.9. The point estimates are similar to those in the main regressions, which could be because only 2.7% of the households in my data have multiple children of the same age and gender. Hence, I conclude that my findings are robust to accounting for the existence of multiple births.

7.2   Quinceañera expenses and sibling composition

In this and the following subsections, I explore what affects the quinceañera expenditures. As mentioned in Section 6, the ceremony expenditures are likely noisily measured. Hence, interpretation of the results needs caution.

First, I investigate if the birth order of sisters matters in the size of quinceañeras. For instance, the first quinceañeras in a family can be a profoundly emotive event, and the parents may decide to throw an especially large ceremony for her. If the sizes are different for the first and the other daughters, then the effect of having a quinceañera could differ as well.

To explore this possibility, I use only households with a 15-year-old girl and run the following regression:

$$E_{ijt} = \lambda F_{ijt} + X_{ijt}\gamma + \mu_j + \tau_t + \epsilon_{ijt},$$

where E_{ijt} is inverse hyperbolic sine of ceremony expenditures in a household i in municipality j in year t and F_{ijt} is an indicator for the girl is the first daughter in the household. The household characteristics (X_{ijt}) are controlled for. In addition to the variables used in the regressions above, the number of daughters in the household is included in X_{ijt}.[14] Municipality and year fixed effects (μ_j and τ_t) are also included in the regression.

The regression results are shown in Table A.3, Column (1). While the point estimate is positive, suggesting that households tend to have larger quinceañera ceremonies for their first daughters, it is not statistically distinguishable from zero. Since this estimate may capture the effect of being the only daughter in a family, I restrict the sample to the households with more than one daughter in Column (2). The result indicates no difference in the size of

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[14]The other household characteristics are household size and the age of the household head.

quinceañera ceremonies by order of birth among sisters. Column (3) allows flexible effects of the composition of sisters and demonstrates no significant difference between quinceañera ceremony expenditures for the first daughter and other daughters. Quinceañera ceremonies for the youngest daughter are as big as those for the older daughters (Column (4)). Therefore, I do not find any evidence that the size of quinceañeras varies by order of the daughter for whom the ceremony is held.

7.3   Quinceañera expenses and permanent/transitory incomes

Finally, I investigate how permanent and transitory incomes change the size of quinceañera ceremonies. Addressing this question advances our understanding of the determinants of the ceremony size. If the size of quinceañeras depends on available resources, then both permanent and transitory income should matter as a determinant of the size of quinceañera ceremonies. On the other hand, if quinceañera expenses depend not on transitory income shocks but on permanent income, this suggests that some factors other than available resources can be important determinants of quinceañera ceremony sizes. For instance, if wealthy households are expected to have large quinceañeras by the social norm in the community, then regardless of the transitory income shocks, the households may spend a substantial amount on the ceremonies.

To explore this question, I use proxies for permanent and transitory incomes. As a proxy for permanent income, I use the wealth index based on the housing status of households. In particular, I use the first principal component from a PCA using the following information: (i) the number of rooms in the house; (ii) if the roof material is concrete or not; and (iii) if the wall material is bricks/concrete or not. McKenzie (2005) uses the same Mexican data as mine, ENIGH, and shows that the wealth inequality measure created based on housing assets such as roof or wall materials has a high correlation with the actual wealth inequality.

As a proxy for transitory income, I use rainfall and temperature shocks. In particular, I use the following municipality-level weather measures: (i) annual precipitation; (ii) an index taking a value 1 if annual precipitation is above 80 percentile and -1 if below 20 percentile of the long-run (1981-2019) precipitation distribution of the municipality; (iii) annual average temperature; and (iv) an index taking a value 1 if the annual average temperature is above 80 percentile and -1 if below 20 percentile of the long-run (1986-2016) annual average temperature of the municipality. The measure (i) is used by Munshi (2003) as a factor to change migration from the US to Mexico through the change in agricultural production. Also, the measure (ii) is considered in Shah and Steinberg (2017) as a shock to agricultural

production in India. Furthermore, I consider temperature shocks as well based on the recent findings that heat negatively affects crop growth (Lobell et al., 2013; Schlenker and Roberts, 2009). For details on weather datasets and construction of the measures, see Appendix C. For comparisons, both permanent and transitory income proxies are standardized to mean 0 and standard deviation 1 in the analyses below. Hence, the point estimate is interpreted as the change in the difference in the outcome between households with a girl and a boy at the same age when a measure increase by a one standard deviation.

First, I analyze if the ceremony expenses in general, not limited to quinceañera expenses, and household permanent and transitory incomes are correlated. For this, I run the following regression equation:

$$E_{ijt} = \lambda M_{ijt} + X_{ijt}\gamma + \mu_j + \tau_t + \epsilon_{ijt}, \tag{2}$$

where E_{ijt} is the inverse hyperbolic sine of ceremony expenditures in a household i in municipality j in year t. The variable M_{ijt} is measures for permanent income or transitory income shocks explained above. I control for household characteristics (X_{ijt}) and include municipality and year fixed effects (μ_j and τ_t). Since weather shocks should mainly affect agricultural production, I use households in rural areas in the analyses.

The regression results are shown in Table A.4. For permanent income, Column (1) shows a statistically significant and positive correlation between the size of ceremony expenses and wealth index. This means that wealthier households spend more on general ceremonies.

For transitory income shocks, I first check if the weather shock measures are correlated with household income. For this, I run the regression Equation (2) with IHS household income as an outcome and weather shocks as the main right-hand side variables. The results are shown in Table A.5.[15] I find that, whereas more rainfall increases household income, the point estimates for temperature shocks are statistically insignificant. This suggests that, in the context of my study, rainfall matters for agricultural production. Hence, I will consider rainfall shocks as transitory income shocks in the discussions below.

The effects of rainfall shocks on ceremony expenditures are shown in Columns (2) and (3) in Table A.4. They demonstrate statistically insignificant point estimates. That is, the rainfall shocks do not change general ceremony expenses.

Next, I analyze how household income is related to expenditures specifically on quinceañeras.

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[15]Since the temperature data are available up to 2016, the observations in 2018 are dropped from the analyses in Columns (3) and (4).

For this, I run the following regression:

$$
\begin{aligned}
E_{ijt} = {} & \lambda M_{ijt} + \sum_{h=8}^{17} \alpha_h G_{ijt}^h + \sum_{h=8}^{17} \beta_h C_{ijt}^h \\
& + \sum_{h=8}^{17} \eta_h M_{ijt} G_{ijt}^h + \sum_{h=8}^{17} \theta_h M_{ijt} C_{ijt}^h + X_{ijt}\gamma + \mu_j + \tau_t + \epsilon_{ijt}.
\end{aligned} \tag{3}
$$

The coefficients of interest are η_h's, which indicate how the differences in the outcome between households with a girl and a boy at the same change as permanent or transitory incomes change.

Panel A in Figure B.10 shows that, although statistically insignificant, I observe an upward jump in the point estimate for the interaction of an indicator for having 15-year-old girls and wealth index. This is suggestive evidence that permanent income matters as a determinant of the size of quinceañera ceremonies. On the other hand, in Panels C and D, I do not observe any evidence that households change quinceañera expenditures in response to rainfall shocks.

In summary, whereas I find suggestive evidence that permanent income matters for the size of quinceañera ceremonies, it does not seem to depend on transitory income shocks. This suggests that the ceremony size depends not only on how much resource is available for the households but also on how large the ceremony is *expected* to be. The origin of this expectation cannot be explored with the data at hand, and exploring this question is left for future research.

8   Conclusion

While documented in the literature that people in developing countries spend significant resources on festivals and ceremonies, there have been few empirical studies on this issue. The endogenous timing of the festivals and ceremonies is one of the factors behind the lack of studies. In this study, I overcome this issue and identify the causal impact of a Latin ceremony, quinceañeras, for Mexican households. I use a unique feature in this ceremony that only households with a girl turning 15 years old hold it. This allows me to use the households with a boy at the same age and households with girls at different ages as control groups.

In particular, I empirically investigate how households afford large expenditures for quinceañeras and how this ceremony affects their economic lives. The main findings are

as follows. First, households use savings and transfers from other households to afford large expenditures on quinceañeras. Secondly, quinceañeras force households to shut down their non-agricultural businesses, potentially due to crowded-out resources. Finally, I do not find any evidence that quinceañeras strengthen social networks among households. These findings contribute to our understandings of the economic lives of the poor, especially in the dimension of festivals and ceremonies.

This study provides several policy implications. First, my results offer insights into the role of financial institutions in the context of developing countries to deal with large expenditures. The results indicate that saving opportunities allow households to smooth their consumption over time, facing large expenditures for quinceañeras. As highlighted in the previous studies, my study demonstrates the value of access to credits for low-income households. Secondly, my findings have implications for the aid of small and medium enterprises in response to large economic needs, which in my study are expenditures for quinceañeras. Since self-employment is an invaluable income source for many households in developing countries, developing a system to support their businesses suffering from economic difficulties is crucial.

There are several limitations to this study. First of all, this study fails to identify the reasons why households spend large expenditures on quinceañeras. Whereas I do not find that quinceañeras help households to strengthen their social ties with neighbors, there are other potential benefits in quinceañeras.[16] For instance, households may spend a lot of resources on quinceañeras for marriage motives. I cannot test this hypothesis in my empirical framework since most girls and boys get married after 15 years old. This makes it impossible to compare how marriage outcome changes before and after quinceañeras.

Another possibility is that households may purely gain utility from quinceañera expenditures. Interacting with friends and relatives in the quinceañera ceremonies can give joy to households. Also, if parents are altruistic to their daughters, making them happy through quinceañera ceremonies can result in higher utility for themselves. Moreover, as several studies have found, festival and ceremony expenditures may play a role as conspicuous consumption (Bloch et al., 2004; Brown et al., 2011). By showing their wealth and status to neighbors, households may gain utility. However, to justify large expenditures on festivals and ceremonies as documented in previous studies (Banerjee and Duflo, 2007) and this paper, this utility gain must be sufficiently large. Considering the large expenditures and the whole discussion over the poverty traps (Barrett et al., 2018) and unexploited investment

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[16]Furthermore, as discussed in Section 6, there are reasons for not finding the effect of quinceañeras on my measure of network strength in my empirical framework while quinceañeras may actually affect social networks between households.

opportunities due to credit constraints (Kaboski and Townsend, 2011), this seems unlikely. Identifying the reasons behind large expenditures on festivals and ceremonies in low-income countries is an important research agenda.

Another thing that could not be addressed in this study is the importance of the size of ceremonies. While I investigate the effect of having a quinceañera, or more precisely, the impact of having a chance to hold a quinceañera, the effects of a large ceremony and a small ceremony can differ. Since the size of the ceremony is endogenous, exogenous factors that vary the size of a quinceañera are required to answer this question. Answering this question is left for future research.

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A   Tables

Table A.1: Weights for the principal component analyses on social network strength

	2008	2010	2012	2014	2016	2018
How difficult is it for you to ask for help to get a job?	0.45	0.45	0.45	0.45	0.45	0.45
How difficult is it for you to ask for help to take care of you in an illness?	0.51	0.51	0.50	0.50	0.50	0.51
How difficult is it for you to ask to borrow the amount of money that you usually earn per month?	0.42	0.41	0.41	0.41	0.42	0.42
How difficult is it for you to ask for help to accompany to go to the doctor?	0.49	0.49	0.48	0.49	0.48	0.49
How difficult is it for you to ask for cooperation to improve your neighborhood or community?	0.36	0.36	0.38	0.38	0.37	0.36

Notes: The table shows the weights in the principal component analyses on social network strength. These weights are used to calculate the first principal component.

Table A.2: Weights for the categorical principal component analyses on social network strength

	2008	2010	2012	2014	2016	2018
How difficult is it for you to ask for help to get a job?	0.64	0.65	0.66	0.63	0.65	0.66
How difficult is it for you to ask for help to take care of you in an illness?	0.75	0.75	0.74	0.72	0.74	0.76
How difficult is it for you to ask to borrow the amount of money that you usually earn per month?	0.57	0.58	0.57	0.56	0.57	0.58
How difficult is it for you to ask for help to accompany to go to the doctor?	0.72	0.72	0.71	0.69	0.71	0.72
How difficult is it for you to ask for cooperation to improve your neighborhood or community?	0.50	0.51	0.55	0.52	0.53	0.51

Notes: The table shows the weights in the categorical principal component analyses on social network strength. These weights are used to calculate the first principal component.

Table A.3: Do ceremony expenditures change by order of births among sisters for whom quinceañeras are held?

		Dependent variable:		
		IHS ceremony expenditures		
	(1)	(2)	(3)	(4)
First daughter	0.07	0.09		
	(0.07)	(0.08)		
Second daughter			−0.07	
			(0.07)	
Third or later daughter			−0.03	
			(0.16)	
Last daughter				−0.07
				(0.08)
Municipality FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Sample	All	HHs w/ > 1 daughter	All	All
Observations	6,235	3,755	6,235	6,235
R^2	0.19	0.26	0.19	0.19

Notes: *p<0.1; **p<0.05; ***p<0.01. The outcome variable is inverse hyperbolic sine of the ceremony expenditures. The outcome variable, in 1,000 Mexican Pesos, is converted to real terms (value in 2015). Only households with 15-year-old girls are included in the regressions. Control variables included in the regression are the number of sisters, household size, and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

Table A.4: Wealth, weather shocks, and ceremony expenditures

|	*Dependent variable:*				
	IHS ceremony expenditures				
	(1)	(2)	(3)	(4)	(5)
Wealth index	0.02***				
	(0.001)				
Annual total precipitation (mm)		0.0004			
		(0.005)			
Precipitation shock			0.0005		
			(0.002)		
Annual average temperature (degree C)				−0.01	
				(0.02)	
Temperature shock					−0.001
					(0.002)
Controls	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	62,848	63,832	63,832	49,835	49,835
R^2	0.04	0.04	0.04	0.05	0.05

Notes: *p<0.1; **p<0.05; ***p<0.01. Only rural households are used in the analyses. The outcome variable is inverse hyperbolic sine of ceremony expenditures. The outcome variable, in 1,000 Mexican Pesos, is converted to real terms (value in 2015). As "Wealth index," I use the first principal component from a PCA on the housing status of households. The variable "Precipitation shock" takes the value 1 if annual precipitation is above 80 percentile and -1 if below 20 percentile of the long-run (1981-2019) precipitation distribution of the municipality. The variable "Temperature shock" takes the value 1 if annual average temperature is above 80 percentile and -1 if below 20 percentile of the long-run (1986-2016) annual average temperature distribution of the municipality. All the weather shock variables are standardized so that the means are 0 and the standard deviations are 1. Since the temperature data is available up to the year 2016, the observations in 2018 are dropped from the analyses in Columns (4) and (5). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

Table A.5: The effect of weather shocks on household income

| | Dependent variable: | | | |
| | IHS HH income | | | |
	(1)	(2)	(3)	(4)
Annual total precipitation (mm)	0.04*			
	(0.02)			
Precipitation shock		0.02***		
		(0.01)		
Annual average temperature (degree C)			−0.08	
			(0.10)	
Temperature shock				−0.01
				(0.01)
Controls	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	63,832	63,832	49,835	49,835
R^2	0.28	0.28	0.29	0.29

Notes: *p<0.1; **p<0.05; ***p<0.01. Only rural households are used in the analyses. The outcome variable is inverse hyperbolic sine of household income. The outcome variable, in 1,000 Mexican Pesos, is converted to real terms (value in 2015). The variable "Precipitation shock" takes the value 1 if annual precipitation is above 80 percentile and -1 if below 20 percentile of the long-run (1981-2019) precipitation distribution of the municipality. The variable "Temperature shock" takes the value 1 if annual average temperature is above 80 percentile and -1 if below 20 percentile of the long-run (1986-2016) annual average temperature distribution of the municipality. All the weather shock variables are standardized so that the means are 0 and the standard deviations are 1. Since the temperature data is available up to the year 2016, the observations in 2018 are dropped from the analyses in Columns (3) and (4). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

B Figures

Figure B.1: How parents' wage earnings change around the year of quinceañeras
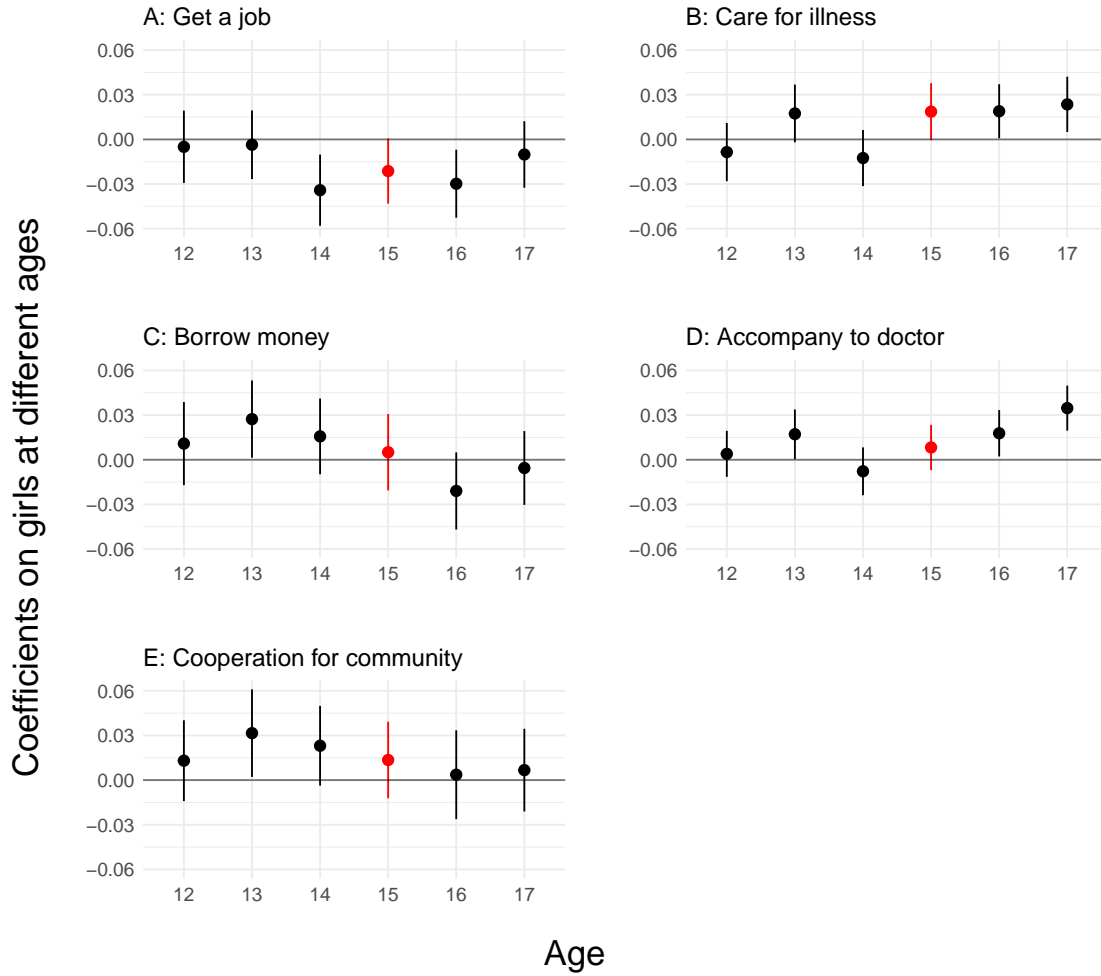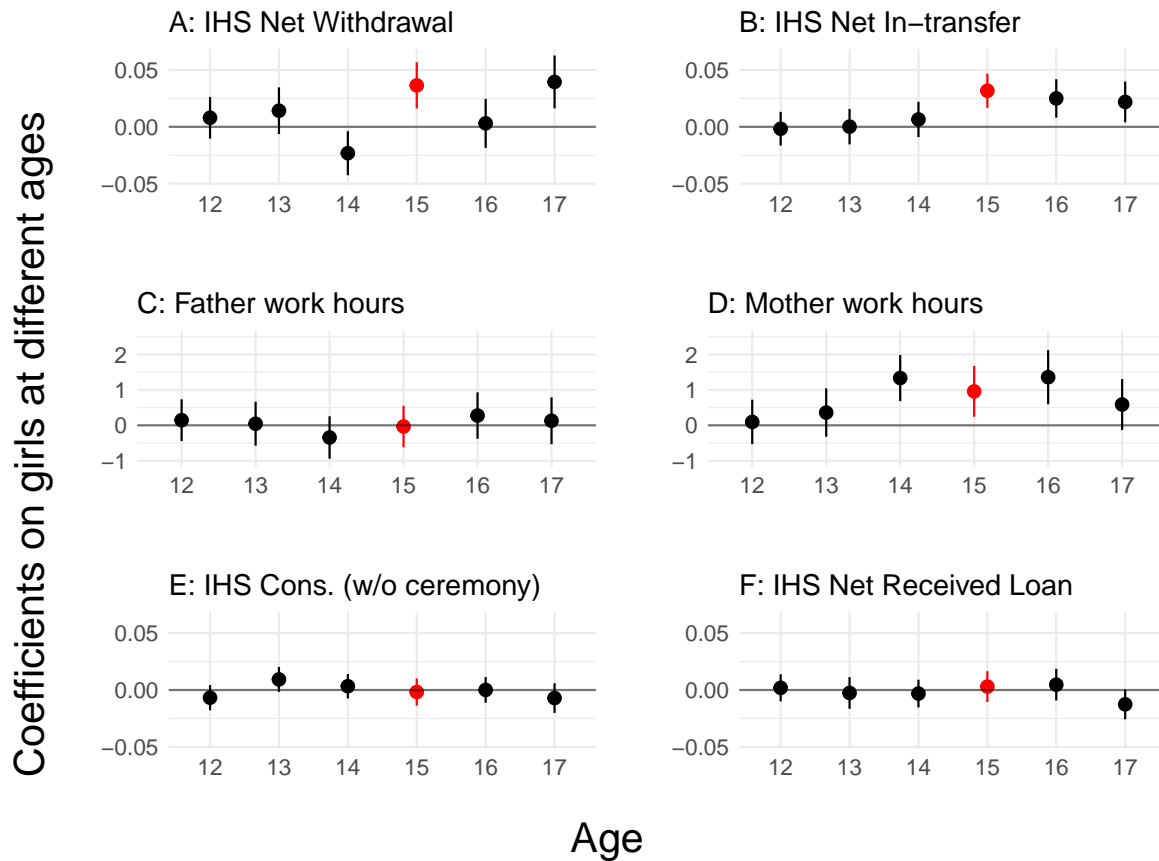

Notes: Points and lines indicate point estimates and 90% confidence intervals. The outcome variables are IHS of fathers' wage earnings (Panel A), and IHS of mothers' wage earnings (Panel B). I use data after 2010 and restrict the analyses to households in which children between 8 to 17 years old have the same father or mother. The outcome variables, in 1,000 Mexican Pesos, are converted to real terms (value in 2015). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.
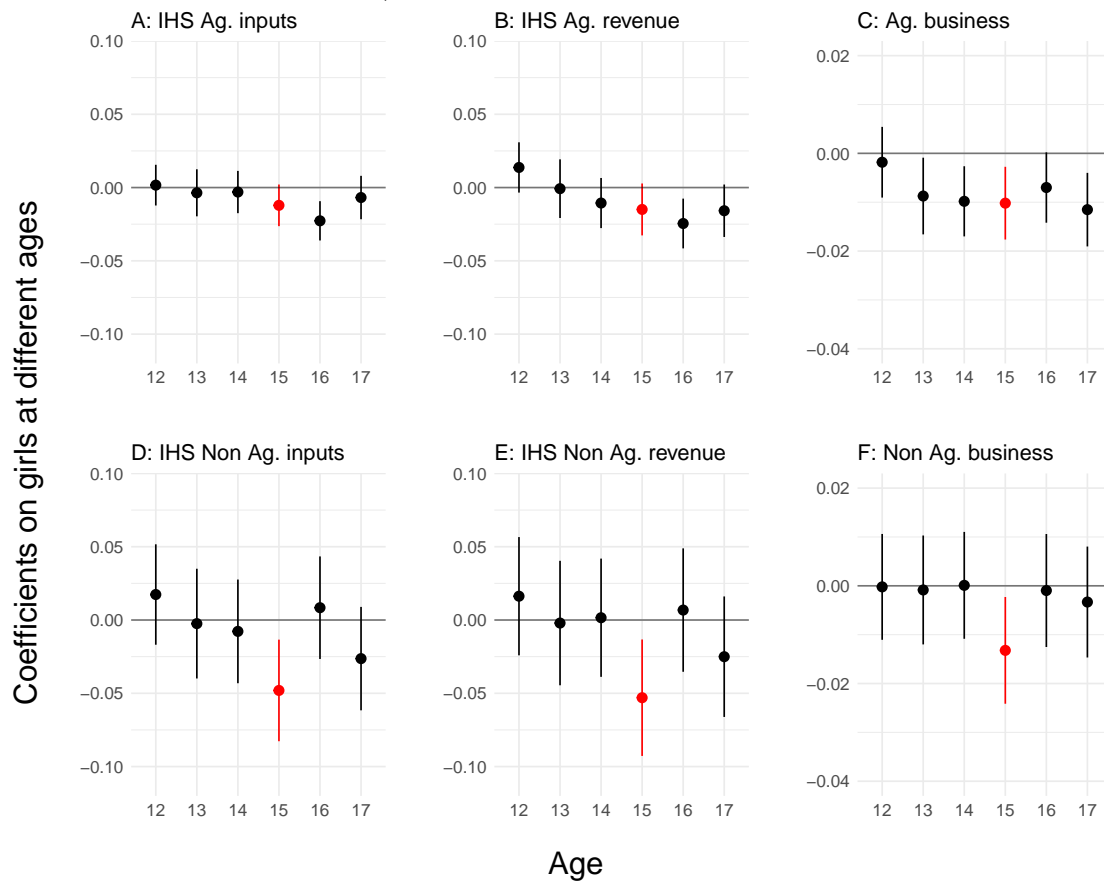
Figure B.2: How quinceañeras affect business profits
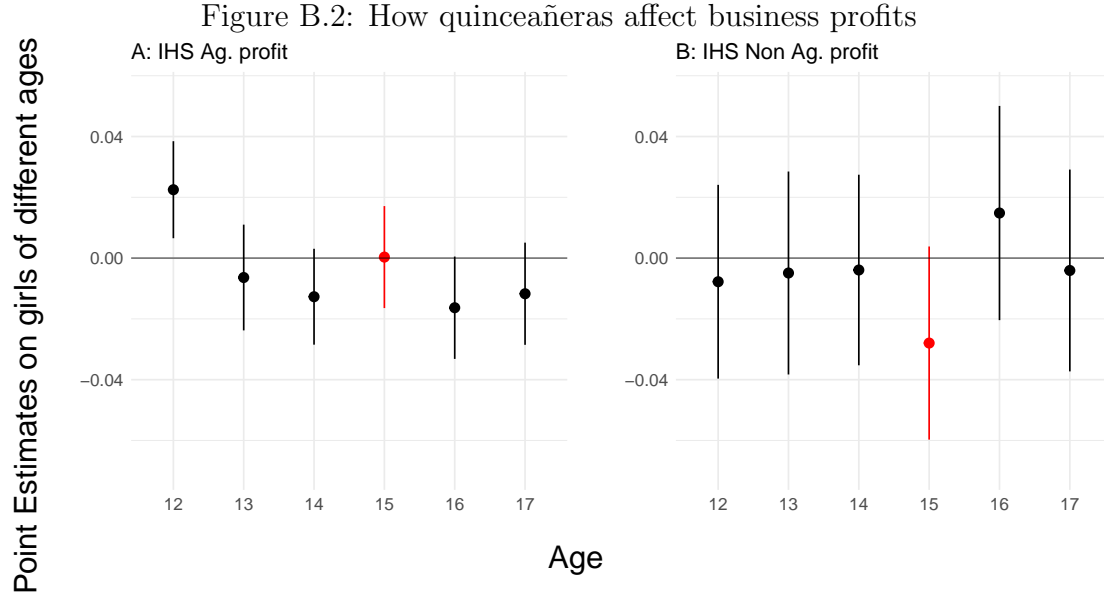
Notes: Black points and lines indicate point estimates and 90% confidence intervals of α_h from equation (1). The outcome variables are IHS of agricultural profits (Panel A), and IHS of non-agricultural profits (Panel B). The outcome variables, in 1,000 Mexican Pesos, are converted to real terms (value in 2015). Control variables included in the regression are household size and the age of household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

Figure B.3: How quinceañeras affect the strength of social networks (individual questions)

Notes: Black points and lines indicate point estimates and 90% confidence intervals of α_h from equation (1). The outcome variables are the answers to the following questions: "How difficult is it for you to get help to get a job?" (Panel A), "How difficult is it for you to get help to take care of you in an illness?" (Panel B), "How difficult is it for you to borrow the amount of money that you usually earn per month?" (Panel C), "How difficult is it for you to get help to accompany to go to the doctor?" (Panel D), and "How difficult is it for you to get a cooperation to improve your neighborhood or community?" (Panel E). The answers are 1: Impossible, 2: Difficult, 3: Neither difficult nor easy, 4: Easy, and 5: Very easy. Control variables included in the regression are household size and the age of household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

Figure B.4: How households afford quinceañeras (households with at least one 12-17-year-old child are used)
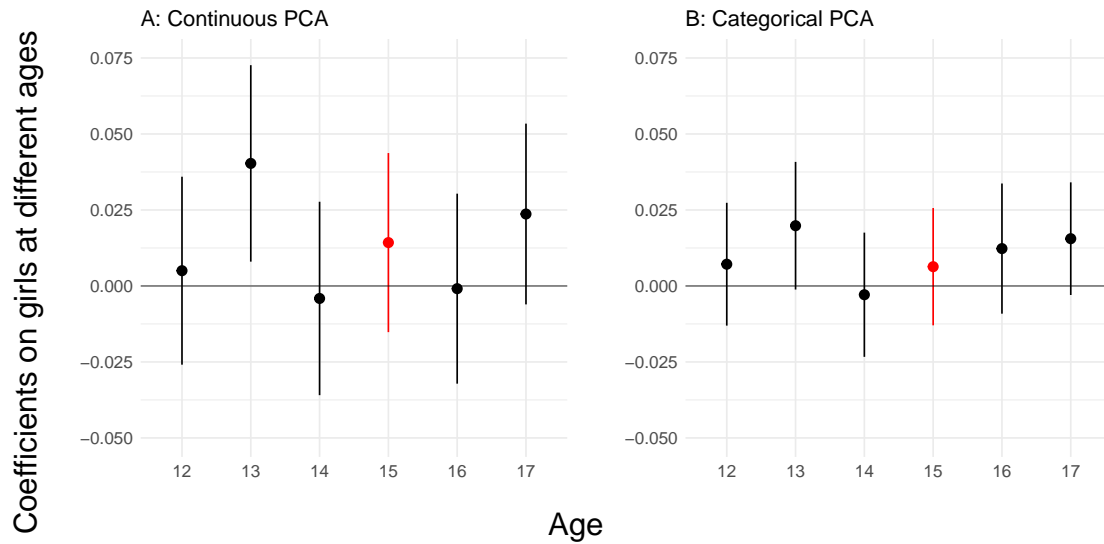

Notes: Points and lines indicate point estimates and 90% confidence intervals. The outcome variables are IHS of net-withdrawal (withdrawal − deposit) (Panel A), IHS of net in-transfers (in-transfers − out-transfers) (Panel B), father's work hours over the past one week (Panel C), mother's work hours over the past one week (Panel D), IHS of household consumption excluding ceremony expenditures (Panel E), and IHS of net received loan (received − given) (Panel F). The outcome variables in Panels A, B, C, and D, in 1,000 Mexican Pesos, are converted to real terms (value in 2015). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

Figure B.5: How quinceañeras affect business inputs and outputs (households with at least one 12-17-year-old child are used)
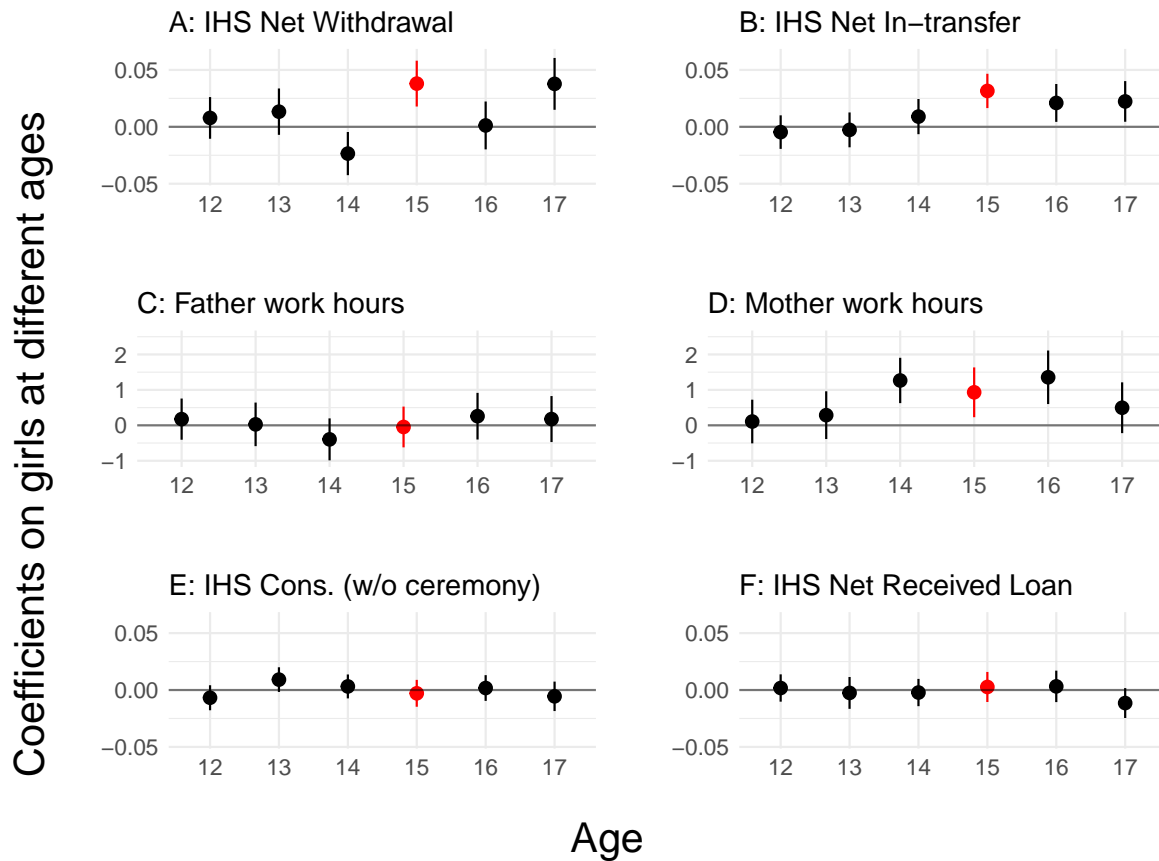

Notes: Points and lines indicate point estimates and 90% confidence intervals. The outcome variables are IHS of agricultural inputs (Panel A), IHS of agricultural revenues (Panel B), an indicator for engaging in agricultural production (Panel C), IHS of non-agricultural inputs (Panel D), IHS of non-agricultural revenues (Panel E), and an indicator for engaging in non-agricultural business (Panel F). The outcome variables in Panels A, B, D, and E, in 1,000 Mexican Pesos, are converted to real terms (value in 2015). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

Figure B.6: How quinceañeras affect strength of social networks (households with at least one 12-17-year-old child are used)
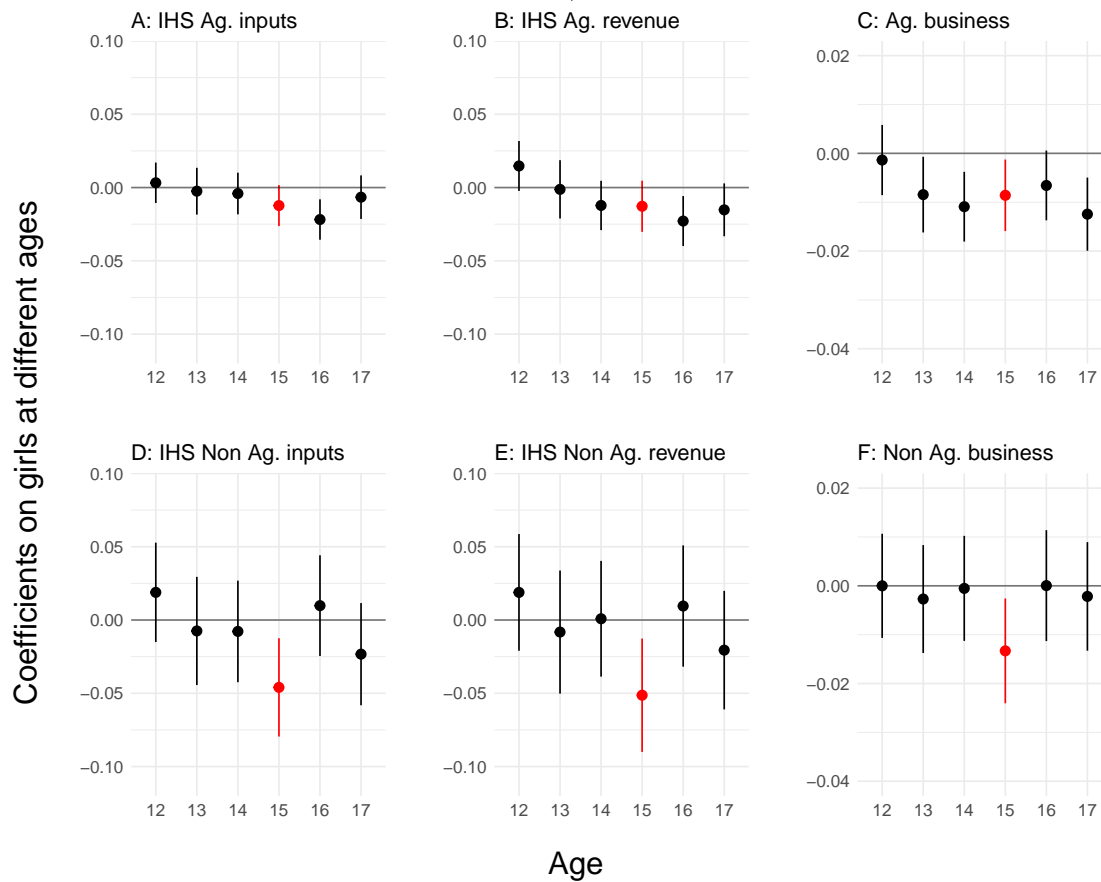

Notes: Points and lines indicate point estimates and 90% confidence intervals. The outcome variables are the first principal component from a PCA considering the answers to network questions are continuous (Panel A), and the first principal component from a PCA considering the answers to network questions are categorical (Panel B). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

Figure B.7: How households afford quinceañeras (the numbers of children, not an indicator for having any child, are used)
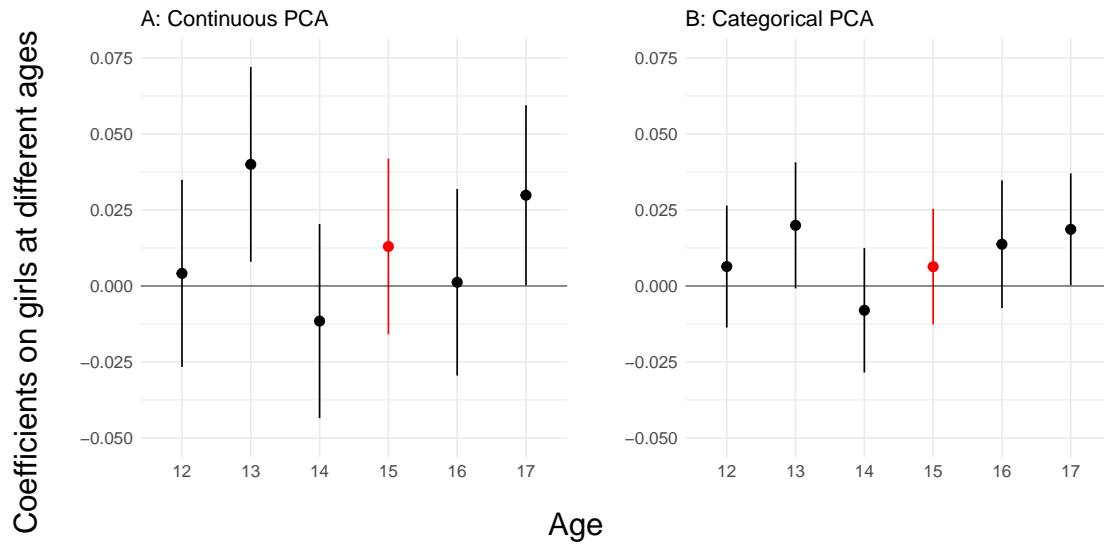

Notes: Points and lines indicate point estimates and 90% confidence intervals. The outcome variables are IHS of net-withdrawal (withdrawal − deposit) (Panel A), IHS of net in-transfers (in-transfers − out-transfers) (Panel B), father's work hours over the past one week (Panel C), mother's work hours over the past one week (Panel D), IHS of household consumption excluding ceremony expenditures (Panel E), and IHS of net received loan (received − given) (Panel F). The outcome variables in Panels A, B, C, and D, in 1,000 Mexican Pesos, are converted to real terms (value in 2015). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

Figure B.8: How quinceañeras affect business inputs and outputs (the numbers of children, not an indicator for having any child, are used)
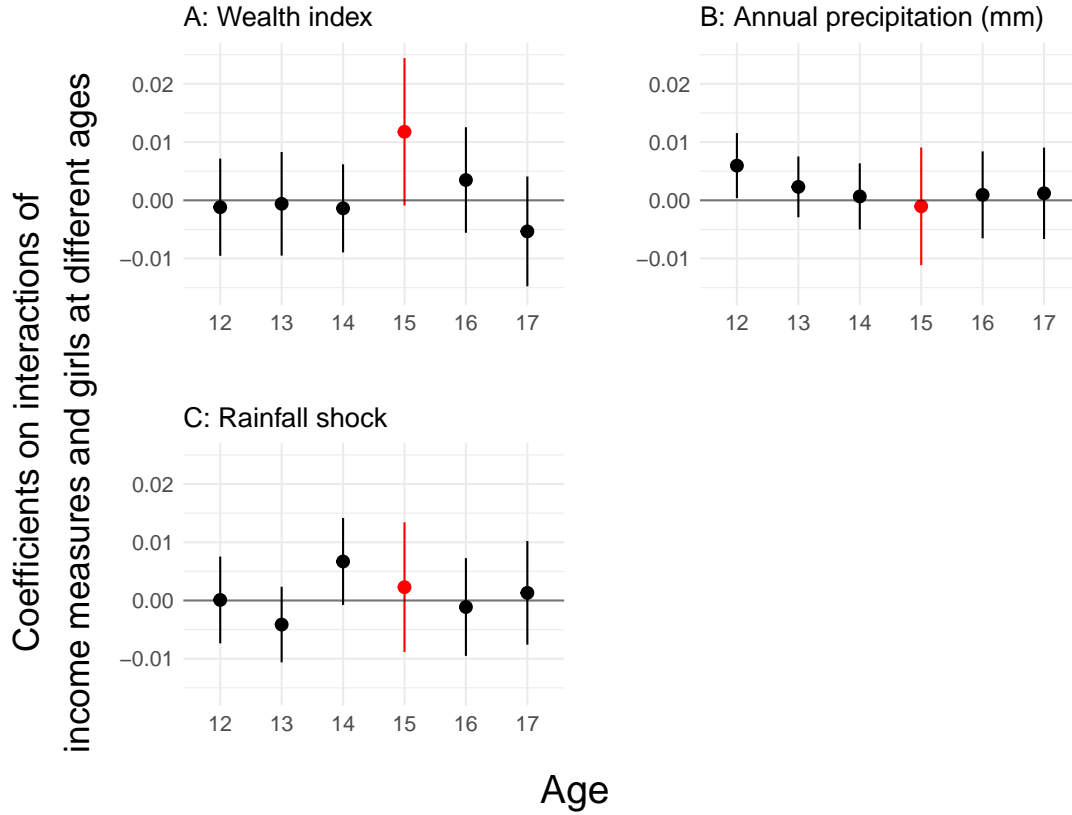

Notes: Points and lines indicate point estimates and 90% confidence intervals. The outcome variables are IHS of agricultural inputs (Panel A), IHS of agricultural revenues (Panel B), an indicator for engaging in agricultural production (Panel C), IHS of non-agricultural inputs (Panel D), IHS of non-agricultural revenues (Panel E), and an indicator for engaging in non-agricultural business (Panel F). The outcome variables in Panels A, B, D, and E, in 1,000 Mexican Pesos, are converted to real terms (value in 2015). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

Figure B.9: How quinceañeras affect strength of social networks (the numbers of children, not an indicator for having any child, are used)

Notes: Points and lines indicate point estimates and 90% confidence intervals. The outcome variables are the first principal component from a PCA considering the answers to network questions are continuous (Panel A), and the first principal component from a PCA considering the answers to network questions are categorical (Panel B). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

Figure B.10: How do expenditures on quinceañera change in response to the change in permanent and transitory incomes?

Notes: Points and lines indicate point estimates and 90% confidence intervals. Only rural households are used in the analyses. The outcome variables in all panels are IHS of ceremony expenditures. The titles of each panel indicate the proxies for permanent or transitory incomes. These variables are standardized so that the means are 0 and the standard deviations are 1. The point estimates are interpreted as the change in the difference in the outcome between households with a girl and a boy at the same age when the variables increase by a one standard deviation. As "Wealth index," I use the first principal component from a PCA on the housing status of households. The variable "Precipitation shock" takes the value 1 if annual precipitation is above 80 percentile and -1 if below 20 percentile of the long-run (1981-2019) precipitation distribution of the municipality. The ceremony expenditures and the household income, in 1,000 Mexican Pesos, are converted to real terms (value in 2015). Control variables included in the regression are household size and the age of the household head. Municipality fixed effects and year fixed effects are included in the regression as well. Standard errors clustered at the municipality level.

C Construction of weather-related variables

In Section 7, I use weather shocks as proxies of transitory income shocks. As weather shocks, I consider the following municipality-level measures: (i) annual precipitation; (ii) an index taking a value 1 if annual precipitation is above 80 percentile and -1 if below

20 percentile of the long-run (1981-2019) precipitation distribution of the municipality; (iii) annual average temperature; and (iv) an index taking a value 1 if annual average temperature is above 80 percentile and -1 if below 20 percentile of the long-run (1986-2016) annual average temperature of the municipality. In this section, I explain the data sources and construction of these measures.

For precipitation measures, (i) and (ii), I use Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) data. Incorporating satellite information and weather station data, the data provides high-resolution (0.05 × 0.05 degrees) information on weather data in various temporal resolutions such as daily, monthly, or daily. Construction of my rainfall measures uses the annual average precipitation information. For details on the dataset, see Funk et al. (2015).

For temperature measures, (iii) and (iv), the information in the Climate Hazards Center Infrared Temperature with Stations (CHIRTS) data is used. For the construction of the measures, I use CHIRTS-Daily, which contains daily maximum and minimum temperatures. I use their average as daily average temperature, and by taking the average of the daily means, I calculate the average annual temperature in a municipality. Refer to Funk et al. (2019) for details on the dataset.

To combine these weather datasets with ENIGH and obtain municipality-level weather variables, we use weather measures at four grid points surrounding municipality centroids. Then, I take the average of them, weighted by the inverse distance between the centroids and each of the four grid points. For annual precipitation and annual average temperature, I directly use the measures created in the process described above. For the rainfall shock measure (ii), following Shah and Steinberg (2017), I create a variable taking the value 1 if the annual precipitation is above 80 percentile and -1 if below 20 percentile of the long-run (1981-2019) precipitation distribution of the municipality. The temperature shock measure (iv) is created similarly.