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Who Cares for the Elderly? Intrafamily Resource Allocation and Migration in Mexico

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Who Cares for the Elderly? Intrafamily Resource Allocation and Migration in Mexico *

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Abstract

This paper considers the intrafamily allocation of elderly care in the context of international migration where migrant children may be able to provide financial assistance to their parents, but are unable to offer physical care. To investigate the interaction between siblings, I take a non-cooperative view of family decision-making and estimate best response functions for individual physical and financial contributions as a function of siblings' contributions. I account for the endogeneity of siblings' contributions and individual migration decisions by using siblings' characteristics as instrumental variables as well as models including family fixed effects. For both migrants and non-migrants, I find evidence that financial contributions function as strategic complements while siblings' time contributions operate as strategic substitutes. This suggests that childrens' contributions toward elderly care may be based on both strategic bequest and public good motivations. In addition, the results from a simulation generating an exogenous switch in child's migrant status show a decrease in time and potentially even financial contributions for elderly parents.

JEL classification: J14, O15, D13, F22
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1 Introduction

Children are sometimes viewed as a method of insuring against disability and providing income after retirement, especially in developing countries with limited markets for credit and insurance. By the time parents have reached an age where they require assistance, however, it is their children that must decide on the distribution of responsibility of caring for their elderly parents. How do children decide on how much care to provide to their parents in old age, particularly in families with many children? The country of focus is Mexico, where the lure of international migration to the U.S. is strong given the possibility of earning a higher income and thus potentially contributing more financially to the elderly parent. At the same time, in most cases the decision to migrate substantially limits the migrant's ability to visit his family in Mexico and thus prohibits him from acting as personal caregiver for the elderly parent. This paper provides insight into the allocation of resources within families by estimating best response functions for individual physical and financial contributions as a function of siblings' contributions. By estimating these equations conditional on a migration decision, I also consider whether motives for giving differ by migration status.

While there is an extensive literature on migrant remittances, few papers have addressed the specific issue of migrant transfers to parents in the home country. One example is Lucas and Stark (1985) who find that migrants with wealthier parents contribute more to their parents relative to those migrants with poorer parents, a result suggestive of the possibility of intervivos transfers and/or a bequest motive. More recently, Alaimo (2006) considers whether parents of migrant children are better off in terms of time and money transfers relative to parents of non-migrants. While she finds that parents with migrant children are better off in terms of financial assistance, because the units of analysis in her study are parents, it is not possible to fully examine the behavior of migrant and non-migrant children within the family.

This paper proposes a deeper analysis of intrafamily resource allocation by focusing on children's behavior toward their parents. I treat elderly care contributions in terms of time and money as the outcome of a non-cooperative game among children. The game is made up of two stages where agents decide whether or not to migrate in the first stage and make contributions to elderly parents in terms of time and money in the second. From this perspective, I estimate best response functions for physical and financial care conditional on migration as functions of contributions made by other siblings. This analysis allows us to determine whether siblings' contributions function as strategic substitutes, implying a negative relationship between siblings' contributions, or strategic complements, in which an increase in one child's contribution is met with an increase in that of his sibling.

Estimating the best response functions is particularly interesting because it sheds light on both theoretical and policy questions. First, it is valuable because it allows us to asses the impact of children's migration on the care of parents remaining in Mexico. If siblings' time contributions are strategic substitutes, then the migration of one child and the reduction in time contribution that it necessarily induces would be offset by siblings in the home country who would compensate for the absent sibling by increasing their own time contributions. On the other hand, if siblings' contributions are strategic complements, one child's move abroad would result not only in the reduction in time contribution of the absent sibling, but also a reduction in time contributions by other siblings. As one child in the family migrates, he may also increase his financial contribution to the elderly parent via remittances. If siblings' financial contributions are strategic substitutes, then his siblings' money contributions in the home country would fall as a result. However, if siblings' financial contributions are strategic complements, then siblings would raise their financial contributions to the parents in response.

Treating siblings' contributions as the outcome of a non-cooperative two-stage game, I account for the endogeneity of siblings' contributions by using siblings' characteristics as instrumental variables. I check the robustness of the IV results by comparing them with results using a smaller set of instruments as well as from models including family fixed effects (FE and FEIV). I also consider the possibility of selection into migration by considering the results with a selection term, where identification is also based on siblings' characteristics. Overall, I find evidence that individuals increase their financial contributions in response to an increase in their siblings' financial contributions and decrease their time contributions in response to an increase in their siblings' time contributions.

These results suggest that for both migrants and non-migrants, financial contributions function as strategic complements while siblings' time contributions operate as strategic substitutes, a distinction that could indicate children's expectation that parents will mainly consider financial contributions when they are making bequest decisions at the ends of their lives. Since the results are mixed in terms of substitutes and complements, it is theoretically unclear whether the consequences of migration should be dampened or amplified by siblings remaining in the home country, and instead depend on the magnitude of the effects. To address this, the final section of the paper uses the estimates from the best response functions to explore whether these findings point to an overall positive or negative effect of migration on contributions toward elderly parents. The results from simulating an exogenous switch in migrant status for one child show a decrease in time and possibly even financial contributions for elderly parents. Consequently, policies that promote migration may have a negative impact on the overall well-being of elderly parents.

This paper proceeds as follows: Section 2 discusses the relevant literature and choice behind the use of a non-cooperative model. Section 3 describes the data set and reviews the summary statistics. Section 4 establishes the empirical strategy with a focus on challenges to identification. Section 5 presents and interprets the results. Section 6 goes through various robustness checks including fixed-effects models. Section 7 discusses the simulation, and Section 8 concludes.

2 Theory

2.1 Background

Estimating the best response functions for children's contributions is of particular interest in light of their theoretical implications pointing to competing models of family interaction. Perhaps the most appropriate theoretical jumping-off point to analyze the elderly care problem is within the context of the public goods literature in the tradition of Bergstrom, Blume and Varian (1986). If a child cannot be excluded from benefiting from her parent's well-being and such a good is not diminished by the consumption of her siblings, then the parent's well-being can be thought of as a public good.[1] If parental well-being is a pure public good, then we would expect the best response functions to indicate that siblings' con-

[1] The good could be considered as the knowledge that the parents are being cared for physically and financially and thus does not require children to spend time with their parents to consume it.

tributions are strategic substitutes. If, however, children's only motivation to contribute is through some preference for personally caring for their parents, referred to as a "warm-glow" in Andreoni (1990), then there would be no relationship between siblings' contributions as there is essentially no public good channel on which to free ride. Finally, if siblings are competing for their parent's attention, perhaps due to affection or in anticipation of a bequest that may function as a form of payment as with Bernheim, Shleifer, and Summers' (1985) strategic bequest motive, we would expect to find siblings' contributions operating as strategic complements. Thus, the estimation of the best response functions, by indicating whether siblings' contributions are strategic complements, substitutes, or neither, can illuminate which model of family interaction is most appropriate.

Much of the literature specific to elderly care has focused on interactions between parent and child, and in particular living arrangements and care relationships in the intergenerational household (Pezzin and Schone, 1997, 1999). More recently, some attention has been paid to how siblings distribute responsibility of caring for their elderly parents but has still largely focused on siblings' choice of co-residence with elderly parents, where only one child ultimately provides physical care (Hiedemann and Stern, 1999; Engers and Stern, 2002). Konrad, et al. (2002) find evidence of strategic considerations in the residential choices of German children which take care-giving for elderly parents into account. Wakabayashi and Horioka (2006) examine the factors determining why eldest sons are more likely to co-reside with their parents in Japan and find evidence of a strategic bequest motive.

Pezzin, et al. (2006) consider a two-stage game where co-residence is determined in the first stage and transfers are determined in the second stage. They find that co-residence of one sibling reduces her bargaining power vis-a-vis her other siblings, so the equilibrium outcome may not be Pareto efficient. Most closely related to this paper, Checkovich and Stern (2002) examine the shared responsibility for physical care-giving among siblings in the U.S. and find evidence that physical care decisions are negatively related across siblings. Financial contributions, however, are not simultaneously considered. To my knowledge, other than the current paper, Byrne, et al. (2009) is the only other paper to allow all siblings to contribute both financial and time assistance to the elderly parent. Their policy context, however, is better suited to the U.S. experience, as opposed to that of international migration considered here.

2.2 Modeling Considerations

There are three main approaches to the analysis of intrafamily allocations: the unitary model that assumes that the family maximizes a joint utility function, cooperative bargaining models that assume the equilibrium outcome is always Pareto efficient, and non-cooperative bargaining models that focus on individuals as units of analysis and view family decision-making as a non-cooperative game. This paper takes the latter approach which, it can be argued, is more appropriate for analyzing the relationship between older parents and their adult siblings that are largely independent and are likely to have conflicting interests.

Given the high levels of remittances and the importance of networks in the context of migration, some might find it more appealing to position the family as unitary decision-maker rather than the individual. In light of the number of studies rejecting the unitary model of intrahousehold decision-making,[2] however, it seems reasonable to believe that this class

[2] See, for example, Thomas (1990), Lundberg, Pollak, and Wales (1996), and Pezzine and Schone (1999) who reject the income-pooling hypothesis of the neoclassical or common preference model.

of models would be even less appropriate for describing decision-making by family members who do not co-reside. A related possibility is that siblings' preferences are interdependent in the sense that siblings care directly for each other so that one sibling's utility enters into the utility function of the other sibling. In this case the interdependence of siblings' actions would lie not only in the provision of the public good, elderly care, but also in the fact that their utility functions are interdependent. While this may be a possibility for the nuclear family living under one roof, I find it much more unlikely among adult children who have formed separate households. One could also argue that if these types of dependencies exist, they are likely to be of second-order importance.

By the same token, while cooperative bargaining has gained traction in modeling intra*household* allocation within marriage and have been used to model decision-making in intergenerational households (Pezzin and Schone, 1999), it is hard to imagine them being used as modeling tools for the allocation of resources among adult siblings that generally live separately. Another alternative would be to use a model akin to the "collective setting" that assumes only that the intrahousehold allocation is Pareto efficient.[3] Yet in the context of adult siblings that may free-ride off of each other's contributions and behave strategically, assuming Pareto efficiency at the outset seems dubious, and the data set used here is very limited with regard to information on adult children (e.g. no consumption, income, or price data) that might be used to test the suitability of such an approach as in Browning and Chiappori (1998).[4]

[3] For an excellent review of intrahousehold allocation models, see chapters 3 through 5 of Haddad, et al. (1997),written by Pierre-Andre Chiappori, Marjorie B. McElroy, and Shelly Lundberg and Robert A. Pollak, respectively.

[4] Checkovich and Stern (2002) consider what such a collective model might look like, but ultimately reject

Instead, in considering the voluntary contributions of adult children toward their elderly parents, one must recognize that any behavior that is not incentive compatible at the individual level is not likely to persist, so any model of cooperation must include some self-enforcing mechanism. One criticism of the approach taken here is the suggestion that siblings are likely to interact repeatedly with regard to the care of elderly parents, allowing for multiple equilibria and the possibility that culture, social norms or rules of thumb help dictate which outcome is most likely to hold. Most notably, in the repeated game agents may be able to generate a Pareto-improvement over the non-cooperative, one-shot, Nash equilibrium outcome (Lundberg and Pollak, 1994). This type of Folk Theorem result, however, requires the siblings to be sufficiently patient with regard to future pay-offs. While estimates vary widely, the available evidence suggests that discount rates can be very high indeed (Frederick, et al. 2008), and even higher for the poor (Harrison, et al. 2002), making the likelihood of sustaining a cooperative agreement among this population less likely. A related problem facing the repeated game approach is consideration of the end-game, since the approaching death of the elderly parent may imply that siblings discount the future at an even greater rate, and consequently further limits the scope for cooperation among them (Pezzin, Pollak, and Schone, 2006).

Thus, it is unsurprising that the non-cooperative approach has gained popularity among the small number of papers to model interactions among multiple adult children. For instance, Hiedemann and Stern (1999) model the long-term care arrangement of the elderly parent as a non-cooperative game where the first stage involves children simultaneously choosing whether to offer care. Fontaine, et al. (2009) take a non-cooperative approach

it as a suitable model for family decision-making among adult siblings.

and assume that the outcome is a pure Nash equilibrium. Byrne, et al. (2009) estimate a structural model with a Nash equilibrium solution concept where each family member takes the other family members' behavior as given. Their goodness-of-fit tests show that the data fit their model reasonably well.

While the papers in this literature generally do not provide empirical justification for their approaches, I agree that a model of conflict is more appropriate for the older family at a stage where children are likely to have families of their own and interests that may conflict with those of their siblings. Thus, the model presented here, while not the only possible approach, can be thought of as one way of analyzing siblings' interaction that is also valid and informative.

2.3 Theoretical model

I begin by specifying a two-stage game in which individuals make decisions about migration, $m_i \in \{0,1\}$, in the first stage, and subsequently decide on the amount of (private) consumption, c_i, and their contributions to their parents in terms of time, t_i, and material goods, g_i, with the objective of maximizing utility less some cost of migration, $C_i(m_i, M_{-i})$. $C_i(m_i, M_{-i})$ is a decreasing function of the number of migrant siblings in the family, $M_{-i} = (m_1, ..., m_{i-1}, m_{i+1}, .., m_n)$, and is equal to zero if the individual does not migrate.[5] Thus, the individual maximizes a net utility function, $U_i(m_i, c_i, g_i, G_{-i}, t_i, T_{-i}|Z_i) - C_i(m_i, M_{-i})$, subject to a resource constraint, $c_i + g_i + wt_i \leq wL$, where L is the total time allocation, w is

[5] The costs of migration are likely to be decreasing in the number of migrant siblings since migrant siblings can potentially steer the individual toward cost-saving alternatives, for instance in the areas of transportation, residence, and job search.

the real opportunity cost of time, and I abstract from a labor-leisure choice. I also assume that the time contribution must equal zero if the individual migrates, $t_i = 0$ if $m_i = 1$, and contributions are subject to a non-negativity constraint.

Note the inclusion of other siblings' goods contributions, $G_{-i} = (g_1, ..., g_{i-1}, g_{i+1}, .., g_n)$, and their time contributions, $T_{-i} = (t_1, ..., t_{i-1}, t_{i+1}, .., t_n)$, as well as the individual contributions, t_i and g_i, in the utility function. This allows for the possibility that individuals care about the well-being of their parents in terms of how much care parents receive from all of the children as well as how much care individuals personally provide to their parents. Also note that the utility function depends on some individual characteristics, Z_i, which include observable and unobservable components, (X_i, ε_i), but siblings' characteristics, such as wealth and its determinants, are explicitly excluded from both the utility function and the individual's resource constraint.

As a simplification, we can assume the resource constraint is binding and substitute out for the consumption good using the budget constraint to rewrite the individual's utility as a function of his own time and goods contributions as well as of his siblings' contributions: $\tilde{U}_i(m_i, g_i, G_{-i}, t_i, T_{-i}|Z_i)$. Using backward recursion, I begin with an examination of the second stage in which M, the vector of migration decisions made by all siblings in the first stage, has been fixed.[6] The individual then solves:

$$\max_{\{g_i,t_i\}} \tilde{U}_i(m_i, g_i, G_{-i}, t_i, T_{-i}|Z_i) - C_i(m_i, M_{-i})$$

$$\text{subject to } t_i = 0 \text{ if } m_i = 1,$$

$$g_i \geq 0, t_i \geq 0$$

[6]Every vector M defines a proper subgame.

This maximization problem yields the following best response functions for g_i and t_i which are conditional on the migration decision:

$$g_i = \gamma(G_{-i}, T_{-i}|m_i, Z_i) \tag{1}$$

$$t_i = \{ \begin{matrix} \tau(G_{-i}, T_{-i}|Z_i) \text{ if } m_i = 0 \\ 0 \text{ if } m_i = 1 \end{matrix} \tag{2}$$

The theories of family interaction laid out in Section 2.1 have specific implications for the partial derivatives of an individual child's contribution with respect to the contributions of his siblings. In particular, the derivative is expected to be positive under a theory of competition between siblings, such as the strategic bequest motive. In contrast, it will be negative under a public good theory of behavior and will have no expected relationship if the motive for giving is purely to confer a "warm glow" on the giver.

Solving the equations simultaneously for all siblings determines the continuation equilibrium, the vectors describing each child's contributions in terms of goods and money as functions of the migration profile in the first stage and the vectors of characteristics for all siblings, $Z = (Z_1, ..., Z_n)$:

$$G^*(M, Z), T^*(M, Z).$$

Note that estimation of the best response functions will yield inconsistent estimates because of the simultaneity inherent in the problem, i.e. sibling i's contribution is a function of sibling j's contribution which in turn is a function of sibling i's contribution. Thus, other siblings' total contributions, G_{-i}, T_{-i}, will be endogenous in equations 1 and 2. Nevertheless, the nature of the continuation equilibrium points to an econometric solution in the form of exogenous variables that only affect individual i's contributions through their effect on G_{-i}, T_{-i}. These potential instruments are simply the other siblings' characteristics,

$Z_{-i} = (Z_1, ..., Z_{i-1}, Z_{i+1}, .., Z_n)$, which do not enter into the best response function directly. Empirically, the econometrician can thus take the observable component of the characteristics of other siblings and aggregate them to produce instruments for the contributions of these siblings: $W(X_1, ..., X_{i-1}, X_{i+1}, ..., X_n)$.

Moving to the first stage of the game, individual i will choose to migrate if his net utility is higher as a migrant than as a non-migrant. That is, he chooses m_i to solve

$$\max_{m_i \in \{0,1\}} V_i^*(M, Z) = \tilde{U}_i(m_i, G^*(M, Z)T^*(M, Z)|Z_i) - C_i(m_i, M_{-i})$$

This yields the following best response function for migration:

$$m_i = \mu_i(M_{-i}, Z). \tag{3}$$

Solving for the fixed point among all siblings in the family yields the vector $M^*(Z)$ which maps characteristics of all siblings into migration outcomes. While it would be instructive to estimate the best response function in equation 3, we would not be able to identify the parameters as we again have an endogeneity problem because of simultaneity, i.e. sibling i's migration is a function of sibling j's migration which in turn is a function of sibling i's migration. Unfortunately, in this case, all siblings' characteristics enter directly into the best response function and therefore cannot be excluded from the equation to be used as instruments. Nevertheless, we may still estimate the equilibrium mapping

$$m_i^* = m_i^*(Z), \tag{4}$$

which is a function of all of the siblings' characteristics. This estimation will prove useful in the robustness section below where I address the concerns arising from selection into migration, with identification based on siblings' characteristics. While it would also be interesting to go through comparative statics exercises for this particular model, deriving predictions regarding the effects of certain exogenous characteristics is beyond the scope of the current paper and left for further research.

3 Data

3.1 Description

The data set used in this paper is the Mexican Health and Aging Study (MHAS) for the years 2001 and 2003, the results of a joint project between Mexico's statistical agency, INEGI, and researchers at the Universities of Pennsylvania, Maryland, and Wisconsin.[7] The MHAS is a nationally representative panel data set of Mexicans born before 1950 that began interviewing respondents in 2001 and returned to collect data from the same respondents in 2003. Respondents are asked a range of typical household survey questions regarding their expenditures, income, assets, and labor supply, as well as detailed questions on the health conditions of the sampled person. Basic information is also collected about the children of the sampled person, including those that live in and outside of the elderly parent's home. In addition, the MHAS also has data on the migration history of the respondent and whether his children are currently in the U.S.

For purposes of the analysis presented here, the data set contains detailed information about financial transfers between the respondent and his children. Information is also provided on the time children spend helping their parents, but these responses are conditional on the respondents reporting difficulty with "Activities of Daily Living" (ADLs) which are

[7] The MHAS is publicly available at http://www.mhas.pop.upenn.edu/

divided into basic ADLs and higher level "Instrumental Activities of Daily Living" (IADLs).[8] The basic ADLs involve getting in and out of bed, bathing oneself, using the toilet, eating, and walking across a room. The IADLs involve preparing a hot meal, shopping for groceries, taking medications if needed, and managing money. Since these are the only measures of hourly time contributions in the study, in most of what follows, I limit the sample to families where the parent reported difficulty with at least one ADL or IADL.

Since my sample is conditional on difficulties with ADLs or IADLs, and respondents are asked to list the amount of time individuals spend helping them with these tasks, the time contributions made by children in this analysis can be thought of as a measure of critical hourly help. While cutting the data set on this dimension limits the number of observations to around 10% of the usable sample, focusing on this restricted group is arguably more appropriate as families with parents with these difficulties are likely to differ considerably from families where the parent is more independent. Thus, the restricted sample can be thought of as a more flexible specification where I have allowed all effects to vary based on the fact that the parent has difficulties with one or more activities of daily living. I take the five indicators of difficulty with the basic ADLs as particularly important indicators of the parent's basic ability to provide for himself and also include them as controls in the regression analysis below.

The two main variables of interest provide data on time and financial contributions by children to parents. The financial variable is the result of a series of questions about how

[8]This restriction in the MHAS data is similar to that in other data sets used in the literature, for example, those used by Byrne, et al. (2009) and Checkovich and Stern (2002).

much money the child has contributed to the elderly parent over the past 2 years.[9] Most participants that respond make reference to a monthly allotment and for those who do not, I convert the answer into a monthly average. In addition, some participants were not sure of the amount and were allowed to respond with a pre-specified range of values. Using the continuous data as the empirical distribution, I converted these responses to the mean of the range specified. The time contribution variable is the result of asking how many days in the last month and how many hours per day the child spent helping the parent with any ADLs or IADLs. In addition, if a non-resident child's spouse or children helped the elderly respondent, the survey records this time contribution as deriving from the child of the elderly parent, so the time contributions can be viewed more broadly as hourly help flowing from the households of the respondent's children.[10] While the survey does not collect data on the earnings of children or transfers among children, it does collect basic information on a child's education, marital status, current migration status, and the number of his children.

3.2 Descriptive statistics

Table 1 illustrates the summary statistics for the children (also referred to as siblings) who form the units of analysis in this paper. Since the estimation of best response functions requires more than one agent and complete records are needed for individuals and their siblings, I restrict my sample to families where there are at least two siblings with non-

[9] I convert financial data to 2002 Mexican pesos using the national Consumer Price Index from the Banco de Mexico.

[10] This caveat actually makes the time contribution more consistent with the financial contribution which certainly stems from the child's entire household.

missing data.[11] Because time contribution data are only collected for those parents with difficulties with ADLs, I also limit the sample to families where the sampled parent has difficulty with at least one basic or instrumental activity of daily life. This leaves a total number of observations of 5,537 child-year (932 family-year) observations, with around 11 percent currently in the U.S.[12]

I focus here on the differences in means between migrants and non-migrants. Table 1, Panel A shows that on average, migrants are more likely to be male, less educated, slightly younger, have fewer children, and are more likely to be married compared with their non-migrant counterparts. Perhaps as expected, on average migrants appear to give more financially to their parents than non-migrants (around 300 pesos relative to 150) and are also more likely to give (32% relative to 16%). While both these differences are statistically significant, once I condition on giving money to parents, the average contributions of the two groups are very close (938 versus 932) and cannot be statistically differentiated.

In terms of hourly help, in the theoretical model above I assumed that migrants would not be able to give time. The data appear to bear this out, with only one percent (6 observations) of U.S. migrants giving time to parents in Mexico compared with 13% of non-migrants. Conditional on giving time, non-migrants also provide many more hours of care than migrants (131 hours relative to 57), justifying the claim that migrants are indeed constrained in providing time care to their elderly parents. Table 1, Panel B shows that

[11] An alternative approach would be to keep the single child families and define their "siblings'" contributions and characteristics to equal zero. Since there are very few families that are made up of only one child, the IV results are very similar using this approach.

[12] Of these, 738 families are observed in 2001 and 194 are observed in 2003. Note that these numbers do not reflect the true attrition rate because parents may report an ADL in one year and not in another.

parents of migrants appear to receive more financial help from their children compared with parents of non-migrants, although due to the high variances in contributions the difference is not statistically significant. At the same time, parents of non-migrant children do receive more hours of care from each of their kids on average relative to parents of migrant children (20.6 hours of care versus 12.4), a result that is statistically significant.

These descriptive statistics point to important differences between parental contributions among siblings based on migrant status. While it would be instructive to estimate the best response functions separately by gender as well, due to the small sample size of each group individually, I estimate only on the pooled sample of men and women. I now turn to controlling for observed characteristics and focusing on the question of how children's contributions respond to those made by their siblings.

4 Empirical strategy

I begin by considering the appropriate estimation of the best response functions as derived in Section 2, where I interpret the goods contribution to be in the form of money, i.e. the financial contribution. The form of the best response functions derived in equations 1 and 2 suggests that the empirical estimation should be conditional on migration status, both because (i) constraining the time contribution to be zero for migrants may affect the optimized value of financial contributions and (ii) opportunities and trade-offs are likely to be different for migrants and non-migrants. This can also be thought of as allowing for a more flexible functional form for the financial contribution to vary with migration status.

Thus, I estimate the following linearized versions of the best response functions.[13] Since the siblings are assumed to care about the total value of contributions going to the elderly parent, I assume that the contributions of other siblings enter as a sum.

$$g_{ij} = G_{-i,j}\alpha_1^1 + T_{-i,j}\alpha_2^1 + X_{ij}\beta_1^1 + u_{ij} \text{ given } m_{ij} = 1 \tag{5}$$

$$g_{ij} = G_{-i,j}\alpha_1^0 + T_{-i,j}\alpha_2^0 + X_{ij}\beta_1^0 + \xi_{ij} \text{ given } m_{ij} = 0 \tag{6}$$

$$t_{ij} = G_{-i,j}\gamma_1 + T_{-i,j}\gamma_2 + X_{ij}\beta_2 + e_{ij} \text{ given } m_{ij} = 0, \tag{7}$$

where i is the individual subscript and j denotes the family. The vector of control variables, X_{ij}, includes characteristics of the individual child: a female dummy, birth order, age and age squared, four categorical variables describing education level, a married indicator, and number of children. In addition, I control for variables describing his parent: a parental female dummy, parental married indicator, five indicators for difficulties with basic ADLs, parent's age and age squared, four categorical variables describing the parent's education level, a year dummy for taking the survey in 2003, and an indicator for residing in a more urban area.

4.1 Identification

The main empirical problem is that siblings' contributions are determined simultaneously, and thus are necessarily endogenous. More generally, this can be thought of as an example of the classic reflection problem illustrated in Manski (1993), wherein the behavior of an

[13] This can be viewed as a Taylor approximation of the structural best response functions. Checkovich and Stern (2002, p.444) also offer a set of utility functions consistent with a linear estimating equation in one contribution good.

individual both affects and is affected by the behavior of a reference group, in this case, his siblings. As Manski points out, it is difficult to tease out the causal effect of the group behavior on the behavior of the individual, because of the presence of endogenous, contextual, and correlated effects within the group.

In equations 5 through 7 above, it is straightforward to show that $G_{-i,j}$ will be correlated with u_{ij} since $G_{-i,j}$ is also a function of g_{ij}. The analog is true for all the variables comprising siblings' financial contributions as well as time contributions, $T_{-i,j}$. As a result, least squares estimation violates the classical assumptions and will lead to biased and inconsistent estimates. An added problem is that the decision to migrate may be influenced by the same factors that affect the parental contribution. For now, I treat migration status as predetermined and consider potential migration selection issues in the robustness section below.

To address the endogeneity of siblings' contributions, I propose a set of instruments that are excluded from equations 5 through 7 but that help to predict the endogenous variables $G_{-i,j}$ and $T_{-i,j}$. These are simply the siblings' characteristics, X_{-ij}, since they help to predict $G_{-i,j}$ and $T_{-i,j}$ but are not included directly in the equations determining g_{ij}, t_{ij}. The identification assumption is that siblings' characteristics only affect individual i's contributions through $G_{-i,j}$ and $T_{-i,j}$.[14]

In the language of Manski (1993), this requires assuming away the existence of contextual and correlated effects that reflect the exogenous characteristics of other siblings in the group, i.e., these variables must correctly be excluded from the individual contribution equation.

[14] A similar strategy is used by Sandler and Murdoch (1990) to estimate the effect of NATO allies' defense expenditure on individual countries' military spending during the Cold War.

At first this may appear to be a point of contention as we might expect for an individual's contribution decision to take his siblings' characteristics into account. For example, one might expect a child to contribute more if his brother was poorly educated and presumably less able to contribute.[15] One might also reason that children may expect their siblings to contribute more out of windfall rather than earned income[16]. Ultimately, however, we cannot forget the context of contributing to the welfare of an elderly parent. The view here is that the actual contribution to the elderly parent trumps any reason for siblings' giving, thus the maintained assumption that the individual's behavior responds to the contributions of his siblings, and not directly to his siblings' characteristics. In short, when the individual decides on his parental contribution it does not matter *why* his siblings are contributing to the extent that they are, it only matters how much they are actually contributing.

In the simple 2-sibling family, it is easy to see that the instrumental variables are just the personal characteristics of the other sibling. In a many-sibling family it would be some aggregate function of the other siblings' characteristics. In particular, I use the sum of siblings' characteristics which can be motivated through some reduced-form algebra..

Consider a 3-sibling household with one public good. Substituting $G_{-1,j} = g_{2,j} + g_{3,j}$,

[15] A related concern, addressed in the Data section above, is that children's contributions to their parents may mask contributions among siblings directly. Unfortunately, the MHAS data has no information to bear on this question.

[16] See Jakiela (2009) for experimental evidence on individuals' willingness to transfer out of earned versus unearned income to an anonymous partner.

$G_{-2,j} = g_{1,j} + g_{3,j}$, and $G_{-3,j} = g_{1,j} + g_{2,j}$ yields:

$$g_{1j} = X_{1j}\beta_1 + \alpha_1(g_{2,j} + g_{3,j}) + u_{1j} \tag{8}$$

$$g_{2j} = X_{2j}\beta_1 + \alpha_1(g_{1,j} + g_{3,j}) + u_{2j} \tag{9}$$

$$g_{3j} = X_{3j}\beta_1 + \alpha_1(g_{1,j} + g_{2,j}) + u_{3j} \tag{10}$$

Solving the system of equations for g_{3j} as a function of exogenous variables leaves us with the following reduced form equation:

$$g_{3j} = \Upsilon[X_{3j}\beta_1 + \frac{\alpha_1\beta_1}{1-\alpha_1}(X_{1,j} + X_{2,j}) + \frac{\alpha_1}{1-\alpha_1}(u_{1j} + u_{2j}) + u_{3j}] \tag{11}$$

where $\Upsilon = [1 - (2\alpha_1^2/1 - \alpha_1)]^{-1}$. Equation 11 is the first stage equation where the instrumental variables $X_{1,j} + X_{2,j}$ are used to predict g_{3j}. The instrumental variables I use are the analogues of the individual-level covariates, but as they relate to the other siblings.[17] They are: (1) number of sisters, (2) number of siblings in each of four education categories, (3) sum of ages of siblings (and sum of squared ages), (4) sum of children of other siblings, (5) number of married siblings, (6) total number of siblings and (7) sum of birth orders of other siblings.

Since the IV strategy relies critically on the strength and validity of the instruments used, Appendix Table A1 presents the OLS regression results where the dependent variables are the sums of the siblings' contributions and the regressors are the sums of the siblings' characteristics. In general, siblings' characteristics appear to affect siblings' contributions in the expected ways, e.g. more sisters implies a lower sibling financial contribution and higher sibling hourly contribution. Many of the coefficient estimates are statistically significant at

[17]Brown (2006) and Coe and van Houtven (2009) make use of siblings' characteristics to account for selection into caregiving.

the 1% level, reflecting the predictive power of the instrumental variables individually and the F statistic on the excluded instruments is 9.93 in the financial help regression and 18.62 in the regression predicting siblings' hourly help.

The estimation strategy thus amounts to estimation of equations 5 through 7 where I account for the endogeneity of siblings' contributions by estimating:

$$T_{-i,j} = Z_{ij}a_1 + \epsilon_{ij} \tag{12}$$

$$G_{-i,j} = Z_{ij}a_2 + \varsigma_{ij}. \tag{13}$$

Due to a high fraction of zeros in both time and financial contributions, some might argue a tobit specification would be more appropriate for estimating equations 5 through 7. The standard maximum likelihood estimation, however, is computationally difficult due to the inclusion of multiple endogenous variables. Instead, I use two-step estimation inspired by Rivers and Vuong (1988) and Blundell and Smith (1986), as detailed in Wooldridge (2002, p.530). The first step amounts to estimation of equations 12 through 13 via OLS and then inserting estimated residuals from those regressions into tobit estimation of equations 5 through 7. I bootstrap the standard errors, clustering at the family level, using 500 replications. For those readers who would argue that the tobit model is not appropriate since there is no real censoring here, only true zeros, I also include LS estimates throughout.[18] Finally, for those who remain skeptical of the IV approach, I include the results from fixed-effects models in section 6.

[18] See Maddala (1983, chapters 1 and 6) for a discussion of truncation versus censoring.

5 Results

5.1 Best response functions

The results from estimation of the best response functions for children's contributions can be found in Table 2. For comparison with the IV estimates, Panel A documents the results from a regression that neglects to account for the endogeneity of siblings' contributions with each column representing estimates from equations 5 through 7. In general, the signs of both the tobit and LS estimates agree with the former being somewhat larger in magnitude.

The results from Table 2, panel A suggest that not accounting for the endogeneity of siblings' contributions would lead us to believe that siblings' financial contributions are strategic complements, but otherwise generally give mixed results. A Hausman test of the exogeneity of the siblings' contributions variables shows that for non-migrants' financial and hourly contribution equations, we can reject the null of the exogeneity of siblings' financial and hourly contributions.

Table 2, Panel B shows the results from the analogous IV linear and IV tobit estimations.[19] Column (1) shows that a 100 peso increase in siblings' contributions leads to a statistically significant 6 peso increase in the financial contribution for the individual migrant child (column 1) and an increase in about 12 pesos for the non-migrant child (column 2). While the magnitude of the response is not very large compared with the levels of financial contribution seen in the summary statistics above, the positive relationship is consistent with strategic complementarity in financial contributions for both migrants and non-migrants.

[19] The IV linear model is implemented using the ivreg2 command in STATA developed by Baum, et al. (2007).

At the same time, Table 2, Panel B shows that the cross-effects between financial and time contributions across siblings are negative. Specifically, an increase in one hour of siblings' total time contribution leads to a decrease of almost 1 peso in the individual non-migrant contribution in the IV linear specification (column 2) and 9 pesos in the IVtobit estimation (column 5). Using the 2000 Mexican Census, Hanson (2003) reports an average hourly wage close to 17 pesos per hour[20], suggesting that the latter estimate is on a reasonable scale relative to the prevailing opportunity cost of time. On the flip side, the IV linear estimate shows a statistically insignificant drop in hours in response to a rise in siblings' financial contributions (column 3), but the IVtobit estimate is statistically significant and close in magnitude (-0.06 in column 6).

Finally, the hourly contribution response estimates in Table 2, Panel B show that time contributions are strategic substitutes. Both estimation methods show a statistically significant drop in individual hourly help with a rise in siblings' hourly help. The IV linear estimate suggests a rise in 1 hour of siblings' help results in a fall in 0.1 hours of individual help (column 3) and the IV tobit estimate implies a substitution ratio that is closer to one-for-one (column 6).

While a test of overidentifying restrictions is not straightforward in the IV tobit estimates, in two of the three IV linear specifications we fail to reject the null of instrument validity at conventional levels. At the same time, the reasonable magnitudes of the estimates here support the credibility of the results.

[20] After dropping the lowest observations, Hanson(2003) reports an average hourly wage of 1.8 dollars in 2000. I convert this to Mexican pesos using 9.5 Mexican pesos per US dollar, approximating the prevailing exchange rate in 2000 using the historic look-up feature at www.x-rates.com.

5.2 Interpretation

Overall, the results from the best response functions suggest that siblings' financial contributions are strategic complements for both migrants and non-migrants while time contributions appear to be strategic substitutes. In addition, the cross-effect between siblings' financial and time contributions points to substitution across siblings. One notable concern is that the complementarity result is being driven simply by unobserved family heterogeneity, such as would be the case if children were responding to some family-specific trait, such as a family where children who were treated better in childhood felt compelled to return the favor to their parent in old age. While I address family-level heterogeneity below, the results above already make this simple scenario unlikely since it cannot explain why the strategic relationship between time contributions would work in the opposite direction as financial contributions.

Instead, the distinction between the complementarity of financial contributions across siblings and the substitutability of time contributions could point to the possibility that children expect their parents will mainly consider financial contributions when they make bequest decisions at the ends of their lives. Although the difference in the complementarity estimates between migrants and non-migrants is not statistically significant, the fact that the magnitude is generally higher for non-migrants may reflect the fact that some fraction of migrants do not plan to return home, and thus inherently have a weaker bequest motive. While limited information is available regarding bequest intentions from only a small sample of elderly respondents, those who report their children will benefit upon their death are asked to specify which child will benefit the most. Compared with their siblings, the children who are reported to benefit the most are reported to give more in financial contributions toward their elderly parents, although the difference (around 185 pesos) is not statistically significant.

Some may question whether it makes sense for a bequest motive to operate in relatively poor populations where parents are observed to receive financial assistance from their children. If parents are planning on leaving bequests to their children, couldn't they use the bequest for financing current consumption, and thus eliminate the need for financial help? The illiquidity of the assets available to parents provides a logical solution to this seeming paradox. While over 40% of parents report zero non-housing related assets, almost 84% report that the housing unit in which they reside is their own property that they either own outright or are paying off. At the same time, about 10% of respondents report that there is no title for the property, underscoring the likelihood that the main asset is illiquid. While the survey does not ask explicitly how respondents came to acquire their home, they do ask whether the property was inherited. Almost 20% of the respondents answering this question report that either they, their spouse, or both of them jointly inherited the property, thus alluding to the possibility that their children will potentially inherit property as well.

Thus, there is empirical support for the proposition that a bequest motive could hold, even among a poor population. Nevertheless, I cannot rule out the possibility that children compete for some other reward, such as affection or admiration from their parents, who may more readily acknowledge financial contributions if they are particularly poor.

6 Robustness

6.1 Instrument Validity

One concern about the instrumental variables strategy employed here is that choice variables such as siblings' education, martial status, and number of children may not be valid instruments if the individual takes them directly into account when making decisions about his own parental contribution. Since the equations being estimated are actually overidentified in terms of the number of instruments, one way to address this critique is to limit the set of instrumental variables to an arguably more exogenous set. The results from the IV linear and IV tobit estimates using the smaller IV set (number of sisters, sum of siblings' birth orders, sum of siblings' ages and squared ages, and the number of siblings) can be found in Table 2, Panel C.

Overall, both the signs and magnitudes of the estimates are very similar, suggesting that the use of the additional instrumental variables does not dramatically affect the results. For instance, the IV tobit specification with the smaller IV set shows statistically significant results for the hourly contribution equation corresponding to a drop in 5.2 hours of individual time help in response to an increase in siblings' contributions of 100 pesos compared with a drop of 5.7 hours in the specification with the full IV set. Similarly, the results from the IV tobit specification using the smaller IV set show a drop in 1.4 hours in response to an increase of 1 hour in siblings' time help relative to a drop in 1.1 hours using the larger instrument set. As with the full IV set, in two of the IV linear specifications for the smaller instrument set, the results of the overidentification test suggest that we can fail to reject the null of instrument validity. Nevertheless, one might argue that the test is less informative in this case since the instruments are all capturing features of fertility and birth spacing.

A related concern with the smaller set of instruments is that in larger families age differences between siblings may be so dramatic that parents may actually observe the earnings potential of older children and adjust their fertility accordingly. Unsurprisingly, the age difference between the oldest and youngest siblings in these large families is considerable and close to 17 years on average. It is important to note, however, that although some children may even reach their early twenties before a parent is no longer fertile, this is likely to be well before the age at which a parent must rely on his children for support. Thus, as Ray (2008, p.314) points out, uncertainty may remain regarding whether children will support parents in old-age. Consequently, fertility choices are not likely to be conditional on the current performance of older children.

6.2 Intrafamily correlation and family-level heterogeneity

Another possibility that may cast doubt on instrument validity is the possibility that since the instruments are based on siblings' characteristics, they may in fact be capturing some heterogeneity at the family level in the disturbance term of the equation determining individual i's contribution. For example, the education of individual i's siblings may be correlated with some unobserved family effect that could be correlated with individual i's contribution. A related possibility is that an unobserved family effect, such as a good parent, or a positive childhood experience, drives all children to behave in a similar manner, biasing the estimates toward a finding of strategic complementarity. One solution to this problem in the linear framework would be to include family fixed effects, thereby ensuring that the error term is purged of any such family-level component which might be correlated across siblings and with siblings' contributions.[21] In a cross-sectional model, however, estimating reaction functions of one individual's contribution as a function of his siblings' contributions would amount to introducing perfect multi-collinearity into the estimation.[22] Instead, one must have panel data to estimate the best response functions with family fixed effects and, importantly, identification rests on variation in the instrumental variables over time. This amounts to relying on a subset of the instrumental variables that potentially vary over time including age, education, marital status, and the number of children.

While panel estimation is possible since the MHAS was designed to observe families at two points in time, rather critically, the elderly parent must suffer from an ADL in both periods to obtain data on time contributions, thus the number of observations drops dramatically when moving to panel analysis. Since children's financial contributions are collected for the full sample of elderly parents, one alternative is to focus on the panel sample and define time contributions to equal zero if the parent reports no difficulty with any activities of daily living. This is akin to interpreting the time help as critical hourly help, where parents who have no critical needs by definition receive no critical hourly assistance.

The results from the fixed-effects estimation can be found in Table 3. A tobit model with fixed effects is computationally difficult, so I focus on the linear estimates here. Panel A

[21] The instrumental variables-fixed effects strategy is employed a great deal in the spatial regression literature to estimate strategic interaction among governments. Anselin (2002) and Brueckner (2003) provide overviews of the empirical issues and literature. Fredriksson and Millimet (2002) consider an application with regard to environmental policy.

[22] To see this, difference each variable on both sides of equation 8 from the mean of each variable over all siblings. You find that α_1 always equals -1.

provides LS-FE and LS estimates using the panel sample for comparison purposes, while the FEIV and IV linear results for the panel sample appear in Panel B.[23] While the latter results are not statistically significant, all of the statistically significant coefficients from the LS-FE model (Table 3 Panel A) are very close to the estimates from the IV model in Table 2, panel B. These results adds credence to the IV estimates from above and suggests that the IV and FE models may be alternative methods of estimating the best response functions. This interpretation is bolstered by the fact that in the LS-FE model, we easily reject the null that the family fixed effects are all equal to zero, while in the FEIV regressions on non-migrants, we fail to reject the null that the family fixed effects are equal to zero. Thus, it may be that the family fixed-effects may not be useful once the IV strategy is implemented. In addition, the fact that the results are similar on a broader sample which is not conditional on ADL difficulties suggests that the strategic behaviors observed above are not limited to families with particularly vulnerable parents.

6.3 Attrition

One concern in relying on the estimates from above may be non-random attrition from the survey. To check the extent to which this may be a problem, Table 4, Panel A reports estimates based solely on the 2001 sample, the initial year of the MHAS, for both the IV linear and IV tobit specifications on the sample of parents with ADL difficulties. Overall, the statistically significant results from the 2001 sample match up closely with the results from the initial sample (Table 2, panel B) in both sign and magnitude. Overall these robustness

[23]The FEIV model is implemented using the xtivreg2 command in STATA developed by Baum, et al. (2007).

checks support the findings that financial contributions are strategic complements across siblings and time contributions are strategic substitutes while providing suggestive evidence that the best response estimates stand up well to critiques of instrument exogeneity, family-level heterogeneity, and non-random attrition.

6.4 Selection into migration

Thus far, I have been operating under the assumption that migration is predetermined and ignoring any possible selection issues. However, if migration status and the unobservable component of contributions were somehow correlated, dividing the sample by migration status would introduce a selection term into the best response functions. For instance, we might be concerned that migrants emerge from a group of people who are not close to their families, so they are more likely to migrate and give less to their parents.

As with the Heckman two-step procedure, to address the omitted selection term I use estimated inverse Mills' ratios which are found from probit estimation on m_{ij}.[24] From the theoretical section above, a suitable equation predicting migration is the equilibrium mapping in equation 4 , $m_i^* = m_i^*(Z)$, where migration status is a function of all siblings' characteristics. Thus, the inverse Mills' ratios can be derived from the migration equation estimated via probit:

$$m_{ij} = \mathbf{1}(Z\delta + \varepsilon_{ij} > 0) \tag{14}$$

where **1** is the indicator function.

While migration does not affect the observability of financial contributions, estimating

[24] For details of this methodology, see Wooldridge (2002, p.567) which considers the case of one endogenous regressor and sample selection.

equations 5 and 6 separately for migrants and non-migrants also requires the inclusion of a selection term to account for the split sample. Thus, to address the possibility of a correlation between selection into migration and the child's contribution, I include the selection term for migration or non-migration into each best response function as appropriate. Because of the non-linear tobit estimation, the most appropriate way to account for selection into migration would be via maximum likelihood. The selection problem coupled with the multiple endogenous variables, however, makes maximum likelihood estimation intractable. Instead, I present the results from the IV linear regressions of best response functions with selection terms. This amounts to equations 5 through 7 with $\widehat{\lambda}_{ij}^{1}$ included as a regressor in equation 5 and $\widehat{\lambda}_{ij}^{0}$ included as a regressor in equations 6 and 7, where $\widehat{\lambda}_{ij}^{1} = \frac{\phi(Z)}{\Phi(Z)}$ is the estimated inverse Mills' ratio term associated with migration from probit estimation of equation 14 and $\widehat{\lambda}_{ij}^{0}$ is the inverse Mills' ratio term associated with selection into non-migration from an analogous probit equation predicting non-migration. Since the inverse Mills' ratio are generated regressors, I bootstrap standard errors clustered at the family level using 500 replications. Note that this strategy does not rely simply on functional form for identification. Rather, the variables that identify migration independently of individual contributions are the same set of instrumental variables used to identify siblings' contributions, but as we have more than three instruments, we are still overidentified. For reference, the results from probit estimation of equation 14 can be found in Table A2 of the Appendix where it can be seen that the signs of the coefficients are generally as expected.

The results from the IV linear regressions accounting for selection and endogeneity of contributions can be found in Table 4, Panel B. While the point estimates are not all statistically significant, the signs of the coefficient estimates are consistent with previous findings of strategic complementarity in siblings' financial contributions and strategic substitution in hourly contributions. Comparing these sets of linear results with those from above, we also see very little change in the magnitude of the estimates after including the selection terms. This is relatively unsurprising given that the selection terms fail to be statistically significant in any specification. These results provide suggestive evidence that if selection into migration exists, it is of second-order importance in determining parental contributions and does not affect the findings of strategic complementarity for siblings' monetary contributions and substitutes for siblings' time contributions.

7 Are parents better off when a child migrates?

7.1 Simulation

The question remains whether parents receive more or less contributions as a result of a child's migration. As touched upon in the introduction, the finding of mixed results of strategic substitution and strategic complementarity in siblings' contributions makes this exercise particularly useful as it is not theoretically clear whether the consequences of migration should be dampened or amplified by siblings remaining in the home country. Estimating best response functions for migrants and non-migrants separately, however, allows me to solve the best response functions simultaneously and obtain the equilibrium contributions which represent the fixed point. To do this, I begin by considering a two-sibling family where the eldest sibling is a potential migrant. Taking the median characteristics for the two siblings and drawing an error term for each, the policy question is whether the estimated best response functions predict a higher total time contribution for the elderly parent when one sibling migrates or when both stay home. An analogous policy question concerns whether the elderly parent receives a higher total financial contribution from his children when one migrates or when both stay home.

The simulation works as follows. After establishing the median characteristics for the two children in the family, I draw a sample of 800 errors from a normal distribution with mean zero and variance equal to that found in the sample populations based on the estimated standard deviations from the three best response functions. For each draw, I compute the equilibrium total contribution to the elderly parent under two assumptions about the migration patterns of the siblings: (i) where both children are non-migrants and (ii) where the eldest son is a migrant.[25] I then compare the equilibrium contributions toward elderly parents under the two scenarios across the 800 simulated observations to see whether, on average, the parent received more under case (i) or (ii).

To find the fixed point, I first make a guess for the initial values, the contribution of the younger sibling in terms of time and money, as a function of whether or not his sibling migrates. Given the younger sibling's contribution, I use the estimated coefficients, median values from the sample of two-sibling families, and the randomly drawn error terms to predict the elder sibling's contribution in the case where he migrates and the case where he does not. From the older sibling's predicted contribution, I then evaluate what the model predicts for the younger sibling's contribution based on his sibling's contributions, the median values for two-sibling families and the randomly drawn error terms. If these predicted values match the initial guesses, then I have arrived at the equilibrium contribution; if they have not, I revise my guess for the value of the younger sibling's contribution accordingly and repeat the

[25] In two-sibling families with one U.S. migrant, it is often the eldest sibling who migrates to the U.S.

exercise with the new guess.[26]. Since the average number of siblings in a migrant family is seven, I conduct an analogous simulation for a seven-sibling family where the fourth brother is the potential migrant.[27]

7.2 Simulation Results

Table 5 presents the results from the simulations for a family of two brothers as well as a family of seven siblings, four brothers and three sisters of alternating sexes. Panel A shows that of the 800 hypothetical families in the two-sibling simulation, the average total financial contribution going to the elderly parent is significantly higher when both children remain in Mexico (1008 versus 662 pesos). In addition, the total time contribution going to the elderly parent is also significantly higher when both children are non-migrants (32 versus 16 hours). The remainder of Panel A shows that the drop in contributions is largely due to the significant fall in contributions from the migrant child whose financial contribution goes from 593 pesos as a non-migrant to 231 pesos as a migrant and whose time contributions falls from 16.5 hours to zero. Although the second sibling compensates somewhat for these declines, on the whole it is not enough to prevent the elderly parent from feeling a decline in total contributions from her children.

Table 5, Panel B shows the results for the seven-sibling family, where there appears to be no significant difference in the total financial contribution to the parent despite the

[26] In practice, I define convergence to be achieved if the predicted value of the younger sibling's contribution is within 1 peso of the guess for his financial contribution and within 0.1 hour of his time contribution. The revised guess is defined to be half of the difference between the guess and the predicted value.

[27] In seven-sibling families with one male U.S. migrant, it is common for the migrant to be the fourth sibling.

switch in the fourth child's migrant status. Note also that there are very small differences in the average total financial contributions and average total time contributions flowing to the elderly parent relative to the results from Panel A. In this case, the total financial contribution is not statistically different (1723 versus 1701 as a migrant family) but total hours of care fall from 60 to 56 (statistically significant at the 1% level). As in Panel A, the potential migrant contributes less on average in terms of time and money when he is a migrant than when he is a non-migrant, but the difference in financial contribution is small and not statistically significant in this case. Also consistent with the two-sibling simulation is that the siblings remaining in Mexico increase their financial contributions when their brother migrates, at least for those who display statistically significant differences. Again, we are not able to rule out that time contributions of other siblings do not respond to the change in migration status because the differences in their contributions are not statistically significant. Thus, it seems that the source of the drop in total time contribution is mainly the drop in the migrant's time contribution from 3.7 hours on average to zero.

One notable difference between the results seen in Panels A and B are the level differences in individual contributions. In the two-sibling family, individual contributions appear to be much larger in magnitude compared to the individual contributions in the seven sibling family. This could indicate additional pressure on the two-sibling family when one sibling migrates because naturally the drop in total contribution going to the elderly parent will be larger in magnitude. This type of comparative static result of the effect of sibship size on contributions could also explain why the difference in total financial contributions is so large in the two sibling case while it is insignificant in the seven-sibling family. Similarly, the drop in time contributions is not as serious in the seven-sibling case because the potential migrant did not have to contribute as much when he was home. Consequently, when he leaves, his absence may result in a significant drop in time care going to the parent, but not as precipitous as if he were one of only two siblings.

It may seem surprising to some that financial contributions are not unilaterally higher when the child migrates. To make sense of this, the importance of the error term cannot be understated as the variance of the error distribution is larger for non-migrants than for migrants.[28] Since contributions are constrained to be greater than or equal to zero, the larger variance in the distribution of the error term for non-migrants implies a higher value of financial contributions when children are non-migrants.

One explanation for the higher variance for non-migrants relative to migrants is that parents in the home country may more readily lean on children that are present when they face a temporary shock. In contrast, children who are out of the country may be more likely to send constant amounts to their parents, and as a result we see a smaller variance in the error distribution for migrants. Consequently, we see that parents of migrants may very well receive less in terms of both time and money as a result of one child's migration than they would have if both children stayed in the home country. As the comparison of the two simulations has shown, another important factor to consider is the number of siblings, because in a larger family it is quite likely that individual contributions will be smaller and so one child's migration may not so deleteriously affect his parent's total contributions.

[28] For example, the standard deviation of the error term in the financial contribution equation for non-migrants in the 2 sibling family is 3,554 while the analog for migrants is 2,210.

8 Conclusion

The results from estimating the best response functions for children's contributions toward their elderly parents suggest that for both migrants and non-migrants, financial contributions function as strategic complements while siblings' time contributions operate as strategic substitutes. At the same time, it appears children substitute for their siblings' time contributions with their own financial contributions and vice versa. This mixture of results provides a blended picture of the model which best describes family interaction. The finding of strategic complementarity in financial contributions is consistent with a strategic bequest motive in which children compete with their siblings for a potential transfer from their parent. This would be in accordance with findings from some of the studies mentioned above that find evidence of a strategic bequest motive (e.g. Lucas and Stark, 1985; Wakabayashi and Horioka, 2006). On the other hand, the finding of strategic substitution in time contributions points to a public good channel in which children can free-ride off of the time contributions of their siblings, consistent with the findings of Checkovich and Stern(2002). The distinction between the strategic behaviors involving the two contribution goods modeled here could indicate that children expect parents to focus mainly on financial contributions when making bequest decisions.

Since the results are mixed in terms of substitutes and complements, it is theoretically unclear whether elderly parents are on the whole helped or hurt by the international migration of their children. I address this question empirically by simulating the equilibrium contributions to the elderly parent when all children remain in the home country as well as the counterfactual when one child exogenously migrates to the U.S. The results suggest that the overall effects of migration are a drop in time and potentially even financial contributions to elderly parents, in part due to the high variance in financial contributions from non-migrants relative to migrants.

While these studies do not take into account the welfare effects of adult children who may on the whole benefit from international migration, given the vulnerability of elderly populations in developing countries, they still pose a cause for concern. In related work, Antman (2010a, 2010b) suggests there is a causal link between poor elderly health outcomes and the international migration of adult children. Taken together, these studies cast doubt on the popular view that families of migrants remaining in Mexico unilaterally benefit from migration. Instead, governments in sending communities should be concerned about the potentially detrimental consequences of migration for their own elderly populations, particularly as family size declines and parents must rely on fewer children for support.

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Table 1: Descriptive Statistics of Primary Sample

Panel A: Comparison of Migrant Children

	Combined Sample	Non-Migrants	Migrants	
Female	0.498	0.513	0.375	***
	(0.500)	(0.500)	(0.485)	
Years of Schooling	7.961	8.074	7.053	***
	(4.414)	(4.495)	(3.574)	
Age	39.924	40.053	38.878	**
	(11.515)	(11.517)	(11.451)	
Married	0.793	0.788	0.836	***
	(0.405)	(0.409)	(0.371)	
No. Kids	2.795	2.827	2.539	**
	(2.283)	(2.312)	(2.015)	
Financial Help to Parent	167.469	150.840	302.277	***
	(1339.355)	(1351.165)	(1232.246)	
Gives Financial Help=0/1	0.180	0.162	0.322	***
	(0.384)	(0.368)	(0.468)	
Financial Help Given Financial Help>0	932.874	931.695	937.675	
	(3047.317)	(3249.597)	(2031.686)	
Monthly Hours Help to Parent	15.524	17.370	0.564	***
	(72.972)	(77.098)	(7.395)	
Gives Hourly Help=0/1	0.119	0.132	0.010	***
	(0.324)	(0.339)	(0.099)	
Hours Help Given Hourly Help>0	130.439	131.112	57.167	**
	(172.592)	(173.179)	(52.492)	
Number of Child-Period Observations	5537	4929	608	

Panel B: Comparison of Parents of Migrant and Non-Migrant Children

	Combined Sample	No Migrant Kids	At Least 1 Migrant Child	
Female	0.690	0.698	0.669	
	(0.463)	(0.459)	(0.471)	
Years of Schooling	3.250	3.503	2.636	***
	(3.597)	(3.654)	(3.383)	
Age	69.832	69.927	69.599	
	(11.068)	(11.156)	(10.867)	
Married	0.471	0.452	0.518	*
	(0.499)	(0.498)	(0.501)	
Assets (Including value of housing)	268655.600	271548.000	261952.600	
	(488085.900)	(524402.500)	(392053.800)	
Monthly Income (Excluding children's contributions)	2156.261	2406.313	1549.518	*
	(7046.120)	(7649.008)	(5269.276)	
Total Children's Financial Help	994.932	886.904	1257.059	
	(4548.389)	(4923.598)	(3467.630)	
Total Children's Time Help	92.231	97.035	80.574	
	(196.475)	(201.581)	(183.330)	
Total Children's Financial Help/No.Children	196.813	186.482	221.881	
	(845.238)	(887.192)	(734.458)	
Total Children's Time Help/No. Children	18.250	20.642	12.445	***
	(43.282)	(47.531)	(29.902)	
Number of Children	5.941	5.503	7.004	***
	(2.752)	(2.616)	(2.788)	
Number of Migrant Children	0.652	0.000	2.235	
	(1.336)		(1.606)	
Number of Parent-Period Observations	932	660	272	

Standard Deviation in Parentheses below Mean Estimate

Difference in means significant at 10% *; significant at 5% **; significant at 1% ***

Table 2: Best Response Functions

Panel A: No Endogeneity

	(1)	(2)	(3)	(4)	(5)	(6)
	Migrants	Non-Migrants	Non-Migrants	Migrants	Non-Migrants	Non-Migrants
	LS	LS	LS	Tobit	Tobit	Tobit
	Financial Help	Financial Help	Hourly Help	Financial Help	Financial Help	Hourly Help
Financial Help from Other Siblings	0.120	0.099	-1.01E-04	0.215	0.190	-2.27E-04
	[0.016]***	[0.004]***	[2.55E-04]	[0.035]***	[0.013]***	[1.44E-03]
Hourly Help from Other Siblings	-0.523	-0.007	-0.007	-1.691	0.909	0.018
	[0.335]	[0.104]	[0.006]	[0.933]*	[0.427]**	[0.030]
p-value from test of exogeneity	0.520	0.090	0.000	0.942	0.000	0.000
Number of Observations	608	4929	4929	608	4929	4929

Panel B: Instrumental Variables

	(1)	(2)	(3)	(4)	(5)	(6)
Financial Help from Other Siblings	0.062	0.115	-0.008	0.170	0.024	-0.057
	[0.023]***	[0.032]***	[0.005]	[0.210]	[0.201]	[0.016]***
Hourly Help from Other Siblings	0.349	-0.92	-0.107	-1.926	-8.509	-1.149
	[0.893]	[0.345]***	[0.053]**	[4.419]	[4.420]*	[0.232]***
Chi-sq. p-value from overid test	0.341	0.026	0.641			
Number of Observations	608	4929	4929	608	4929	4929

Panel C: Smaller Instrument List

	(1)	(2)	(3)	(4)	(5)	(6)
Financial Help from Other Siblings	0.140	0.100	-0.005	0.709	0.215	-0.052
	[0.101]	[0.033]***	[0.004]	[0.795]	[0.291]	[0.019]***
Hourly Help from Other Siblings	-1.007	-1.124	-0.112	-6.995	-11.076	-1.418
	[2.055]	[0.475]**	[0.059]*	[12.014]	[5.587]**	[0.271]***
Chi-sq. p-value from overid test	0.022	0.423	0.446			
Number of Observations	608	4929	4929	608	4929	4929

Standard errors in brackets * significant at 10%; ** significant at 5%; *** significant at 1%

In Panels B and C, columns (1) - (3), robust standard errors are clustered at the family level

In Panels B and C, columns (4) - (6), standard errors are bootstrapped and clustered at the family level based on 500 replications

Other covariates include: Female, Birth order, Age, Age squared, 4 Education Categorical variables, Married, Number of Kids, Year dummy for 2003, Parent's Variables: Female, 5 indicator variables for Difficulty with Bathing, Eating, getting out of Bed, using the Toilet, Walking across the room, Age, Age Squared, 4 Education Categorical variables, Married, Urban Dummy

Instrumental Variables in Panel B include: number of sisters, sum of siblings' birth orders, sum of siblings' ages and squared ages, number of siblings, number of siblings in 4 educational categories, number of married siblings, and number of children born to siblings

IVs in Panel C are limited to number of sisters, sum of siblings' birth orders, sum of siblings' ages and squared ages, and number of siblings

Table 3: Robustness to Intra-Family Correlation & Family-Level Heterogeneity
Time contribution assumed to equal 0 if parent reports no difficulty with any ADLs
Panel A: Least Squares with and without Family Fixed Effects on Panel Sample

	(1) Migrants LS FE Financial Help	(2) Non-Migrants LS FE Financial Help	(3) Non-Migrants LS FE Hourly Help	(4) Migrants LS Financial Help	(5) Non-Migrants LS Financial Help	(6) Non-Migrants LS Hourly Help
Financial Help from Other Siblings	0.022	0.170	5.25E-06	0.025	0.218	-3.68E-06
	[0.006]***	[0.004]***	[5.72E-05]	[0.032]	[0.053]***	[8.97E-06]
Hourly Help from Other Siblings	0.544	-0.005	-0.162	-1.200	0.047	0.038
	[2.161]	[0.598]	[0.008]***	[1.190]	[0.096]	[0.022]*
Family Fixed Effects	YES	YES	YES	NO	NO	NO
Number of Families	284	863	863			
p-value from test that FE=0	0.000	0.000	0.000			
Number of Observations	1198	7626	7626	1198	7626	7626

Panel B: Instrumental Variables with and without Family Fixed Effects on Panel Sample

	(1) Migrants FEIV Financial Help	(2) Non-Migrants FEIV Financial Help	(3) Non-Migrants FEIV Hourly Help	(4) Migrants IV Linear Financial Help	(5) Non-Migrants IV Linear Financial Help	(6) Non-Migrants IV Linear Hourly Help
Financial Help from Other Siblings	-0.06	0.183	-0.002	0.014	0.136	-0.002
	[0.112]	[0.196]	[0.003]	[0.028]	[0.098]	[0.002]
Hourly Help from Other Siblings	12.565	-1.451	0.359	-4.019	-3.08	0.038
	[19.016]	[12.457]	[0.218]	[4.478]	[2.377]	[0.092]
Family Fixed Effects	YES	YES	YES	NO	NO	NO
Number of Families	284	863	863			
p-value from test that FE=0	0.000	0.927	1.000			
Number of Observations	1198	7626	7626	1198	7626	7626

Standard errors in brackets * significant at 10%; ** significant at 5%; *** significant at 1%
Robust standard errors clustered at family level reported in Panel A columns (4)-(6) and Panel B columns (4)-(6)
See Table 2 for list of covariates included in regressions as well as list of instrumental variables, but note that in Panels A and B, columns (1)-(3), covariates and IVs that do not change over time (e.g. birth order, gender, number of siblings) will drop out of the regressions in the FE estimation and thus are excluded in those models

Table 4: Additional Robustness Checks

Panel A: Robustness to Attrition--2001 Sample only

	(1) Migrants IVLinear Financial Help	(2) Non-Migrants IVLinear Financial Help	(3) Non-Migrants IVLinear Hourly Help	(4) Migrants IV Tobit Financial Help	(5) Non-Migrants IV Tobit Financial Help	(6) Non-Migrants IV Tobit Hourly Help
Financial Help from Other Siblings	0.078	0.136	-0.005	0.191	0.201	-0.042
	[0.023]***	[0.027]***	[0.004]	[0.258]	[0.224]	[0.018]**
Hourly Help from Other Siblings	0.729	-0.968	-0.128	-1.182	-7.998	-1.31
	[0.816]	[0.453]**	[0.068]*	[4.107]	[5.524]	[0.358]***
Year of Sample	2001	2001	2001	2001	2001	2001
Number of Observations	464	3988	3988	464	3988	3988

Panel B: Robustness to Migrant Selection

	(1) Migrants IVLinear Financial Help	(2) Non-Migrants IVLinear Financial Help	(3) Non-Migrants IVLinear Hourly Help	(4) Migrants IV Tobit Financial Help	(5) Non-Migrants IV Tobit Financial Help	(6) Non-Migrants IV Tobit Hourly Help
Financial Help from Other Siblings	0.059	0.122	-0.008	0.097	0.026	-0.058
	[0.134]	[0.027]***	[0.003]***	[0.213]	[0.202]	[0.016]***
Hourly Help from Other Siblings	0.281	-0.921	-0.107	-7.465	-8.509	-1.15
	[2.086]	[0.392]**	[0.040]***	[6.098]	[4.421]*	[0.233]***
Inverse Mills' Ratio for Migrants	-85.653			-2,640.03		
	[446.203]			[2,067.988]		
Inverse Mills' Ratio for Non-Migrants		-113.747	30.223		-301.221	167.33
		[159.408]	[28.206]		[1,774.258]	[150.394]
Selection Corrected	YES	YES	YES	YES	YES	YES
Number of Observations	608	4929	4929	608	4929	4929

Standard errors in brackets * significant at 10%; ** significant at 5%; *** significant at 1%

In Panel A, robust standard errors are clustered at family level

In Panel B, standard errors are bootstrapped and clustered at family level based on 500 replications

See Table 2 for list of other covariates included in regressions as well as list of instrumental variables

Table 5: How Does a Switch in Migrant Status Affect Elderly Contributions?
Simulation Results
Panel A: Two Brothers; Older Brother Is Potential Migrant

	Non-Migrant Family	Migrant Family		N
Total Financial Contribution from all Siblings	1007.811	662.334	***	800
	(1857.478)	(1225.377)		
Total Time Contributions from all Siblings	32.222	16.412	***	800
	(82.441)	(58.490)		
Financial Contribution from Potential Migrant	592.782	230.814	***	800
	(1454.673)	(636.002)		
Financial Contribution from Sibling 2	415.029	431.521	***	800
	(1051.779)	(1056.449)		
Time Contribution from Potential Migrant	16.530	0		800
	(62.329)			
Time Contribution from Sibling 2	15.692	16.412		800
	(58.571)	(58.490)		

Panel B: 7 Siblings--4 Brothers, 3 Sisters; Middle Brother (Sibling 4) Is Potential Migrant

	Non-Migrant Family	Migrant Family		N
Total Financial Contribution from all Siblings	1722.743	1700.746		800
	(2555.868)	(2553.991)		
Total Time Contributions from all Siblings	60.217	55.889	***	800
	(106.899)	(104.362)		
Financial Contribution from Potential Migrant	254.099	221.186		800
	(884.649)	(666.973)		
Financial Contribution from Sibling 1	426.359	429.931	*	800
	(1267.163)	(1267.538)		
Financial Contribution from Sibling 2	156.964	157.767		800
	(593.776)	(596.141)		
Financial Contribution from Sibling 3	302.371	306.241	**	800
	(969.787)	(977.883)		
Financial Contribution from Sibling 5	168.046	170.353	*	800
	(703.664)	(706.985)		
Financial Contribution from Sibling 6	219.072	218.070		800
	(750.881)	(741.454)		
Financial Contribution from Sibling 7	195.832	197.201		800
	(809.128)	(810.331)		
Time Contribution from Potential Migrant	3.705	0		800
	(22.351)			
Time Contribution from Sibling 1	5.882	5.809		800
	(35.631)	(35.197)		
Time Contribution from Sibling 2	9.024	8.948		800
	(45.077)	(44.744)		
Time Contribution from Sibling 3	4.016	3.785		800
	(27.295)	(24.478)		
Time Contribution from Sibling 5	16.009	16.345		800
	(64.228)	(63.485)		
Time Contribution from Sibling 6	8.992	8.630		800
	(48.423)	(47.213)		
Time Contribution from Sibling 7	12.590	12.372		800
	(58.268)	(57.378)		

Standard deviations in parentheses below point estimates
Difference in means significant at 10% *; significant at 5% **; significant at 1% ***

Appendix, Table A1: First Stage Least Squares Regressions

Dependent Variable: Sum of Siblings' Contributions in:	(1) Financial Help	(2) Hourly Help
<u>Sum of Siblings Characteristics:</u>		
Female	-208.763	8.929
	[43.492]***	[1.849]***
Birth Order	-26.657	0.198
	[10.245]***	[0.436]
Age	-32.17	-0.02
	[9.534]***	[0.405]
Age Squared	0.352	0.004
	[0.114]***	[0.005]
Education Group 1: 1-6 yrs	9.583	8.38
	[71.006]	[3.019]***
Education Group 2: 7-9 yrs	87.636	-0.051
	[74.724]	[3.177]
Education Group 3: 10-12 yrs	-131.536	7.11
	[93.423]	[3.972]*
Education Group 4: 13+ yrs	201.378	3.293
	[82.635]**	[3.513]
Married	-258.335	0.092
	[43.823]***	[1.863]
Number of Kids	30.383	-1.417
	[9.622]***	[0.409]***
Number of Siblings	1,095.27	1.828
	[213.023]***	[9.056]
F stat on Excluded Instruments	9.93	18.62
Observations	5537	5537

Standard errors in brackets * significant at 10%; ** significant at 5%; *** significant at 1%
Other covariates include: Female, Age, Age squared, 4 Education Categorical Variables, Married, Number of Children, Year dummy for 2003,Parent’s Variables: Female, 5 indicator variables for Difficulty with Bathing, Eating, getting out of Bed, using the Toilet, Walking across the room, Age, Age Squared, 4 Education Categorical variables, Married, Urban

Appendix, Table A2: Marginal Effects From Probit Predicting Migration

	(1) Full Sample dProbit Migration		(1) continued
		Number of Siblings	0.043
			[0.022]*
Sum of Siblings Characteristics:		Individual Characteristics	
Female	-0.008	Female	-0.049
	[0.005]*		[0.009]***
Birth Order	-0.002	Birth Order	0.009
	[0.001]*		[0.003]**
Age	-0.002	Age	0.006
	[0.001]		[0.003]**
Age Squared	1.40E-05	Age Squared	-3.07E-05
	[1.26E-05]		[2.89E-05]
Education Group 1: 1-6 yrs	0.009	Education Group 1: 1-6 yrs	0.057
	[0.007]		[0.023]**
Education Group 2: 7-9 yrs	0.002	Education Group 2: 7-9 yrs	0.054
	[0.008]		[0.028]*
Education Group 3: 10-12 yrs	0.015	Education Group 3: 10-12 yrs	0.028
	[0.010]		[0.033]
Education Group 4: 13+ yrs	0.001	Education Group 4: 13+ yrs	-0.014
	[0.009]		[0.026]
Married	0.005	Married	0.033
	[0.005]		[0.011]***
Number of Kids	1.07E-04	Number of Kids	-0.012
	[1.12E-03]		[0.002]***
Observations	5537		5537

Robust standard errors, clustered at family level, in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%
Other covariates include: Year dummy for 2003, Parent's Variables: Female, 5 indicator variables for Difficulty with Bathing, Eating, getting out of Bed, using the Toilet, Walking across the room, Age, Age Squared, 4 Education Categorical variables, Married, Urban Dummy