How Does International Migration Affect the Health of Elderly Parents Left Behind? Evidence from Mexico *

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Abstract

This paper considers whether the health of elderly parents is adversely affected by the international migration of their adult children. Estimation of a causal effect is complicated by the fact that there may be unobserved factors influencing both parental health and child migration. I address this endogeneity problem by using an empirical strategy with individual parent fixed effects thus purging the estimates of biases due to time-invariant selection factors. For robustness, I also offer an additional identification strategy based on instrumental variables methods, where the instruments used in the analysis are characteristics of the children of elderly parents. Overall, evidence from both identification strategies suggests that having a child migrate to the U.S. raises the probability that the elderly parent in Mexico will be in poor health. Specific health outcomes providing support for this conclusion include poor self-rated health status, obesity, and feelings of loneliness and depression.

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1 Introduction

In developing countries with high rates of international migration and rapidly aging populations, an important public policy concern is how elderly parents of migrants fare in the absence of their children. In the case of Mexico, conventional wisdom suggests that the large flow of remittances from the U.S. to that country implies that elderly parents should benefit from a child's international migration. Nevertheless, little is known about the extent to which remittances are directed at elderly parents, particularly when migrants are old enough to have established households of their own.[1] At the same time, the possibility that elderly parents may require physical care from their children for which there may be no close substitutes suggests that elderly parents may suffer when a child migrates. In addition, elderly parents in Mexico may suffer emotionally from a lack of contact with an adult child who migrates to the U.S., particularly when that child lacks documents to legally cross the international border.[2]

This paper aims to establish the overall consequences of a child's migration to the U.S. for the health of his elderly parent remaining in Mexico. The data come from the Mexican Health and Aging Study (MHAS) that collects health and financial information from elderly participants in Mexico and indicates whether they have children living in the U.S. A broad spectrum of elderly health outcomes are considered including self-rated health (SRH), obesity, and indicators of depression and loneliness.

[1] Gibson, et al. (2011) examine the impact of migration on older adult household members left behind, but not all are parents of the migrant.

[2] Indeed, Massey, et al (2015) notes that return migration rates for undocumented immigrants to the U.S. have declined substantially over the past 30 years due to increased border enforcement.

In the economics literature, the question of how migration affects family members left behind has now received significant attention (Gibson et al., 2011; Yang, 2008).[3] Most of the focus, however, has centered on how parental migration affects the educational outcomes of children (Acosta 2011; Cox-Edwards and Ureta, 2003; Alcaraz et al., 2012; Amuedo-Dorantes and Pozo, 2008; Hanson and Woodruff, 2003; McKenzie and Rapoport, 2011; Antman, 2012b; Antman 2011). With regards to the health effects of migration, Hildebrandt and McKenzie (2005) find that children in migrant households in Mexico have lower infant mortality rates and higher birthweights. Similarly, Kuhn, et al. (2011) find positive effects of children's internal migration on the health of elderly parents in Indonesia. Of course, parental health may also affect children's migration. For example, Giles and Mu (2007) examine Chinese data and find that poor parental health reduces the likelihood of rural-urban migration for male children.

Another important factor to consider is how children remaining in Mexico respond to the migration of one sibling by altering their own contributions toward their elderly parents. If, for instance, children remaining in Mexico were to fully substitute for the absent child's time contributions, then elderly parents may not be harmed by the migration of one child. Antman (2012a) explores this possibility by estimating best response functions for individual time and financial contributions to elderly parents as a function of siblings' contributions in the context of international migration. Using these estimates, the results from a simulation generating an exogenous switch in a child's migrant status show a decrease in time and possibly even financial contributions for elderly parents (Antman 2013). The question remains whether changes in these contributions following one child's migration have an impact on the overall

[3] See Antman (2013) for a review of this literature.

health of elderly parents.

Antman (2010) represents a first step in addressing this question by using the first wave of the MHAS (2001) to investigate the relationship between children's migration and elderly parent health outcomes such as self-rated health and negative emotions such as feelings of loneliness and sadness. Notably, that paper looks at some of the same outcomes as those investigated here, with the important distinction that Antman (2010) offers no identification strategy to determine whether the cross-sectional results represent causal relationships. Thus, the descriptive findings in Antman (2010) which employ OLS and probit estimation and reveal a negative relationship between adult child migration and the health of elderly parents left behind are qualitatively consistent with the findings in the current paper, but far more limited in their capacity to make a causal claim.

The main methodological obstacle is the endogeneity of migration. First and foremost, migration is not randomly assigned and self-selection patterns may introduce important biases into the estimated effect of migration on outcomes for elderly parents left behind. For instance, several studies find evidence consistent with the so-called "healthy migrant hypothesis," the idea that migrants are positively selected on health (Riosmena, et al. 2012; Rubalcava, et al. 2008). If one expects that health outcomes between children and parents are positively correlated due to common genetic or environmental factors, we should therefore expect a bias toward finding that parents of migrants have better health outcomes than parents of non-migrants. The endogeneity of migration may also be manifested as a problem of simultaneity or reverse causation if children make migration decisions in response to their parent's health status. *A priori*, we cannot say whether this would generate a spurious positive or negative correlation as children of parents in ill health may be more likely to

migrate to earn additional funds for medical services or be more likely to stay home to care for their ailing parents.

To ensure the results are not driven by these factors, and to control for any biases in interpresonal comparisons of subjective health measures across individuals, I exploit the panel nature of the MHAS to estimate an individual fixed effects model where changes in health conditions of elderly parents are identified off of changes in the migration status of their children. This fixed effects regression model can thus overcome endogeneity concerns related to time-invariant unobservables that may be driving both the migration of children and health outcomes of elderly parents. This would address the main threats to causal identification due to migrant selection factors that are time-invariant and the associated correlations with the health of elderly parents described above. Nevertheless, this methodological approach will not address time-varying selection patterns, such as the case where an unobserved shock affects both parental health and a child's decision to migrate, and may pose additional challenges to estimation in cases where short panel surveys inherently limit the changes that can be observed between waves.

Thus, I offer another identification strategy based on instrumental variables that uses variation in children's characteristics that were likely determined before the period under study to generate exogenous variation in the likelihood that a child migrates. These instrumental variables are the share of children that are women as well as the share of children that are married. Since men and married persons are more likely to migrate to the U.S., a parent with a higher fraction of sons and married children is more likely to have a child who is in the U.S. To address concerns that these instruments also influence elderly parental health directly through their financial contributions to their parents I exploit another fea-

ture of the MHAS data set by including children's financial contributions directly in the analysis. I also experiment with treating the financial contributions variable as endogenous, using the number of migrant children as the independent variable of interest, and limiting the instrumental variables to an arguably more exogenous set that is determined solely by the gender mix of children. The broad pattern of results from these and other robustness checks are qualitatively similar to the main results, with the totality of the evidence pointing to a causal relationship in which children's migration has a detrimental impact on parental health.

Since the first empirical strategy relies on matching changes in migration with changes in health over a relatively short time horizon, I focus on health outcomes that can change quickly and are more likely to reflect health conditions at the time of the survey, thus limiting the possibility of reverse causation.[4] These include indicators for poor self-rated health (SRH) status, obesity, and indicators of depression. Overall, both the fixed effects and instrumental variables strategies suggest that a child's U.S. migration leads to a greater chance that his elderly parent in Mexico will be in poor health, as defined by both physical and mental health criteria. By controlling for contributions directly in the analysis, the results also suggest that these effects persist despite children's contributions to their parents, raising questions about what might be driving the results. Since the results hold for mental and physical health outcomes, one hypothesis is that migration implies a loss in social support or psychological cost which affects mental health and consequently physical health. However,

[4]Of course, almost any health condition can be argued to be the culmination of a long process. The argument here is only that there are some conditions that may be more malleable than others (e.g. loneliness versus heart attack or stroke).

another possibility is that the absence of a child imparts physical costs on the parent and thereby results in mental health deterioration. The fact that parents of migrant children are also more likely to report substantial feelings of loneliness suggests that the social impact of having a child migrate is an important factor which may affect both physical and mental health, and is consistent with the increased attention paid to the negative consequences of loneliness on a wide range of health outcomes (Brody 2017).

The paper proceeds as follows. Section 2 describes the MHAS data set used in the analysis. Section 3 discusses the fixed effects and instrumental variables empirical strategies. Section 4 presents the main results from both identification strategies, the first stage results from the IV strategy, and results controlling for children's financial contributions. Additional robustness checks and extensions are included in Section 5. Section 6 concludes with a discussion of potential mechanisms underlying the observed relationship.

2 Data

2.1 Description

The data come from the Mexican Health and Aging Study (MHAS), a joint project between Mexico's statistical agency, INEGI, and researchers at the Universities of Pennsylvania, Maryland, and Wisconsin.[5] The MHAS was designed as a nationally representative panel data set of Mexicans born before 1950 with surveys in 2001 and 2003. Although a 2012 follow-up survey has more recently become available, I do not make use of it here because by 2012 Mexico had achieved universal health care coverage under the expansion of

[5] Available at http://www.mhasweb.org/.

its national health insurance program, *Seguro Popular* (Lancet 2012).[6] Consequently, the first two waves of the MHAS survey (2001 and 2003) study a substantially different health context than subsequent waves, and thus focusing on the first two waves is more suited to the empirical strategies employed here. I further limit the sample to those elderly parents whose demographic information such as gender and age do not suggest a conflict between the two waves and who have complete data on the health and demographic information used in the analysis.[7] For the fixed effects strategy employed below I utilize data from both waves, but as the instrumental variables strategy relies on time-invariant characteristics of children to be described below, I limit the sample in that analysis to the first wave of the study in 2001.

MHAS respondents are asked questions regarding their income, assets, health status, and financial contributions received from all sources.[8] The financial contributions variable used here is the result of a series of questions regarding how much money each child contributed to the elderly parent in the past 2 years. Most participants that respond refer to a monthly contribution from each child and for those who do not, I convert the answer into a monthly average. Respondents who were not sure of the amount were allowed to respond with a pre-specified range of values, and I convert these to the mean of the range specified using the continuous data as the empirical distribution. These values are then aggregated so that

[6] While Seguro Popular was passed by Congress in 2003, it did not go into effect until 2004 when individual health insurance coverage began to accelerate (Bosch, Cobacho and Pages 2012).

[7] The MHAS identifies an elderly sampled person and subsequently also interviews his spouse. However, since spouses are not always parents of the children of the sampled person, I limit the sample here to the elderly sampled person alone.

[8] All financial data were converted to 2002 Mexican pesos using the national Consumer Price Index.

the financial contribution variable reported here is the monthly financial support from all children of the elderly respondent.[9]

The independent variable of interest is an indicator for whether the elderly parent has any children currently living in the U.S.[10] The main outcome variables of interest relate to parental health, where the focus in this paper is on those measures that can potentially change over a short time horizon, and thus lend themselves to a fixed effects estimation strategy. Since actual migration dates are not available, focusing on outcome variables that more closely reflect health status at the time of the survey also limit the possibility that reverse causation may be driving the observed correlation. The first outcome considered is a self-rated health (SRH) status variable ranging from one, excellent, to five, poor. Figure 1 shows the cumulative distribution of this variable by migration status. As can be seen from the figure, the distribution of health quality of parents with at least one child in the U.S. is shifted right from that of parents with no children in the U.S., already suggesting that the former group reports poorer health outcomes. Parents with no children in the U.S. are more likely to report they are in excellent, very good, or good health, while parents with at least one child in the U.S. are more likely to report their health is fair or poor. I convert the self-rated health outcome into a dichotomous outcome equal to one if the respondent claims

[9] While the MHAS data also includes information on the number of hours of help the respondent receives, these responses are conditional on the respondent reporting difficulty with Activities of Daily Living (ADLs), resulting in a very small sample that is likely to differ in important ways. Since I am not able to explicitly include hourly contributions as part of the analysis below, the coefficient on migration status should be interpreted to include the effects of changes in time contributions resulting from migration itself.

[10] Robustness checks below investigate the use of an alternative variable to capture children's migration status, namely, the number of children in the U.S.

his health is poor, and zero if the respondent describes his health as fair, good, very good, or excellent.[11]

One concern with the poor SRH measure is that it is inherently subjective, and it may be difficult to compare what constitutes "poor" health across different people. Here it is important to note that the fixed effects strategy will address any biases associated with interpersonal comparisons, since it exploits variation within the same individual over time. Still, some may be concerned that SRH may not portray health status accurately (Strauss and Thomas 2008), if, for instance it is correlated with wealth measures that are unobserved and potentially changing with migration of children. At the same time, it is important to note that a significant body of literature finds a robust relationship between poor self-rated health measures and more objective measures, such as mortality across a wide variety of settings, suggesting that SRH provides an important dimension of health not captured by other measures (Idler and Benyamini 1997; Kuhn et al. 2006). Nevertheless, to address the potential subjectivity of SRH, I explore additional health outcomes, again focusing on those measures that can potentially change over a short time period that could coincide with observed changes in migration over the period under study. These measures include a dummy variable indicating the respondent is obese, that is, having self-reported weight and height that translate into a body mass index (BMI) of 30 or higher.[12] While obesity is a

[11] Converting SRH into a binary indicator of health status is a standard approach used throughout the literature, although sometimes the "fair" health response is combined with the "poor" response, particularly in instances where relatively few respondents indicate "poor" SRH (Idler and Kasl 1995). Robustness checks below show the results when using the poor/fair combination to ease comparison with this study and others in the literature.

[12] BMI is constructed as the weight (in kilograms) of the respondent divided by his squared height (in

health outcome in its own right, it is also known to be an important risk factor for long-term health problems such as heart disease, diabetes, stroke and certain cancers (Strauss and Thomas 2008).

While other measures of physical health are also available in the MHAS, they are arguably more subject to resulting biases due to the endogeneity of diagnosis and self-reporting,[13] or, as in the case of extremely rare events such as heart attack and stroke, exhibit few changes over the short window between survey waves. To provide a broader portrait of health impacts as well as to explore mechanisms, I also examine mental health outcomes including indicators for whether the respondent felt depressed the majority of the time over the last week.[14] To add a potential mechanism underlying that change, I also explore impacts when using an indicator for having experienced loneliness over the majority of the previous week. The negative health consequences of social isolation have recently received significant attention in the medical literature and wider public sphere (Brody 2017).

2.2 Summary Statistics

Descriptive statistics of the variables discussed above are presented in Table 1, where I present summary statistics for the pooled sample from 2001 and 2003 as well as the means

meters), where all measures are self-reported. I do not use BMI in and of itself as an outcome because it is harder to interpret the results, i.e. raising BMI is not obviously a bad outcome.

[13]For instance, many respondents may suffer from diabetes or hypertension without ever having received a formal diagnosis.

[14]The mental health literature uses a wide array of measures to gauge mental health problems such as depression depending on the context and the particular survey instruments available, but these particular instruments are not available here.

and standard deviations after cutting the sample based on whether the observation has one or more children currently in the U.S.[15] As can be seen from the table, roughly 20 percent of the 10,287 respondent-period observations (representing 6,601 parents) report having at least one child in the U.S. (2,102 observations), and a similar percentage have at least one migrant child in each wave of the survey.[16] Differences in summary statistics indicate that individuals with migrant children are likely to be slightly older, less educated, receive more financial help from children, and have more children (6.9 versus 4.9) and grandchildren (13.8 versus 8.1). They are also less likely to live in an urban area and less likely to have access to medical services. The fraction of female children of the elderly respondent appears to be roughly equal across the two samples (about 0.48) but the share of married children appears to be significantly higher for the parents with migrant children (0.70 versus 0.59).

Finally, the health outcomes appear to be generally worse for the parents with children in the U.S. ranging from a greater likelihood of poor self-rated health (0.21 versus 0.13) and obesity (0.28 versus 0.24). Similarly, the indicators of depression and loneliness are also higher for the sample of parents with a migrant child in the U.S., where the differences across samples are all statistically significant at the 1 percent levels. For example, 41 percent of the observations with at least one child in the U.S. reports having felt depressed the majority

[15] This forms the sample for the pooled and FE estimates, while the subset of parents observed in 2001 (5,707 observations) make up the sample used in the IV analysis.

[16] While migration of parents themselves is not the focus of this paper, about 10 percent of parents in the sample report having migrated. As might be expected, parents with migrant children in the US. are also more likely to have had migration experience (roughly 20 percent) versus parents without children in the U.S. (roughly 8 percent). Nevertheless, this difference will not affect the FE estimates below since past U.S. migration of parents is fixed over time.

of the time in the last week compared with 35 percent of the observations with no children in the U.S.

Overall, the descriptive statistics from Table 1 present a strong case for a negative correlation between children's migration and the health outcomes of elderly parents left behind. To what extent that correlation is causal is explored in the remainder of the paper. For instance, the fact that the two samples differ across important demographic dimensions may raise concerns that some of those demographic differences are driving the correlation between migration and health, and thus it will be important to control for these variables in the regression analysis below. To the extent that differences across these dimensions suggest that time-invariant unobservables may also differ based on migration status of children, it will also be important to compare OLS results with the fixed effects analysis that controls for time-invariant factors which might be correlated both with migration and the health outcomes. Finally, the instrumental variables analysis, relying on differences in the demographic characteristics of children, will provide an alternative identification strategy.

3 Empirical strategy

3.1 Fixed Effects Model

The simplest regression model would use purely cross-sectional variation to estimate the following equation determining the health of an elderly parent as a function of his children's migration status and other demographic characteristics:

$$Health_i = \beta MigrantChildUS_i + X_{it}\gamma + \epsilon_i \ , \tag{1}$$

where the dependent variable, $Health_i$, denotes the health outcome of the parent remaining in Mexico. The effect of interest is captured by the coefficient on $MigrantChildUS_i$, a dummy variable which indicates whether the respondent has at least one child currently in the U.S. The vector of covariates X_i , includes the following characteristics of the elderly parent: female indicator, age, age squared, education categorical variables (corresponding to educational attainment of 1-6 years, 7-9 years, 10-12 years, and 13 or more years), a married dummy variable, assets, monthly income, a dummy indicating whether the respondent reports having access to medical services, number of children, number of grandchildren, and a dummy variable indicating that the respondent lives in a more urban area (population of 100,000 or more). In specifications controlling for contributions from children, it also includes the average monthly financial contribution from all children.[17]

As discussed in the introduction, one concern with estimating the equation above is that OLS estimation will yield biased estimates of β since the $MigrantChildUS_i$ variable is endogenous. One potential source of endogeneity is the relationship forged by genetics and experience that results in a correlation between unobserved components that influence the migration choices of the child and the health of the parent. Another possible source is reverse causation where a child chooses whether to migrate in response to the health of his elderly parent.

The first identification strategy offered to address this endogeneity problem relies on an

[17] In the pooled OLS model using data from both waves of the MHAS, an indicator for the second wave of the survey (year 2003) is also included on the right-hand side of equation (1).

individual fixed effects model that links changes in the migration status of adult children with changes in the health outcomes of their parents in Mexico:

$$Health_{it} = \theta MigrantChildUS_{it} + X_{it}\delta + \phi_i + \varepsilon_{it} \ . \tag{2}$$

Note that the important difference between equations (1) and (2) is that equation (2) is estimated over time and includes an individual-specific fixed effect that can control for all time-invariant factors that may have led to a non-causal correlation between children's migration and the health of the elderly parent. This empirical strategy will address concerns over time-invariant sources of endogeneity such as the case where healthy individuals are more likely to have healthy children and migrants are positively selected on health, as with the "healthy migrant hypothesis" described above. However, this strategy will not address time-varying sources of endogeneity, such as the case where migration is costly and individuals hit with a positive unobserved income shock are more likely to migrate and also better able to afford medical care for their elderly parents. As the estimates are identified off of changes to the underlying variables, this empirical strategy may also pose challenges to causal inference if relatively few changes are observed over the short period between survey waves.

3.2 Instrumental Variables

To bolster the case for a causal relationship, I offer a second identification strategy, relying on instrumental variables methods. While time-varying instrumental variables would ideally be coupled with individual fixed effects to produce an FE-IV estimator as in Antman (2011), in practice finding such instrumental variables that are both relevant and valid is especially

challenging, particularly with relatively small sample sizes. Instead, I propose an IV method that relies on different sources of variation from the FE strategy to test whether the pattern of results is robust to different identification strategies. Here, the IV strategy relies on variation in a set of characteristics that affects children's propensity to migrate but, after controlling for several important covariates, does not independently affect elderly parent health. The instrumental variables considered here include the female share of the children of the elderly parent and the fraction of children that are married. The share of children that are women is believed to affect whether the elderly parent has any migrant children in the U.S. because it is more likely that men will migrate than women, as immigrants are more heavily concentrated in male-dominated industries such as manufacturing and construction (Grieco and Ray, 2004). Similarly, married individuals are more likely to migrate to the U.S. than unmarried ones, perhaps because of the increased responsibility that marriage implies. The main empirical model amounts to estimation of equation (1) by instrumental variables over the first wave of the survey where the migration status of the children is estimated via the following first-stage regression:

$$MigrantChildUS_i = Z_i\pi + X_i\varphi + u_i \ . \tag{3}$$

Importantly, Z_i is a vector of instrumental variables excluded from equation (1), i.e. the fraction of women among the children of the elderly parent as well as the fraction of her children that are married. Verifying that the instrumental variables are predictive of children's migration is an empirical question, to be discussed below. However, the other well-known criterion for IV analysis is the exclusion restriction, which is ultimately untestable. Although

the fraction of children that are female can be argued to be randomly assigned in a country like Mexico with no documented pattern of sex selection, the question remains whether this variable does not influence elderly health independently of the migration status of children. For instance, having a higher fraction of daughters or married children might make it less likely that a parent will have a child in the U.S., but it might also translate into higher contributions from her children which might affect her health directly. Similarly, children's marriage could be correlated with income shocks that could also affect parental health. To address this, I experiment with including financial contributions in the analysis, first as a control variable and then as an endogenous variable with the same instrumental variables used for identification. In the latter case it is argued that the instrumental variables do not affect elderly health outcomes outside of their influence through migration and contributions, and after controlling for the other covariates in the analysis. While the results may be seen as purely suggestive, this more comprehensive model can also be viewed as a framework for exploring whether the migration status of children affects elderly health over and above its effect on the contributions from those children. A potential mechanism explored below is the psychic cost of missing children that are out of the country and the inherently more limited emotional support migrant children can provide to their parents from abroad, which may impart feelings of loneliness and depression.

4 Results

Table 2 presents the results from the individual fixed effects (FE) strategy (equation 2), and for comparison, the ordinary least-squares (OLS) results of estimating equation (1)

on the pooled sample of the 2001 and 2003 data.[18] Results without controlling for financial contributions from children are reported in columns (1) and (2), and results with the financial contributions control are reported in columns (3) and (4). Each entry in the table can be read as the coefficient (and standard error) associated with the indicator for having at least one child in the U.S. resulting from a separate regression with the dependent variable listed in the column furthest to the left.

In Table 2, the strongest result across all columns is clearly for the self-rated health outcome, where having a child migrate to the U.S. is associated with an increased likelihood the elderly parent in Mexico reports poor health. The estimate without financial contributions in the model ranges from 3.7 percentage points in the OLS model to 6.3 percentage points in the FE model, where both estimates are statistically significant at the 1 percent level. It should be noted that the latter represents a substantial impact, equal to approximately half of the mean for the group of parents with no children in the U.S. (0.129). It is also clear that controlling for financial contributions of children does not make much of a difference in the impact of children's migration on parental self-rated health, as the estimates with and without financial contributions are very similar, and statistically significant at the 5 percent level or better. Overall, these results suggest an increased likelihood of poor health for parents with migrant children in the U.S. that is likely to occur over and above any changes

[18]Note that in the fixed effects estimation, variables that do not change over time, such as gender for example, are accounted for by the individual fixed effect and thus there is no need to separately control for them. Also, as mentioned above, a year 2003 indicator is separately included in the OLS pooled model. As nonlinear, maximum-likelihood based estimators are problematic with many fixed effects, all results are interpreted within the context of the linear probability model.

in children's financial contributions.

Additionally, the pooled OLS results suggest an increase in obesity, feelings of loneliness, and depression that are consistent with the pattern observed in the summary statistics, but now are more robust as they control for several factors thought to affect health outcomes that may also be correlated with children's migration. Specifically, the OLS results suggest that children's migration is associated with an increased probability of obesity, depression, and loneliness on the order of 2 to 3 percentage points. Although these estimates are not substantial compared with the relatively large means of these variables noted in Table 1, the OLS estimates of the impact on obesity and loneliness are statistically significant at the 5 percent level, while the coefficients associated with feelings of depression are statistically significant at the 10 percent level. Nevertheless, there may still be concerns that children's migration may be a function of unobservable variables correlated with elderly parent's health. Thus the focus on the identification strategy based on individual fixed effects which shows a statistically significant impact of children's migration on poor SRH on the order of 6.3 percentage points, regardless of whether financial contributions are included as a control. Declines in mental health are suggested by the point estimates in the depression and loneliness specifications, respectively, but are not statistically significant at conventional levels in the fixed effect specifications (columns 2 and 4).

One concern with the fixed effects estimation strategy is that it may be limited in its explanatory power, as it relies upon changes observed over a relatively short time frame, and can not account for time-varying sources of endogeneity. Thus it might be possible that a family was hit with an unobserved shock that affected the likelihood of migration for the child and affected the health of his elderly parent, resulting in a non-causal correlation be-

tween migration and parental health. To the extent that these shocks are not accounted for by the time-varying controls included in the FE analysis, then some may be concerned that the FE results may be biased as well. While there are no suitable time-varying instrumental variables available to propose an FE-IV strategy as in Antman (2011), I can offer an alternative identification strategy based on instrumental variables that produce estimates based on different sources of variation, namely the extent to which migration of children is influenced by fixed demographic characteristics of the children. Thus, we can compare results across identification strategies to see whether the results suggest a broad pattern that is robust to identification based on different sources of variation. Here the demographic characteristics considered as sources of variation are the fraction of female children and the fraction of married children. Since the instrumental variables are essentially fixed over time, the IV estimation results are only estimated on the first wave of the survey (5,707 observations).[19]

To show that the instruments are indeed correlated with migration outcomes of children, Table 3 presents first-stage results from a least squares regression where the dependent variable is whether the elderly parent has a child in the U.S. at the time of the survey (column 1).[20] As expected, the fraction of daughters is found to decrease the probability of having a child in the U.S. (point estimate -0.027, statistically significant at 10 percent level) and having a greater fraction of married children is found to raise the probability of having a migrant child (point estimate 0.096, statistically significant at 1 percent level). In addition,

[19] The pattern of IV estimation results using both waves of the survey show similar impacts.

[20] Financial help from children is not included as a control variable in these reported first stage statistics. Nevertheless, its exclusion matters little to the strength of the instruments overall. The analogous F statistic on excluded instruments is almost identical to those reported in columns (1) and (2) if financial contributions are included as a control variable in the first stage regression.

the F statistic on the excluded instruments, a commonly used diagnostic for detecting weak instruments, is 20.53, indicating the relative strength of this set of instrumental variables.

Table 4 shows the results from the corresponding IV regressions using instrumental variables and interpreted within the context of the linear probability model. For comparison, OLS results on the same sample are provided alongside the IV results. To begin, I discuss the OLS and IV results without controlling for financial contributions from children (columns 1 and 2), where the instrumental variables are the fraction of daughters and fraction of married children discussed above. As can be seen from the table, all of the statistically significant coefficient estimates point to a worsening of elderly health associated with children's migration, in which case statistical significance is typically at the 1 or 5 percent level unless otherwise noted. Specifically, in the areas of obesity, depression, and loneliness, both the OLS and IV results show an increased likelihood, although the OLS estimate for obesity is only statistically significant at the 10 percent level. The OLS results also indicate an increased likelihood of reporting poor SRH equal to 4 percentage points. While the magnitude of the IV results also suggests an increase in poor SRH (coefficient of 0.175), this estimate is not statistically significant at the ten percent level. Another important difference to point out is that the statistically significant IV results (ranging from around 0.46 to 0.58) are substantially larger than the OLS or FE estimates. This may stem from differences in the population that was induced to migrate based on variation in the instrumental variables, in the so-called compliers interpretation of the IV estimate as a (LATE) local average treatment effect (Imbens and Wooldridge 2007). Thus, the difference in results could also reflect heterogeneous effects and in particular a relatively high impact of children's migration on parental health for those with a relatively high fraction of sons or married children. Nev-

ertheless, the broad pattern of results suggests that children's migration is associated with worse outcomes for their elderly parents in Mexico.

Finally, the last two columns of Table 4 report the results of estimation accounting for children's financial contributions, and again using both instrumental variables available. As with the results from Table 2, it is striking that the results look very similar between the models controlling for financial contributions (columns 3 and 4) and those that do not (columns 1 and 2). Again, the OLS estimates point to statistically significant impacts of child migration on poor SRH, obesity, as well as feeling depressed and lonely. The IV estimates point to statistically significant impacts on obesity, feelings of depression, and feelings of loneliness (statistically significant at the 5 percent level or better). Again, the magnitudes of the IV estimates are large, suggesting increases in these outcomes on the order of 0.5, which again may be due to the particular sample of individuals that are affected by the instrument in a LATE interpretation of the estimator.

5 Extensions and Robustness

As an extension, I present results when the migration variable is measured as the number of children currently in the U.S., as opposed to the indicator for having at least one child in the U.S. The first stage results using this alternative measure are reported in Table 3 where it can be seen that the F statistic i still relatively high with a first stage F statistic of 16.67 (column 2). The IV results using this alternative measure of children's migration as well as the companion OLS results are presented in Table 5, where we see OLS suggests an additional migrant child increased the likelihood of poor health outcomes for elderly

parents, as measured by loneliness and poor SRH in particular (column 4). IV estimates show a statistically significant impact on obesity, depression, and loneliness. Comparing the results from Tables 4 and 5, it should be noted that the estimates using the number of migrant children as the dependent variable are about half as large as the ones using the indicator measure of children's migration. This makes sense since each parent appears to have just over two kids in the U.S. on average, conditional on having children in the U.S. (Table 1). As with the results from above, accounting for financial contributions from children does not meaningfully affect the estimates in either OLS or IV models.

One concern with the IV strategy may be with the share of married children instrument in particular, as it is arguably less likely to be purely exogenous compared with the share of children that are women. To address this, I limit the instrumental variables used in the analysis to the fraction of daughters only and report results from estimation without controlling for children's financial contributions.[21] As can be seen from Table 3, the F statistic on the excluded instruments from the first stage regression with purely this instrument is still high (10.79), suggesting that the instrument is still relatively strong. The IV results using only this instrument are reported in Table 5, column (3) where again, the point estimates are almost all positive suggesting a worsening of parental health associated with children's migration, though only the coefficient from the depression regression is statistically significant at the 5% level.

Another concern with the IV estimates is that financial contributions from children are included as a control variable and may in fact be endogenous as well. Since there are two instrumental variables in the main part of the analysis, it is possible to address this concern by

[21] Note that with only one instrumental variable, it is only possible to treat one variable as endogenous.

treating financial contributions from children as an additional endogenous variable, where the instrumental variables are again the share of children that are women and the share of children that are married. It makes sense that these should be relevant instruments since both gender and marriage help to determine earnings and financial contributions from children are likely to be a function of children's earnings. The F statistic on the excluded instruments when financial contributions from children is the dependent variable, however, is relatively weak (1.69), thus, the IV results treating financial contributions in addition to children's migration as endogenous should be viewed as purely suggestive. These are reported in Table 5, column (6) where we find statistically significant impacts on obesity and depression with similar magnitudes to those from the IV estimates in column (5), although the coefficient in the latter estimates are now statistically significant at the 10 percent level.

As another robustness check, Table 6 presents the results when the SRH measure is redefined so that poor or fair health is included as a poor outcome. To be clear, in Table 6, the dependent variable equals one if the respondent indicates SRH is poor or fair and zero if the respondent indicates health is good, very good, or excellent. This makes the measure more consistent with the dependent variable used in other studies. As can be seen from Table 6, using this measure, all estimates have a positive sign and are statistically significant at conventional levels, suggesting children's migration results in an increase in the likelihood a parent's SRH is poor or fair. Compared with the prior results using poor health as the dependent variable (Table 4), the IV point estimates are somewhat larger in magnitude in Table 6 (around 0.6), however, the overall likelihood of reporting fair health also appears to be larger than the probability of reporting poor health (Figure 1), thus the results are qualitatively consistent with the results from above.

6 Discussion

Altogether, the totality of the evidence presented here suggests that having a child migrate to the U.S. leads to a greater chance that elderly parents in Mexico will be in poor health. This is supported to varying degrees by impacts on outcomes such as poor SRH, obesity, feelings of depression, and loneliness. The extent to which the broad pattern of results holds across OLS, FE, and IV strategies relying on different sources of variation for identification also lends credence to the robustness of this relationship. The fact that this relationship exists despite controlling for children's financial contributions also leaves open the question as to what mechanism could be driving the relationship between children's migration and parental health.

One possible channel alluded to in the introduction is the psychic cost of a child's migration on his elderly parent. Child migration could affect an elderly parent's mental health because the migration of a child necessarily means limited contact between the elderly parent and the migrant child, which might entail an important loss of social support. This is particularly true in the case of migration to the U.S. which is often undertaken without legal documents, thus limiting opportunities for travel between the two countries. Another possible channel could be the anxiety involved in worrying about a child who may have migrated illegally. The result could be the increase in feelings of loneliness and depression for the elderly parent documented here.

These findings would be consistent with studies finding a negative relationship between social support (Gadalla 2009) or loneliness (Alpass and Neville 2003) and depressive symptoms. Furthermore, the connection between mental and physical health outcomes is also

suggested by studies in the medical literature which have found significant effects of depressive symptoms on subsequent physical and health outcomes (Vaillant 1979; McCusker, et al. 2007). Importantly, the medical literature has also established a role for social interactions, particularly with children, to mediate the influence of mental on physical health (McCusker, et al. 2007; Leifheit-Limson, et al. 2010). It should also be noted that most of the physical health outcomes measured in the latter studies are more severe than the outcomes considered over the short period observed here. This suggests that there may be substantially worse health outcomes for the population of parents with migrant children over time.

Overall, the totality of the evidence is consistent with a story in which adult child migration results in greater social isolation which worsens mental health outcomes for elderly parents in Mexico and this mental health decline precipitates a deterioration in physical health as well. However, we cannot rule out that children's migration is primarily affecting a parent's physical health through reduced levels of informal caregiving and also resulting in an increase in social isolation and a decline in the parent's mental health. Further research should investigate how children's migration affects the emotional and caregiving support elderly parents receive directly and how parental health outcomes vary based on the duration of children's migration. Another interesting area to explore would be how return migrants in particular influence their parents' health behaviors and outcomes. Nevertheless, even these first steps into the investigation of this important topic cast further doubt on the view that families in Mexico unambiguously benefit from having a member migrate to the U.S. These findings should present cause for concern in all areas where high rates of migration have coincided with the rapid aging of the population and suggest policymakers should shore up alternative sources of support for elderly dependents.

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Figure 1

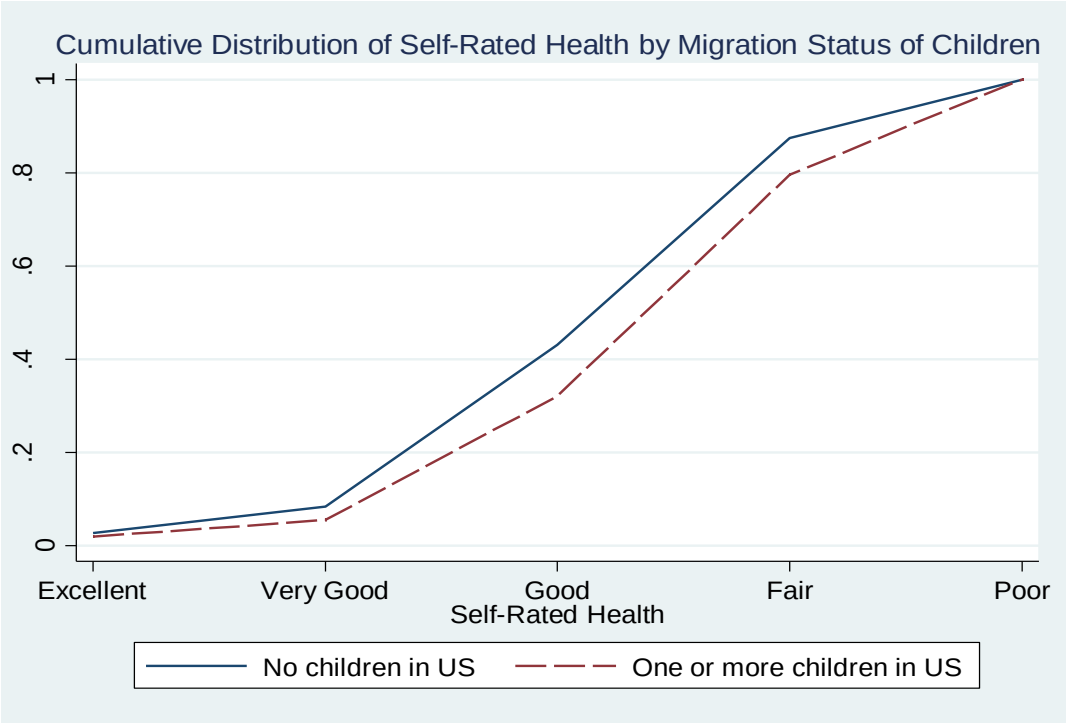
Cumulative Distribution of Self-Rated Health by Migration Status of Children
0
.2
.4
.6
.8
1
Excellent
Very Good
Good
Fair
Poor
Self-Rated Health
No children in US
One or more children in US

Table 1: Descriptive Statistics of Elderly Parents by Migration Status of Children

	No Child in US		Has Child in US			Full Sample	
	Mean	SD	Mean	SD		Mean	SD
Characteristics							
Female	0.482	0.500	0.498	0.5001		0.485	0.500
Age	61.474	9.012	63.287	8.8344	***	61.845	9.006
Education (Year of schooling)	5.883	4.705	3.868	3.7384	***	5.471	4.597
Married	0.637	0.481	0.627	0.4836		0.635	0.481
Assets[a]	149.229	537.8	137.788	588.69		146.891	548.6
Monthly Income[a]	8.780	121	5.588	43.566	*	8.127	109.7
Monthly Financial Help from Kids[a]	0.782	5.717	1.971	13.005	***	1.025	7.796
Right to Medical Services	0.720	0.449	0.607	0.4885	***	0.697	0.46
Number of Children	4.885	2.747	6.941	2.9078	***	5.305	2.901
Number of Grandchildren	8.079	9.019	13.789	10.602	***	9.246	9.643
Year=2003	0.446	0.497	0.441	0.4966		0.445	0.497
More Urban Area (100,000 ppl +)	0.773	0.419	0.557	0.4968	***	0.729	0.444
Fraction Daughters (Daughters/Kids)	0.488	0.269	0.484	0.2122		0.487	0.259
Fraction Married Kids (Married Kids/Kids)	0.586	0.347	0.704	0.2568	***	0.610	0.334
Outcomes							
Poor Self-Rated Health	0.129	0.336	0.206	0.4045	***	0.145	0.352
Obese	0.239	0.427	0.280	0.449	***	0.248	0.432
The majority of the past week, respondent felt…							
Depressed	0.349	0.477	0.405	0.4911	***	0.361	0.48
Lonely	0.286	0.452	0.355	0.4786	***	0.300	0.458
Number of Observations	8,185		2,102			10,287	

*** Difference in means is statistically significant at 1 percent level

** Difference in means is statistically significant at 5 percent level

*Difference in means is statistically significant at 10 percent level

[a]Units of financial variables are thousands of 2002 pesos

Table 2: OLS and Fixed Effects Estimates of Impact of Children's Migration Status on Parental Health Outcomes, 2001 & 2003 Samples

Each entry in table represents coefficient on indicator for having at least one child in US at time of survey in separate regression

	(1) OLS	(2) FE	(3) OLS	(4) FE
Dependent variable				
Poor SRH	0.037***	0.063***	0.038***	0.063**
	(0.011)	(0.024)	(0.011)	(0.024)
Obese	0.030**	-0.031	0.028**	-0.031
	(0.013)	(0.022)	(0.013)	(0.022)
The majority of the past week, respondent felt…				
Depressed	0.022*	0.027	0.023*	0.027
	(0.013)	(0.030)	(0.013)	(0.030)
Lonely	0.030**	0.039	0.031**	0.039
	(0.012)	(0.029)	(0.012)	(0.029)
Controlling for Financial Assistance from Kids	NO	NO	YES	YES
Number of Parents		6601		6601
Number of Parent-Period Observations	10,287	10,287	10,287	10,287

Robust standard errors clustered at household level in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Additional regressors include: female indicator, age, age squared, a set of dummy variables indicating educational attainment, assets, monthly income, right to medical services indicator, number of children, number of grandchildren, year 2003 indicator (in full sample), and urban area indicator, where time-invariant controls have been dropped from the FE analysis

Table 3: First Stage Regressions

2001 Sample

	(1)	(2)	(3)
	Has kid in US	Kids in US	Kids in US
Fraction Daughters (Daughters/Kids)	-0.027*	-0.125***	-0.128***
	(0.016)	(0.039)	(0.039)
Fraction Married Kids (Married Kids/Kids)	0.096***	0.189***	
	(0.016)	(0.039)	
Observations	5,707	5,707	5,707
F statistic on excluded instruments	20.53	16.67	10.79

Robust standard errors clustered at household level in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Additional regressors include: female indicator, age, age squared, a set of dummy variables indicating educational attainment, assets, monthly income, right to medical services indicator, number of children, number of grandchildren, and urban area indicator

Table 4: OLS and IV Estimates of Impact of Children's Migration Status on Parental Health Outcomes, 2001 Sample

Each entry in table represents coefficient on indicator for having at least one child in US at time of survey in separate regression

	(1) OLS	(2) IV	(3) OLS	(4) IV
Dependent variable				
Poor SRH	0.040***	0.175	0.041***	0.173
	(0.013)	(0.161)	(0.013)	(0.160)
Obese	0.028*	0.583***	0.026*	0.585***
	(0.015)	(0.216)	(0.015)	(0.216)
The majority of the past week, respondent felt…				
Depressed	0.044***	0.466**	0.045***	0.458**
	(0.017)	(0.229)	(0.017)	(0.228)
Lonely	0.051***	0.499**	0.053***	0.498**
	(0.016)	(0.224)	(0.016)	(0.223)
Controlling for Financial Assistance from Kids	NO	NO	YES	YES
Endogenous variable(s)		Has kid in US		Has kid in US
Instrumental variable(s)		Frac. Daughters, Frac. Married Kids		Frac. Daughters, Frac. Married Kids
First Stage F Statistic on excluded Instruments		20.53		20.53
Number of Observations	5,707	5,707	5,707	5,707

Robust standard errors clustered at household level in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Additional regressors include: female indicator, age, age squared, a set of dummy variables indicating educational attainment, assets, monthly income, right to medical services indicator, number of children, number of grandchildren, and urban area indicator

Table 5: OLS and IV Estimates of Impact of Number of Children in US on Parental Health Outcomes, 2001 Sample

Each entry in table represents coefficient from separate regression where dependent variable is number of children in US at time of survey

	(1) OLS	(2) IV	(3) IV	(4) OLS	(5) IV	(6) IV
Dependent variable						
Poor SRH	0.008	0.081	0.078	0.008*	0.081	0.081
	(0.005)	(0.072)	(0.132)	(0.005)	(0.072)	(0.072)
Obese	0.005	0.232**	0.030	0.004	0.234**	0.247*
	(0.005)	(0.097)	(0.164)	(0.005)	(0.097)	(0.128)
The majority of the past week, respondent felt…						
Depressed	0.010	0.255**	0.460**	0.010	0.254**	0.240*
	(0.006)	(0.106)	(0.225)	(0.006)	(0.106)	(0.137)
Lonely	0.016***	0.194**	-0.005	0.016***	0.196**	0.208
	(0.006)	(0.099)	(0.173)	(0.006)	(0.099)	(0.127)
Controlling for Financial Assistance from Kids	NO	NO	NO	YES	YES	YES
Endogenous variable(s)		Kids in US	Kids in US		Kids in US	Kids in US & Fin asst. from kids
Instrumental variable(s)		Frac. Daughters, Frac. Married Kids	Frac. Daughters		Frac. Daughters, Frac. Married Kids	Frac. Daughters, Frac. Married Kids
Number of Observations	5,707	5,707	5,707	5,707	5,707	5,707

Robust standard errors clustered at household level in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Additional regressors include: female indicator, age, age squared, a set of dummy variables indicating educational attainment, assets, monthly income, right to medical services indicator, number of children, number of grandchildren, and urban area indicator

Table 6: OLS and IV Estimates of Impact of Children's Migration Status on Poor/Fair Self-Rated Health (SRH)

Each entry in table represents coefficient on indicator for having at least one child in US at time of survey in separate regression
2001 Sample

	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) IV
Dependent variable					
Poor or Fair SRH	0.031*	0.615**	0.031*	0.608**	0.674**
	(0.016)	(0.246)	(0.016)	(0.245)	(0.336)
Controlling for Financial Assistance from Kids	NO	NO	YES	YES	YES
Endogenous variable(s)		Has kid in US		Has kid in US	Has kid in US & Fin asst. from kids
Instrumental variable(s)		Frac. Daughters, Frac. Married Kids		Frac. Daughters, Frac. Married Kids	Frac. Daughters, Frac. Married Kids
Number of Observations	5,707	5,707	5,707	5,707	5,707

Robust standard errors clustered at household level in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Additional regressors include: female indicator, age, age squared, a set of dummy variables indicating educational attainment, assets, monthly income, right to medical services indicator, number of children, number of grandchildren, and urban area indicator