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Modeling old-age wealth with endogenous early-life outcomes: The case of Mexico

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Abstract

This paper contributes to the literature on the life course and aging by examining the association between early-life outcomes and late-life well being, using data from the Mexican Health and Aging Study. Empirical research in this area has been challenged by the potential endogeneity of the early-life outcomes of interest, an issue which most studies ignore or downplay. Our contribution takes two forms: (1) we examine in detail the potential importance of two key life-cycle outcomes, age at marriage (a measure of family formation) and years of educational attainment (a measure of human capital investment) for old-age wealth, and (2) we illustrate the empirical value of past context variables that could help model the association between early-life outcomes and late-life well being. Our illustrative approach, matching macro-level historical policy and census variables to individual records to use as instruments in modeling the endogeneity of early-life behaviors, yields a statistically identified two-stage model of old-age wealth with minimum bias. We use simulations to show that the results for the model of wealth in old age are meaningfully different when comparing the approach that accounts for endogeneity with an approach that assumes exogeneity of early-life outcomes. Furthermore, our results suggest that in the Mexican case, models which ignore the potential endogeneity of early-life outcomes are likely to under-estimate the effects of such variables on old-age wealth.

Keywords

Old-age wealth; Life-cycle models; Mexico

Introduction

Over the last couple of decades, there has been a growing theoretical emphasis on the life-cycle approach in aging studies that investigate late-life well being, with a corresponding increase in studies that model late-life outcomes as a function of early-life factors (Corman et al., 2011; Palloni, 2006). This orientation considers aging as a life process, and gives a

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prominent role to decision-making, as well as to the timing of events and the historical time and place throughout people's lives (see summary provided in Settersten, 2003). From this perspective, individuals are viewed as experiencing events and making choices throughout the life cycle that impact significantly on their late-life well being. However, we know little about the relative importance of specific life-cycle paths as determinants of late-life outcomes. Particularly in societies with vast socioeconomic inequalities such as Mexico, the paths may diverge significantly due to cultural or socioeconomic contexts. Furthermore, in these societies the likely paths are changing rapidly due to economic and social development, thus it is important to understand the relative impact of one path or another for later life.

An example serves to illustrate this point. Following a homemaker path during adulthood for a woman can be significantly different from following a labor-market-oriented path. While these two paths obviously differ in terms of lifestyle and individuals' preferences, it is an empirical question whether they translate into much different well being in late-life as indicated by some measurable outcome variable, such as wealth. In this example, determining the relative importance of these two paths is of interest because the current generations of older-adult women in countries with low institutional support for old age, such as Mexico, are mostly women who devoted the majority of their adult life to family life, whereas the future generations of older women will increasingly spend a larger share of their life course in labor-market activities. How this transformation will impact their well being in old age is of particular importance as developing countries move through this transition in women's roles.

The theoretical orientations of the life course framework include not only trajectories but also transitions. Thus "turning points" in a person's life, such as decisions to marry or pursue higher education, are meaningful changes in the direction of the life course that have potentially important consequences for the individual's development and hence for their old-age (Rutter, 1996). Durations of events (the length of time spent in particular stages) also have salient implications. Through forces of habit or social commitment, long durations are associated with increasing propensity to continue in the same state and thus to follow a path with fewer changes in direction (Becker, 1965). Another theoretical orientation of the life course that is of interest to our work is that normative or culturally accepted social expectations regarding the timing of life events can be captured by 'appropriate' ages for transitions such as entry into marriage or retirement, leading to some people experiencing early or late transitions in contrast to the norm. Obtaining information at the individual level about what was the appropriate age for transitions (such as marriage) for each subject is difficult, but the average age observed among subjects in each context can convey this normative concept. Similar arguments can be made regarding appropriate durations for selected life experiences influencing outcomes such as years of education.

The value of accumulated assets, or wealth, at old age is a powerful indicator of economic well being, and it is natural to expect that this indicator would be affected by the specific path followed by individuals along the life course. However, while the life-course theoretical framework has continued to evolve, empirical analyses that attempt to establish causal relationships using this approach have been less common. This is partly because the ideal applications demand longitudinal data that are costly and require long periods of research observation. Furthermore, a key methodological issue is common in this line of work: endogeneity of the early-life behaviors. Taking an example from the health literature to illustrate, a model of late-life health as a function of earlier-life smoking makes analytical sense. However, the same unobserved factors that determined a person's propensity to smoke over the life course may contribute directly to determining the observed late-life health outcomes. In this case, if causality is of concern, the resulting estimators of the effect of smoking on late-life health may be biased.

One possibility to model this type of endogeneity is to find suitable instrumental variables that can help tease out the source of endogeneity of the early-life outcomes. The issue is whether there are factors from the individual's life that affect the propensity to smoke but not the late-life health outcome; finding such suitable factors at the individual level can be difficult. Instead, one can take advantage of the changing social environment, and use aspects of the historical social context as determinants of an individual's behavior. We adopt this approach and consider variables that capture the past context as the instruments for early-life behaviors in models of late-life outcomes.

This paper contributes to the literature on the life course and aging by examining the association between early-life outcomes and late-life well being. Our contribution takes two forms: (1) we examine in detail for the case of Mexico the potential importance of two key early life-cycle outcomes, age at first marriage (a measure of family formation) and years of educational attainment (a measure of human capital investment) for old-age wealth, and (2) we explore the empirical value of past context variables that could help model the association between early-life outcomes and late-life well being in any setting where the historical context is characterized by important changes. In what follows, we first discuss the theoretical life-cycle framework more fully and the integration of historical context into this framework. We then provide background on the historical context for the relevant cohorts and time periods in Mexico. Next we describe our data sources, the Mexican Health and Aging Study which is a detailed data collection project focusing on the elderly, and many years of census data. The next section presents our empirical methodology with an emphasis on the role of the historical data. The following discussion of empirical results focuses first on assessing the validity of the methodology, and then on the implications of the results for the determinants of old-age wealth in Mexico.

Life-cycle framework

We use the life-course perspective to study late-life well being in Mexico, following previous research (see, for example, Settersten, 2003 or Wong and DeGraff, 2009). This approach considers aging as a process, and late-life stocks are the results of lifetime investments. In particular, models of late-life financial wealth consider earlier labor force participation and income as determinants of late-life economic well being (Smith et al., 2003). The majority of this research, however, has been conducted in high-income countries because of the greater data availability. In addition, the research has focused largely on men because there tends to be an interest in the long-term effect of work and retirement decisions, and the information on such work-related factors is more available for men. In our previous work (Wong and DeGraff, 2009), we adapted this theoretical perspective to the context of developing countries and aimed to integrate more fully the experience of women. We argued that in order to apply this perspective to the case of Mexico, a country experiencing fast demographic and economic changes, the models not only need to include measures of engagement in the labor force as potential determinants of late-life financial wealth, but also factors that capture structural changes, such as in family formation behavior and human capital investment. Of particular interest is the timing of events such as first marriage and first job, as well as total accumulated outcomes such as number of children, the total years of education, and total years of labor force work. Our previous analysis, however, did not attempt to address the potential endogeneity of the early-life behaviors included in our model of late-life economic well being.

The main elements of our conceptual framework are illustrated in Fig. 1, building upon our previous work (Wong and DeGraff, 2009). The bottom of the figure outlines the stages of an individual life cycle. Educational attainment, age at first job and age at first marriage mark the early work and family trajectories followed by an individual. As mentioned, we focus particular attention in this analysis on educational attainment and age at marriage. Educational attainment serves as a measure of investment in human capital, and is widely used as an explanatory variable in models of earnings capacity in both industrialized and developing countries. We expect higher levels of education to contribute to greater labor market earnings and, thus, a greater potential to save and accumulate wealth. Higher levels of education could also be associated with access to higher returns on any savings or assets. Age at first marriage might, for example, influence old-age wealth through the timing of family formation and maintenance expenditures. Later marriage can postpone the onset of expenses associated with setting up one's own household and supporting children, and also may be indicative of being better established prior to marriage more generally. We expect age at marriage to positively influence wealth in old age. Importantly, both of these measures exhibit substantial variation in our sample of elderly in Mexico and, thus, are of substantive interest and well suited for our empirical methodology. Finally for this early stage of the adult life cycle, age at first job is associated with an earlier initiation of earning income which would contribute positively to the accumulation of savings.

Number of children, work attributes, and years worked are indicators of decisions throughout the early to middle adult years that impact late-life economic well being through their effects on income earning and consumption expenditures to maintain one's family. During middle and old age, the traits of adult children may turn into powerful determinants of financial well being, particularly for women in settings with low institutional support which are common in contemporary developing countries. The loss of a spouse may also influence the financial status of adults in old age.

In the present study, we argue that many of the outcomes or decisions made throughout the life cycle, such as age at first marriage or educational attainment, may be endogenous to late-life economic well being. Unobservable characteristics may affect these past outcomes as well as have a direct effect on the dependent variable, wealth in older ages, resulting in biased estimates if not taken into account. For example, a person's intelligence and motivation, characteristics that are unavailable in most data sets, could have influenced

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decisions about one's own education as well as having a direct effect on the accumulation of wealth in later life. Similarly, an individual's attitude towards risk, or the nature of one's family relationships, might influence the timing of marriage and also various financial decisions that determine wealth in old age.

The early-life behaviors are also strongly affected by the context that prevailed at the time, in the past. The characteristics of this context reflect the structural changes mentioned above, which can be captured by changes in government policies such as educational, health, family planning or social security policies that influence individual decisions or behaviors. In addition, the social norms and attitudes towards marriage, education and family size, as well as the overall economic environment at the time, could have impacted these early individual behaviors. These influences are shown on the extreme left side of Fig. 1 as past context, and convey the social changes that could have affected the early human capital and family formation decisions directly but would not continue decades later to influence the late-life well being of older adults, other than via their indirect effects through early-life behaviors (Kelley-Moore and Lin, 2011; Kenkel and Terza, 2001). Thus, for our empirical models of old-age outcomes in which we treat the individual human capital and family formation decisions as endogenous, these past-context factors can serve as potential identifiers in the system.

Hardly any authors have modeled the endogeneity of early-life outcomes in models of late-life well being, with a few notable exceptions. For developing countries, Emerson and Souza (2011) model late-life earnings in Brazil, treating early-life participation in the labor force as endogenous. Also, the approach we use is consistent with recent and innovative developments in aging studies that use a life history approach for developed countries. Börsch-Supan and Schröder (2011) examine the effect of the welfare system in European countries on old-age health by combining life history micro data from individuals with macro data capturing the history of welfare state interventions, such as changes in education or access to health care, in more than 20 countries. Similarly, Portrait et al. (2010) include historical macroeconomic indicators and aggregate measures of health conditions and policy to capture early-life influences on health status in late life in the Netherlands. Although not necessarily modeling the endogeneity of early-life outcomes, the approach of using macro data to capture the historical context over the individual's life course is consistent with the approach we use in our research. For the case of Mexico, McKenzie and Rapoport (2011), while not focusing on outcomes among the elderly, use aggregate historical migration rates to instrument for individual migration in a model of children's educational attainment.

Historical context

The past context of the cohorts that are currently older adults in Mexico can be examined with respect to several important dimensions that relate to the life-cycle framework. Rapid aging has resulted from accelerated mortality and fertility declines relative to the pace of aging in developed countries. The percentage of the population in Mexico aged 60 and older is projected to increase from 4.4% in the year 2000 to about 25% by 2050. By way of comparison, similar growth took longer in developed countries; 13% of the U.S. population was aged 60 and older in 1950 and is projected to increase to about 25% in 2025 (Day, 1996; Partida, 1999). At the individual level, these trends relate to decisions regarding childbearing and to the number of children available to potentially assist their parents in old age.

In addition to these rapid demographic changes, today's elderly in Mexico have experienced dramatic transformations in political, economic and social institutions and conditions. The middle- and old-age cohorts (aged 50 or older in the year 2000) were born roughly between 1900 and 1950. These cohorts are survivors of a revolutionary war from 1910 to 1921 and, in 1917, saw the establishment of the (still governing) Constitution which secured fundamental rights for Mexican citizens. The Ministry of Education was created in 1921, initiating around 1930 a period of gains in literacy, particularly in rural areas (Ham-Chande, 2003). Still, in 1943, the general literacy rate was only about 50%, compared to 90% in 2000, suggesting substantial differences in education levels across cohorts and generations.

In addition, the elderly in Mexico have experienced important changes in institutional support for health care and retirement. The Mexican Social Security Institute (IMSS) was created in 1943, securing health care and risk pooling (for disability or retirement pensions) among workers in the formal labor market, while the equivalent institution for federal workers (ISSSTE) was created in 1959. Around the same time, state-level and other decentralized organizations launched their social security systems (Montes de Oca, 2001). These institutions initially covered urban populations and generally offered health care services as well as old-age pensions to their beneficiaries. The Ministry of Health, which was also created in 1943, takes care of the uninsured population, traditionally those in the informal labor market, the unemployed and those not in the labor force. All of these institutions supported a social and medical infrastructure that contributed to the major declines in mortality mentioned above.

The political origins of these social institutions and their evolution, however, resulted in a system of segregated and unequal access to education and health care, with a large divide in the human capital and income of the population by social class and in urban versus rural areas that remains today (Ham-Chande, 2003; Montes de Oca, 2001; Secretaría de Salud, 2004). Coverage by the social security system is determined largely by participation in the formal labor market; hence this system tends to discriminate against agricultural workers and those living in rural areas, domestic workers, and small commerce industry workers. These groups tend to be among the poorest sectors of the population (Lozano et al., 1993; Parker and Wong, 1997).

The agricultural sector in Mexico subsidized the growth of industry, enabling the economic development of the country during the 1950s, in particular in urban centers. More recently, there has been a shift of population out of agriculture and from rural to urban areas, with the percent urban increasing from 51% in 1960 to 77% in 2000. Two important labor programs supporting these transitions emerged: the *bracero* program exported male workers to the U.S. from 1943 to 1964; the *maquila* program started around 1965, employing mostly young women in assembly manufacturing for export. Mexico enjoyed industrial and oil booms during the 1960s and 1970s, which ended with economic crises that started around 1976 and became evident in 1982. The 1990s were largely characterized by economic revitalization, with a brief downturn in 1995, and a definite transformation into a more service oriented economy by 2000 (Fleck, 2001; Ramirez-Lopez, 2000).

Of particular importance for our analysis are the changes in age at marriage and educational attainment of Mexicans during the 20th century. The institution of marriage underwent a vast transformation in terms of type of union, with the dominant form shifting prevalence over time from religious marriages to secular marriages. By the end of the 20th century, a rise in consensual unions and never-married persons was also evident (Quilodrán, 2010). Over the century, average age at first union/marriage (regardless of type) showed a tendency to fall and then rise slightly for women while staying relatively constant around age 24 for men. In 1930, average age at first union was 24.6 for men and 21.9 for women. In 1960 it was 23.9 for men and 20.7 for women; by the year 2000 the corresponding figures were 24.9 for men and 22.7 for women (Quilodrán, 2010). Even greater change has occurred in the area of education, with literacy and educational attainment rising rapidly during the second half of the 20th century. Although men and women in both rural and urban areas experienced gains in education, the largest gains were among women in rural settings. For example, rural women aged 26–30 in 1970 had an average education of 2.3 years. By the year 2000, this cohort had an average of 6.1 years of education, representing an increase of 260% over this 30-year period (Wong and Palloni, 2009).

In summary, the current generations of Mexicans aged 50 and older have lived through periods of dramatic changes, not only in the social and technological transformation inherent in the demographic and epidemiological transitions, but also in the institutional, economic, and political context. Gradual changes and vast inequalities imply that the historical experience across age cohorts varies widely, but major intra-cohort differences exist as well.

Data

We use both individual-level data and aggregate historical data in this analysis. The historical data are described in detail in the following section. The individual data derive from the first wave of the Mexican Health and Aging Study (MHAS), a nationally representative, prospective panel study of Mexicans aged 50 and over in 2001.[1] The study design and content are comparable to the U.S. Health and Retirement Study. Interviews were sought with spouses or partners of sampled persons in a couple regardless of their own age. Data were collected on multiple domains of health; demographic traits, including marriage, fertility, and the migration histories of respondents, their parents and offspring; family networks and transfers exchanged; some aspects of work history; current income and assets; and the built environment. States with high rates of out-migration to the United States were over-sampled. Baseline interviews were completed with about 15,000 respondents in 2001. These data are particularly useful for the purpose of this research because the survey gathers retrospective information on labor force participation, including age at first employment, total years worked, main occupation and attributes of the work environment; and on marriage, including age at first marriage/union and details on the first and last

[1]The MHAS (Mexican Health and Aging Study) is partly sponsored by the National Institutes of Health/National Institute on Aging (Grant No. NIH R01AG018016). Data files and documentation are public use and available at www.MHASweb.org.

unions. The survey also includes information on a variety of indicators of current economic well being such as income and wealth. The MHAS data include information for both persons in a couple; the 2001 sample contains roughly 4500 couples, 950 unmarried men, and 2800 unmarried women.

We select wealth as the outcome of interest in our analysis because it is a powerful indicator of late-life economic well being. In particular in developing countries, where credit markets are not well developed and institutional support for old age is scarce, the population may be highly dependent on accumulated assets to provide for their expenditures in old-age. The information on wealth was collected at the level of the individual respondent or couple (when applicable). Specifically, wealth was measured using the net worth (estimated selling value minus debts) of homes, businesses, rental properties, capital, vehicles, as well as financial assets and debts.[2] To calculate individual wealth, we use the total value of net worth in the case of respondents who do not live with a spouse/partner, and one-half of the total value of net worth for the couple in the case of respondents who have a spouse/partner. Because of the high non-response rate in terms of exact values for these questions it was necessary to use imputation. Following conventions used for the U.S. Health and Retirement Study and other surveys of its type, the MHAS used unfolding brackets to recover the non-response on wealth items. These bracket responses were then used in the imputation procedure (RAND, 2009; Wong and Espinoza-Higgins, 2004).[3] On average, about 60% of a person's net worth in the MHAS is represented by their home, compared to 20% from businesses and other real estate, and 6% from capital assets and vehicles. We have found in previous work using MHAS data that the measure of wealth is externally and internally consistent, that it is a good indicator of economic well being, highly correlated with current health and education, and performs better as an economic covariate than current income for this population (Wong and Espinoza-Higgins, 2003).[4]

[2]The survey instrument asked for the approximate value of financial assets including bank accounts, stock market holdings and other financial accounts such as individual pension funds. Access to old age pensions and/or knowledge of pensions is relatively rare among older adults in Mexico. For those holding a retirement account in the form of an individual fund, the balance of the fund was reported as part of their financial assets.

[3]Respondents were queried separately about each category of assets (home, vehicle, financial assets, etc.), and were first asked whether they owned any of the asset. The non-response rates to these questions were very low (less than 2%). Those indicating non-ownership were assigned a value of zero for the asset, while those indicating ownership were asked about the value of the asset and of any debt associated with the asset. Those unable to provide exact values were further queried using the unfolding brackets methodology, and imputation was used both for those providing values through brackets and those not providing any value. Using as an example the most commonly held asset, a home (owned by 75% of the sample), 61% of owners provided an exact value of their home, another 28% provided the value through brackets, and 11% did not report a value. Overall, exact values were more often reported by those with lesser wealth than by those with greater wealth; the rate of reporting exact values was similar for males and females. The imputation technique utilized the SAS-based software IVEware, distributed by the University of Michigan and used by the Health and Retirement Study, which is described in detail in Wong and Espinoza-Higgins (2004). Importantly, the methodology allows for the imputation of zero as a possible value. Also, following standard practice to measure current net worth, any transfers to children that had already occurred are not included in the wealth measure. To the extent that inter-vivos transfers differ systematically in their incidence and/or relative magnitude by level of wealth, analysis that accounts for such transfers could yield different results. However, in Mexico, the practice of inter-vivos financial transfers is uncommon, and tends to be positively correlated with education which is included in the model (Alaimo, 2007; Wong and Higgins, 2007).

[4]External consistency was assessed by comparing the wealth values with other sources for Mexico as summarized in Wong and Espinoza-Higgins (2003). Internal consistency was assessed by examining the wealth distribution in relation to socioeconomic characteristics such as age, gender, education, and urban-rural residence. Other studies using this wealth measure from the MHAS include Camacho (2008), Maurer (2008) and Smith and Goldman (2007).

Empirical methodology

The life-cycle framework of old-age wealth outlined in Fig. 1 suggests an empirical model that includes among the explanatory variables, in addition to measures of initial endowments and family background, measures of own human capital investment, family formation and lifetime work experience. We operationalize these conceptual measures as follows:

1. initial endowments and family background: age, male or female, an indicator of health status at age 10, and an indicator of parental socioeconomic status;
2. own human capital investment: years of education;
3. family formation: age at first marriage/union, number of marriages, number of children and highest education level of children;
4. lifetime work experience: age at first job, percentage of life employed, a set of occupational status variables, and an indicator of any migration experience to the United States.

A key focus of our analysis is to assess to what extent such earlier-life decisions and outcomes as listed in (2) through (4) impact economic well being in old age, as represented here by a measure of wealth. A challenge to this type of analysis, as discussed above, is the potential endogeneity of these early-life behaviors. In an effort to address this concern, we develop and implement a novel instrumental variables approach that makes use of macro-level historical data matched to individual MHAS records in order to identify the model. An important additional aim of the paper is thus to demonstrate this approach and assess its value.

Of the explanatory variables in the model that represent early-life decisions, we focus on two variables: age at first marriage and years of own education. While any of the above measures of early-life decisions could be argued to be endogenous, we single out these two variables as potentially endogenous and treat the remainder as if exogenous.[5] We adopt this approach for both practical and conceptual reasons. We do not have sufficient historical data to construct valid instruments for all of the measures of early-life decisions in a single exploratory model, and the historical data available to us are best suited to these two variables. Also, as mentioned previously, these measures display considerable variation in our sample. In addition, on conceptual grounds, these are the “earliest” of the series of life-cycle behaviors and, therefore, have had the opportunity to impact old-age wealth cumulatively over a number of years.

A historical instrumental variables approach

The structure of the empirical model is summarized in the equations below. Y_1 and Y_2 are measures of age at first marriage/union and years of own education, and are treated as endogenous in the model for Y_3, late-life wealth. Y_1 and Y_2 are estimated in a first-stage reduced form regression and Y_3 is estimated in a second-stage regression. The X vectors

[5]We acknowledge that some endogeneity bias may remain in the model as a result but, if so, this does not detract from the demonstration and assessment of the methodology nor the conclusion that the substantive results differ in comparison to treating all explanatory variables as exogenous.

represent individual and family characteristics assumed to be exogenous, W is a vector of exogenous factors that influence Y_3 directly, and Z_i are vectors of macro-level historical variables intended to identify the model. Given the different family and work life experiences of men and women among the current elderly in Mexico, the model is estimated separately for sex-specific sub-samples.

$$\begin{aligned} Y_1 &= \alpha_0 + \alpha_1 X + \alpha_2 Z_1 + \varepsilon_1 \\ Y_2 &= \beta_0 + \beta_1 X + \beta_2 Z_2 + \varepsilon_2 \\ Y_3 &= \gamma_0 + \gamma_1 Y_1 + \gamma_2 Y_2 + \gamma_3 W + \varepsilon_3 \end{aligned}$$

Our goal in the specification of the Z vectors is to include historical variables that measure aspects of the larger demographic, social, economic and policy environments in which individuals were making these early-life decisions. Such measures, if available, are useful for model identification because they are exogenous to the individual actor, vary across time and demographic characteristics of individuals, are theoretically compelling as shaping early-life behaviors, and do not directly impact current wealth holdings because they are long past. We employ two types of macro-level historical variables, those derived from records of key events and policy changes, and those derived from census data. Before describing these measures in detail, we first note that the former variables (which we refer to as “historical policy” variables) are often readily available and can easily be matched to individual data. In contrast, the second set of variables (which we refer to as “historical census” variables), are more difficult to match to individual records and might not be readily available or available at all for some countries. Thus, a secondary methodological goal of this analysis is to compare the performance of these two sets of variables in terms of model identification. In other words, is it worth it in terms of econometric validity to seek out and prepare variables akin to our historical census variables?

We begin by describing the simpler historical policy variables. We have identified three points in time during the relevant period of the MHAS cohorts’ earlier lives when important changes in educational policy were enacted in Mexico. In 1917, legislation was passed that for the first time made elementary education of children mandatory. 1943 marked the start of a national educational campaign that emphasized literacy and the building of schools. In 1960, a program to provide school textbooks at no cost was initiated. Based on these dates, for each MHAS respondent we create three variables measuring the number of years between the ages of 6 and 15 (the intended 10 years of primary and secondary school) that occurred after the respective change in policy. Note that this formulation of the historical policy variables generates greater variability than would a simple dummy variable for whether the individual was born (or reached some specific age) before or after the relevant date. For example, an individual born in 1935, while having a value of 10 for the 1917 variable and a value of 0 for the 1960 variable, would have a value of 7 for the 1943 variable. The oldest cohorts would generate variability around 1917, the youngest around 1960, and so on.

Construction of the historical census variables benefits from the availability in Mexico of at least some census data dating back as far as 1910 and continuing at 10-year intervals to the present. We use data from the 1910 census through the 1970 census.[6] Detailed census data were made available to us for 1950, 1960 and 1970 from the IPUMS-international census project at the University of Minnesota. More limited tabulations of data from the earlier censuses were made available to us by the Statistical Bureau of Mexico (Instituto Nacional de Estadistica y Geografia, INEGI).[7] We define three nationally-based historical census variables that we argue shaped the context for early-life marriage and education decisions of these elderly cohorts: an age-lagged male-to-female sex ratio, a sex- and age-specific percentage married, and a sex-specific literacy rate. The sex ratio measure is based on 5-year age groups and is lagged by 5 years for females (i.e., the males in the numerator are 5 years older than the females in the denominator) because, for these cohorts, women are on average about 5 years younger than their husbands in first marriages. This variable provides an aggregate measure of potential marriage partners. The percentage married variable is also based on 5-year age groups, and is sex-specific. It captures both availability of potential spouses and societal norms regarding age at marriage. The literacy measure is derived from census questions on the ability to read and write, administered to the population aged 10+ and aggregated (in the earlier census years) across all relevant ages but separately for females and males. It offers a rough proxy for societal expectations regarding education. For each census year we calculate multiple values for each of these variables, based on the relevant sex and/or age categories.

This approach is illustrated in Fig. 2 for the lagged age-sex ratios. It shows a matrix with columns defined by census years and rows defined by lagged sex ratios for each of the 5-year age groupings. The procedure for matching these aggregate census values to individual MHAS respondents is based on selecting the census year that is closest to the event (for example, first marriage), and the sex ratio that matches the age at the event. For example, a woman who married at age 18 in 1932 would be assigned the matrix cell labeled “sex ratio 23” for a census year of 1930 and a female age range of 15–19. Similar matching algorithms are used for the other historical census variables.[8]

In summary, the historical instrumental variables approach involves estimating two reduced form first-stage regressions – age at first marriage and years of own education – that include two sets of macro-level historical variables (six variables in total; described in Table 1) for model identification. The two first-stage models include the same explanatory variables (descriptive statistics for all variables are presented in Appendix Table A1). Note in Table 1 that the definition and matching of the historical variables generates moderate to considerable variation in these variables, a desirable characteristic for potential instruments. The age at first marriage model is estimated using OLS regression.[9] The years of own education model is estimated using zero-inflated negative binomial regression (ZINB). The

[6]Census data from 1980 might be relevant for a small number of the youngest MHAS cohorts who were born in the early 1950s, but these data are unavailable as they were destroyed in the 1984 earthquake in Mexico City.

[7]The individual records from the earlier censuses are unavailable; only archived tabulations are available.

[8]Stata programs for all of the matching algorithms are available from the authors upon request.

[9]The small percentage of respondents who never married or were missing valid data on age at first marriage (5.1% for males and 7.3% for females) are included in the analysis sample with a value of zero for age of marriage and 0/1 flags among the explanatory variables to indicate observations with such data issues. These cases also lack the information needed to match percent married and sex ratio from the census. Accordingly, we adjust the census matching algorithm for these observations to use the year of birth to select census year and the youngest marriageable cohort to define the age range. Given that this census matching is arbitrary, we also re-estimate the model omitting these observations. The overall results of the model are not sensitive to the exclusion of these cases for males, and are generally robust for females but with greater increases in standard errors in some instances.

functional form for ZINB is similar to that of a Poisson model in that it treats the variable as a count variable. However, unlike a Poisson, it also takes into account clustering at zero (there are many among the MHAS cohorts with no formal schooling), and allows for greater variance in the distribution than does a Poisson function. This latter property is useful here because the thresholds that characterize education systems result in natural clustering at a few positive values. This results in greater variation in values than would be the case for a typical count variable with an ever-decreasing frequency as values increase.[10]

The second-stage model of old-age wealth is estimated in log-linear form as a function of predicted age at first marriage, predicted years of own education, and a set of other individual characteristics assumed to be exogenous. Standard errors of the estimated coefficients are corrected for use of estimated values of explanatory variables from the first-stage regressions. The full two-stage model is estimated separately for males and females.

Results

Assessment of historical instrumental variables approach

Before considering the substantive results for the model of wealth among the elderly in Mexico, we first discuss the performance of the historical instrumental variables approach. We focus on three areas: statistical identification, sufficiency of explanatory power, and differences between the IV model and a model of old-age wealth that assumes exogeneity of age at first marriage and own education. The upper panel of Table 2 summarizes the results for the six historical variables in the models of age at first marriage and years of own education, for men and women, respectively. For each set of results, at least two of the potential instruments are statistically significant, with different subsets of these variables being significant in each model.[11] This is an encouraging result; such a pattern of statistical significance is necessary for model identification.

A second way of thinking about statistical identification is to focus on the potential identifier variables as sets of variables – the historical census variables and the historical policy variables – rather than examining each variable individually. Joint significance tests for both sets of historical variables, in comparison to a model that includes neither set, yield the following results. The historical census variables are jointly statistically significant at a 5% level in all four regressions. In contrast, the historical policy variables are not jointly significant at a 5% level in any of the four regressions, and are significant at a 10% level in only one case, the education model for women. We conclude that, at least for the MHAS sample, the historical census variables are more effective at model identification than are the historical policy variables.

While statistical significance is a necessary condition for the validity of the instrumental variables approach, it is now well established that it is not a sufficient condition. Recent research has shown that if the instruments are "weak," meaning that they have limited

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[10]We also estimated the education model using several alternative functional forms, including log-linear, ordered probit and Poisson. The results upon which we focus are not sensitive to these changes.

[11]We use a 10% level of significance throughout and indicate in Tables 2 and 3 significance levels of 1%, 5% and 10%. The more detailed results in Appendix Table A2 also include standard errors and P-values.

explanatory power in the first-stage regression even though statistically significant, the second-stage results of the IV model can be even more biased than a model that assumes exogeneity (Bollen et al., 1995; Bound et al., 1995; Hall et al., 1996; Moffitt, 2005; Shea, 1997; Stock and Yogo, 2005). Examination of the increase in explanatory power associated with the historical census variables is, therefore, warranted. Stock and Yogo (2005) derive thresholds for sufficient explanatory power of the first-stage instruments for alternative scenarios defined by number of variables and other factors. Examples of papers that use the Stock and Yogo metric to evaluate IV results include Beegle et al. (2010), Carstensen and Gundlach (2006), Garcia Nuñez (2008), and Shen et al. (2009).

Application of this metric to the model of age at first marriage indicates that the historical census variables meet the criterion for sufficient explanatory power to achieve minimal bias, for both men and women.[12] The Stock and Yogo metric is designed for linear models and, consequently, cannot be applied to the education model because it uses a non-linear specification. We are not aware of a comparable set of thresholds having been established for non-linear models. However, casual examination of results suggest that the explanatory power of the historical census variables is likely sufficient even in the non-linear case. The chi-squared values associated with tests of their joint significance in the education model for men and women are approximately 80 and 200, respectively. The critical value of chi-squared at a 5% level of significance in this context is only 7.82, indicating quite large increases in explanatory power upon inclusion of the historical census variables.[13]

The third question to consider in assessing the historical instrumental variables approach is whether treating age at first marriage and own education as endogenous rather than exogenous has any meaningful implications for the second-stage model of wealth. Table 3 summarizes results for two versions of the wealth model, the IV version and a version assuming exogeneity. While there are several instances of differences in statistical significance between the two versions, the results of the models in terms of significance and sign are more similar than different, for both men and women. Accordingly, it is important to also consider the predicted values associated with each version of the model, and the magnitudes of individual coefficients that are statistically signifi-cant in both the IV version and the exogenous version. Fig. 3 shows estimated values of net worth by age for the IV and exogenous models, separately for men and women. It is immediately obvious that the exogeneity assumption is more problematic for males than for females, though the results differ for both. For example, at age 70, the difference between the estimated values in the two models for women is about 1800 pesos, whereas for men at age 70 the difference is nearly 8000 pesos.

We also conduct a series of simulations to evaluate magnitudes of effects. Before examining selected simulation results for individual variables, it is useful for comparing the IV and exogenous models to consider the combined simulation effects.[14] Fig. 4 shows the baseline estimates for the IV and exogenous models, separately for men and women, along with the

[12]Minimal bias is defined as at most 5% of any bias that would exist if age at first marriage were treated as exogenous in the model of net worth (Stock and Yogo, 2005).

[13]We also estimated a linearized version of the education model; it meets the Stock and Yogo criterion for sufficient explanatory power for minimal bias.

combined simulation results for each of these four cases. It is apparent that, at almost all ages, the simulated effects are greater in the IV model than in the exogenous model, for both men and women, with the differences in general being more pronounced for men. Based on this evidence, we conclude that the estimated results of the IV model are meaningfully different in comparison to the exogenous model for both men and women, but especially for men. Furthermore, when examining the point estimates of coefficients for each individual explanatory variable, those for the IV model are most often greater than those for the exogenous model. Overall, these results suggest that models of old-age wealth which assume exogeneity of early-life outcomes are likely to under-estimate the effects of such variables for the case of Mexico.

Determinants of wealth among the elderly in Mexico

The results above suggest that the historical instrumental variables approach, and especially the historical census variables, perform well in terms of model identification, and that the instrumental variables model is meaningfully different from a model that assumes exogeneity. Accordingly, we focus on the IV results in considering the substantive implications of the model. We first briefly discuss statistical significance and then examine simulated effects of selected explanatory variables. Detailed regression results for the IV model of wealth are presented in Appendix Table A2, and summarized in Table 3, for men and women, respectively.

The two estimated explanatory variables – age at first marriage and years of own education – are both statistically significant for women (with P-values of .060 and .061, respectively), while only the latter is so for men (with a P-value of .036). Consistent with expectations, a higher level of education is associated with greater wealth in older ages for both men and women of these cohorts, as is later age at marriage among women. These results suggest that delaying marriage in order to invest in human capital or simply to be better established before taking on the financial obligations of a family contributes to the ability to accumulate assets over one's lifetime.

In contrast, an older person's earliest life background, proxied roughly by a health indicator and access to a toilet as a child, generally does not have significant effects. This result is not unexpected because, while many studies find significant effects of childhood socioeconomic status on late-life outcomes, this is far from a generalized finding as the results vary according to the outcomes being studied, the country of study and the covariates that are used. Researchers find, for example, that educational achievement mediates the influence of early-life socioeconomic status on late-life outcomes (Claussen et al., 2003; Hayward and Gorman, 2004; Osler et al., 2003).

Investing in the next generation also contributes positively to old-age wealth, as both the number of children and the highest level of education among one's children have positive

[14]Simulations are used to assess the magnitude of effects of variables that are statistically significant. The simulations included in the combined results in Fig. 4 are as follows: increase own education by 2 years, increase age at first marriage by 3 years, decrease number of children by two, increase highest education of children by 3 years, shift those in lower blue collar work to upper blue collar work, shift U.S. migrants into the non-migrant category (for men only), and increase the percentage of years employed by ten points (for women only).

and significant coefficients for both men and women. However, men and women differ somewhat in the effects of labor market experience on oldage wealth. For both men and women, the set of dummy variables indicating job type are statistically significant, even having controlled for own education, with “better” jobs being associated with greater net worth in old age. The results suggest, though, differences by gender in the areas of migration and labor market attachment. For men, migration experience to the United States is positively associated with greater wealth in old age; this is not the case for women. In contrast, while the percentage of one's years of life spent employed does not significantly affect the results for men, it is negatively associated with old-age wealth among women. For men, there is less variation in this characteristic, whereas for women this result is likely to be a reflection of economic need “pushing” women into the labor force rather than representing a true effect of lengthier employment on assets.

The controls for age are consistent with a standard life-cycle model of savings wherein those in the early years of old age are still building net worth, which they then draw down as they age further. The results also suggest that wealth holdings among the elderly are greater in rural than in urban areas, for both men and women, likely owing to the value of landholdings among rural households.

To better illustrate the implications of the regression results we present simulations for selected explanatory variables that are consistent with changes already occurring or anticipated in the next generations of the elderly in Mexico. For both men and women we simulate the effects on net worth of increasing own education, increasing children's education, decreasing numbers of children, and shifting from lower blue collar employment to upper blue collar employment (see note 14 for detailed definitions of the simulations). We also examine simulated effects on old-age wealth of increasing age at marriage and the percentage of years employed (for women only), and of limiting migration to the United States (for men only) in view of the resurgence of this policy issue. Each of these variables is statistically significant in the corresponding model. The simulation results are presented in Fig. 5.[15]

First note that for each of the four simulations in common for men and women, the pattern of the simulated effect by age is highly similar for both groups. This is not surprising given that the majority of respondents are a member of a couple with their measure of wealth derived from the same data as that of their spouse. The simulated wealth profiles are shifted to the left, towards younger years, for women in comparison to men, owing primarily to the difference in age between husbands and wives. Because of the increasing dominance of the negative second derivative of the age function as age increases and wealth is drawn down, simulated effects tend to collapse on the baseline at older ages, with this phenomenon also being shifted to the left for women relative to men.

Turning to specific simulation results, the impact of investment in human capital, either one's own or one's children's, is clear. For both men and women we see sizeable effects of a

[15]The simulation results for increasing women's employment track very closely those for shifting lower to upper blue collar and, thus, are not presented in Fig. 5.

2-year increase in own education or a 3-year increase in the highest education level of children. At the peak of the wealth functions as graphed against age (at age 60 for men and age 54 for women), the increase in own education raises predicted assets by nearly 40,000 pesos for men and about 24,000 pesos for women. The corresponding numbers for the simulated increase in children's education are about 50,000 pesos and 28,000 pesos, respectively. These are substantial increases in both absolute and relative terms (the corresponding percentage increases in the same order are 31%, 27%, 39% and 31%). Note that these effects of increased education are more pronounced for men than for women, in both absolute and relative terms.

Shifting all those labor force participants in the lower blue collar employment category to the upper blue collar employment category has positive but smaller effects on predicted wealth. Men experience on average nearly a 10% increase in predicted wealth at age 60, whereas women experience an increase of about 18%. Men and women of these older cohorts are almost equally represented in the lower blue collar category (around 35%), but women are much more of a minority in the upper blue collar category (roughly 11% vs. 21%). Upper blue collar status is a relatively scarce labor market attribute among this cohort of older women in Mexico, thus, shifting into it has a substantial impact.

The simulated decline in fertility has a modest negative effect on predicted wealth. The decline at the peak of the wealth profile is somewhat less than 7% for men and 9% for women, on average. While the estimated effect of number of children possibly involves some reverse causality (wealthier families can afford to have more children), such an influence should be substantially netted out by controlling for education and job type. We argue that this result primarily represents the greater material support during older ages that could be available from a larger number of children. In other words, this result suggests that any negative effect of high fertility on the ability of parents to accumulate savings over the life cycle is more than offset by inter-generational transfers from children to parents later in life. This conclusion makes sense in the context of Mexico and in similar settings where institutional sources of old-age support are lacking. To the extent that this conclusion is correct, declining fertility in Mexico may detract from the economic well being of the elderly if alternative forms of material support are not in place.

Finally, a simulated increase for women in age at first marriage of 3 years has a modest positive impact on the predicted wealth profile, shifting it up by about 5% at the peak. For men, an average predicted decrease in net worth of similar magnitude arises when males with migration experience to the United States are shifted into the non-migrant category. Given that only about 16% of the male MHAS sample have ever migrated to the U.S., the average effect on this portion of the sample would be much greater than the 5% average effect across the entire sample. As has been documented elsewhere, life-cycle migration of men to the United States contributes importantly to economic well being in old age for those who are back in Mexico (Wong and Gonzalez-Gonzalez, 2010).

Discussion

We aim in this paper to contribute to the literature on population aging and the life course that constructs models of late-life well being as a function of early-life conditions or outcomes. As substantive advances have been made in this area of study, there has been a gap in the empirical literature to match the conceptual innovations. One common hurdle in this advancement has been methodological, in that it is difficult to estimate late-life outcome models taking into account the endogeneity of early-life outcomes or behaviors. Thus the goals of this paper are both substantive and methodological.

With respect to the substantive goals, our results indicate that early-life behaviors are statistically significant covariates in models of wealth among the elderly in Mexico. In particular, both of the early-life behaviors treated here as endogenous, age at first marriage and years of education, are significant predictors of old-age net worth in the expected direction among women, while years of education is so for men. The simulation results, which are designed to reflect current or anticipated changes in the policy environment and societal trends, suggest that modest increases in the education levels of cohorts reaching old age or in the education of their children are associated with sizeable increases in old-age wealth, especially for men. Similarly, shifting labor force participants out of lower blue collar jobs and into upper blue collar jobs has a relatively large positive impact on old-age wealth, with this simulated effect being more pronounced among women. The simulated effects of declining fertility are of smaller magnitude but nonetheless statistically significant, and importantly are associated with lower wealth among the elderly. We argue that this is likely due to diminished monetary and in-kind transfers from younger to older generations. Our results suggest that, on average, women are at somewhat greater risk in this regard than are men. Finally, gradual increases in age at marriage for women yield modest simulated increases in wealth among elderly women.

One of the limitations of our work is that we treated only two early-life outcomes as endogenous in our models of late-life wealth, and this strategy clearly can be extended to other early-life decisions.[16] Nevertheless, we hypothesized, and the data confirmed, that if our methodological strategy was to show some effect of early-life outcomes on indicators of late-life well being, these two early-life behaviors would be useful to examine. Early entry into marriage and educational achievement are markers of two important pathways to late-life well being: family formation and human capital investments. As discussed, not only are these two indicators statistically significant for the cohorts of current older adults, but are also indicators that are likely to change as social and economic development proceeds in Mexico and in other developing countries where the population is aging rapidly.

Regarding the methodological aspect of our research, the results suggest that the use of historical variables as instruments in models of late-life well being is a promising new

[16]Another limitation of our analysis is that, due to selective mortality over the life cycle, our sample might not be representative with respect to wealth. In other words, if mortality is negatively correlated with wealth, our sample is likely to over-represent wealthier individuals in comparison to the cohorts of these individuals at younger ages. This is a common issue in empirical research on the elderly, one that cannot be addressed even with conventional panel data given that the first wave of such a data set would be subject to the same survival selectivity.

approach for empirically assessing the long-term consequences of early-life behaviors on later-life outcomes. Our approach, matching macro-level historical policy and census variables to individual records to use as instruments in modeling the endogeneity of early-life behaviors, yields a statistically identified two-stage model with minimum bias. Furthermore, the results for the model of wealth in old age are meaningfully different when comparing the two-stage instrumental variables approach with an approach that assumes exogeneity of early-life outcomes. Specifically, our results suggest that models of old-age wealth for Mexico which assume exogeneity of early-life outcomes are likely to under-estimate the effects of such variables. Finally, in the analysis of wealth among the elderly in Mexico, the historical census variables appear to be much more useful in terms of serving as statistical instruments compared to the historical policy variables. Whether these conclusions generalize to other variables and countries is an empirical question. Given that the methodology presented here can be widely applied, we anticipate that this analysis will encourage others to explore this approach in different settings and for a variety of early-life behaviors and late-life outcomes.

Appendix A

See Tables A1 and A2.

Table A1

Descriptive statistics for all variables.

Variable	Males		Females	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
Dependent variable				
Assets (log wealth)	11.59	(2.95)	11.03	(3.71)
Endogenous explanatory variables				
Years of own education	5.02	(4.83)	4.06	(3.99)
Age at first marriage	23.07	(8.03)	18.94	(7.59)
Individual-level explanatory variables				
Age	62.26	(9.46)	61.92	(9.35)
Age-squared	3966.31	(1252.64)	3921.98	(1235.46)
Flag, never married	1.17	(0.37)	1.85	(0.99)
Flag, married at young age	0.00	(0.07)	0.01	(0.08)
Flag, missing age at marriage	0.02	(0.14)	0.02	(0.13)
Urban residence around age 10	0.24	(0.43)	0.25	(0.43)
Urban now, unknown age 10	0.41	(0.49)	0.43	(0.5)
Rural now, unknown age 10	0.16	(0.36)	0.15	(0.36)
Poor health around age 10[a]	0.09	(0.28)	0.09	(0.28)
Had toilet around age 10	0.31	(0.46)	0.35	(0.48)
Urban residence	0.65	(0.48)	0.68	(0.47)
Number of marriages	1.20	(0.65)	1.07	(0.46)
Number of children	5.91	(3.63)	6.04	(3.67)
Highest education of children	11.27	(4.85)	11.19	(5.07)

Variable	**Males**		**Females**	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
Age at first job	13.31	(5.08)	12.89	(12.8)
% of life worked	0.69	(0.16)	0.24	(0.27)
Job type (reference = agriculture or not employed)				
Agriculture or not employed	0.29	(0.45)	0.39	(0.49)
Upper white collar	0.13	(0.33)	0.08	(0.27)
Lower white collar	0.03	(0.17)	0.06	(0.23)
Upper blue collar	0.21	(0.41)	0.11	(0.31)
Lower blue collar	0.35	(0.48)	0.37	(0.48)
Former U.S. migrant	0.16	(0.37)	0.03	(0.18)

[a]Experienced any of four serious diseases (tuberculosis, rheumatic fever, polio, or typhoid fever) or suffered a serious head injury.

Table A2

Detailed results for model of net worth for males and females aged 50 or older, instrumental variables approach and exogenous approach.

	Males						**Females**					
	IV model			**Exogenous model**			**IV model**			**Exogenous model**		
	Coef.	**Std. Err.**	***P*-value**	**Coef.**	**Std. Err.**	***P*-value**	**Coef.**	**Std. Err.**	***P*-value**	**Coef.**	**Std. Err.**	***P*-**
Endogenous explanatory variables[a]												
Age at marriage	0.011	0.007	0.138	0.005	0.005	0.319	0.016	0.008	0.060	0.022	0.006	0.
Education (years)	0.134	0.064	0.036	0.094	0.012	0.000	0.118	0.063	0.061	0.112	0.017	0.
Individual-level explanatory variables												
Age	0.177	0.057	0.002	0.144	0.048	0.003	0.279	0.058	0.000	0.274	0.056	0.
Age-squared	–0.001	0.000	0.000	–0.001	0.000	0.000	–0.003	0.000	0.000	–0.003	0.000	0.
Poor health around age 10	0.091	0.134	0.498	0.059	0.132	0.654	–0.158	0.157	0.313	–0.140	0.156	0.
Had toilet around age 10	–0.455	0.264	0.085	–0.107	0.094	0.258	–0.280	0.214	0.191	–0.088	0.105	0.
Urban residence	–0.305	0.154	0.048	–0.102	0.098	0.300	–0.351	0.136	0.010	–0.232	0.104	0.
Number of marriages	–0.123	0.061	0.042	–0.105	0.059	0.078	–0.112	0.111	0.313	–0.132	0.101	0.
Number of children	0.035	0.012	0.004	0.050	0.012	0.000	0.045	0.014	0.001	0.068	0.014	0.
Highest education of children	0.110	0.009	0.000	0.095	0.009	0.000	0.089	0.010	0.000	0.069	0.010	0.
Age at first job	0.006	0.008	0.485	–0.004	0.008	0.660	–0.006	0.005	0.173	–0.007	0.005	0.
% of life worked	0.095	0.259	0.713	0.121	0.257	0.638	–0.777	0.206	0.000	–0.722	0.204	0.
Job type (reference = agriculture or not employed)												
Upper white collar	0.868	0.159	0.000	0.259	0.177	0.143	1.154	0.225	0.000	0.467	0.247	0.
Lower white collar	–0.002	0.241	0.994	–0.250	0.241	0.298	0.592	0.235	0.012	0.228	0.241	0.
Upper blue collar	0.235	0.129	0.069	0.115	0.129	0.372	0.556	0.198	0.005	0.465	0.198	0.
Lower blue collar	–0.286	0.114	0.012	–0.304	0.113	0.007	–0.357	0.150	0.017	–0.302	0.150	0.
Former U.S. migrant	0.312	0.105	0.003	0.317	0.104	0.002	0.391	0.249	0.117	0.340	0.249	0.
Number of Obs.	5384			5381			6487			6484		

	Males						Females					
	IV model			Exogenous model			IV model			Exogenous model		
	Coef.	**Std. Err.**	***P*-value**	**Coef.**	**Std. Err.**	***P*-value**	**Coef.**	**Std. Err.**	***P*-value**	**Coef.**	**Std. Err.**	***P*-**
F	30.03			33.32			36.77			39.93		
Prob. < *F*	0.0000			0.0000			0.0000			0.0000		
R-squared	0.0869			0.0955			0.0881			0.095		
Adjusted *R*-squared	0.0840			0.0927			0.0857			0.0926		

[a]Endogenous explanatory variables included in the IV Model are estimated variables.

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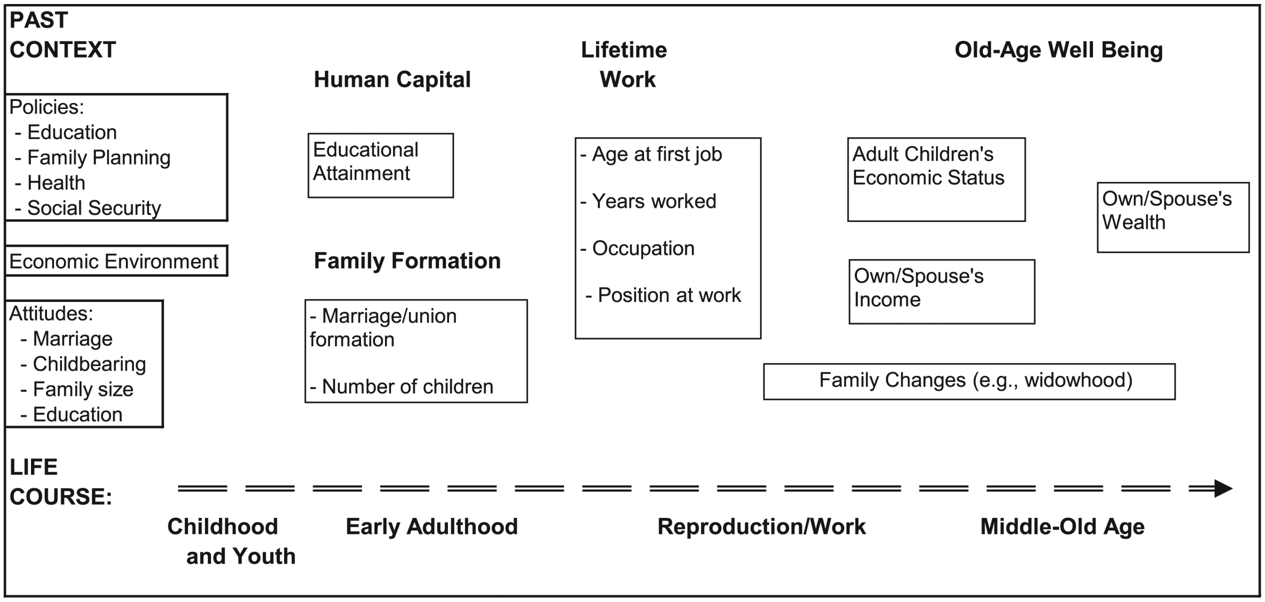

Fig. 1.
Conceptual framework to study the impact of life-course decisions on old-age economic well being.

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	Census Year				
Lagged Age Sex Ratios	**1910**	**1921**	**1930**	………	**1970**
M(15-19)/F(10-14)	sex ratio 11	sex ratio 12	sex ratio 13	……….	sex ratio 17
M(20-24)/F(15-19)	sex ratio 21	sex ratio 22	sex ratio 23	……….	sex ratio 27
M(25-29)/F(20-24)	sex ratio 31	sex ratio 32	sex ratio 33	……….	sex ratio 37
………..	……….	……….	……….	……….	……….

Fig. 2.
Matching method for instrumental variable, sex ratio.

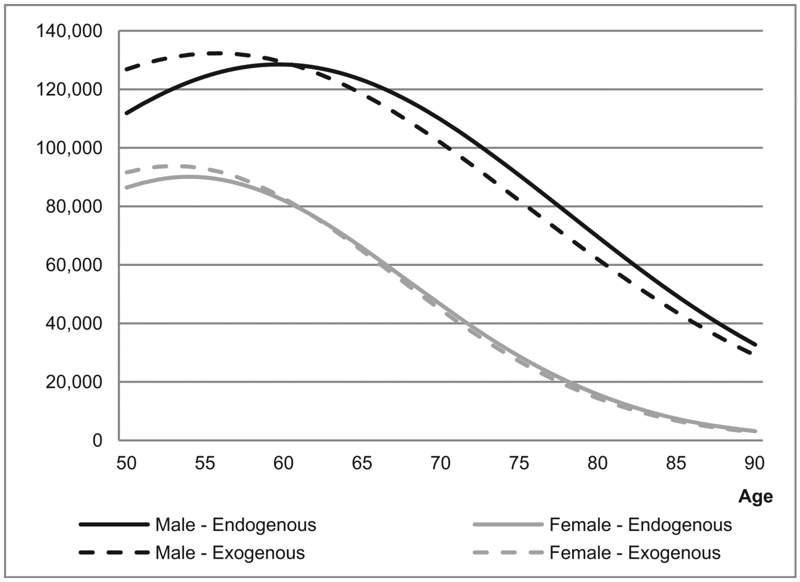

Fig. 3.
Estimated net worth, by gender and model.

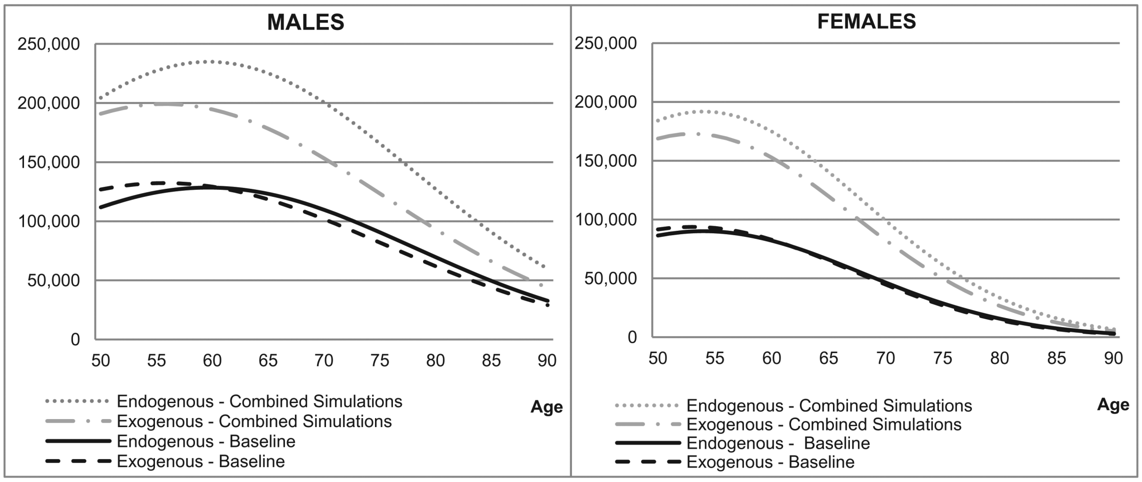

Fig. 4.

Estimated net worth, IV and exogenous models, by gender.

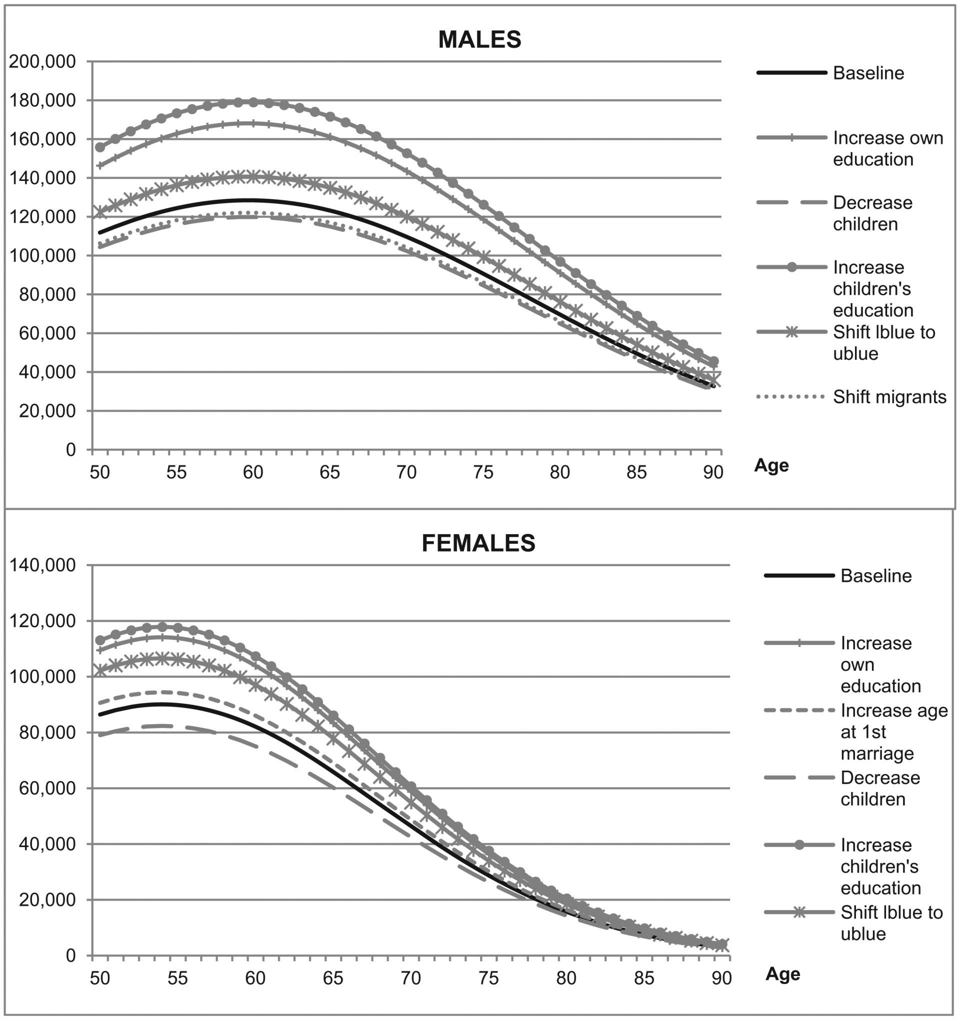

Fig. 5.

Estimated net worth, multiple simulations using IV models, by gender.

Table 1

Descriptive statistics for matched historical census and context variables.

Variable	Definition	Males		Females	
		Mean	Std. Dev.	Mean	Std. Dev.
Sex ratio	Age-lagged male-to-female sex ratio	77.09	(4.29)	77.65	(4.76)
Literacy rate	Sex-specific literacy rate	51.38	(7.75)	44.05	(7.86)
% married	Sex- and age-specific percentage married	50.42	(24.61)	49.62	(22.6)
1917 policy	Elementary education of children mandatory	9.97	(0.41)	9.97	(0.39)
1943 policy	National education campaign, emphasized literacy	7.30	(3.91)	7.48	(3.83)
1960 policy	Program that provided school textbooks at no cost	1.08	(1.88)	1.11	(1.91)

Table 2

First-stage results, determinants of age at marriage and years of education for males and females aged 50 or older.

	Males				Females			
	Age at marriage		Education (years)		Age at marriage		Education (years)	
Historical explanatory variables								
Sex ratio	0.181	***	–0.002		0.108	***	0.001	
% married	0.137	***	0.004	***	0.142	***	0.005	***
Literacy rate	–0.071	**	0.001		–0.066	***	–0.001	
1917 policy	1.083	***	0.069	*	0.668	***	–0.051	
1943 policy	0.030		0.015	*	–0.651	***	–0.011	**
1960 policy	–0.037		–0.003		–1.217	***	–0.028	***
Individual-level explanatory variables								
Age	–1.232	***	–0.119	***	–2.435	***	–0.076	***
Age-squared	0.009	***	0.001	***	0.015	***	0.000	**
Flag, never married	–21.005	***	0.205	***	–18.106	***	0.387	***
Flag, married at young age	–23.092	***	–0.165		–17.813	***	–0.171	
Flag, missing age at marriage	–21.046	***	–0.002		–17.644	***	–0.004	
Urban residence around age 10	0.370	*	0.366	***	0.404	**	0.265	***
Urban now, unknown age 10	0.490	**	0.449	***	0.411	***	0.297	***
Rural now, unknown age 10	0.267		0.155	***	0.028		0.018	
Poor health around age 10	–0.556	**	–0.009		–0.180		0.059	*
Had toilet around age 10	0.699	***	0.495	***	0.757	***	0.447	***
Number of observations	5659		5656		6699		6696	
R-squared/Chi-squared	.608		1335.42		.667		1360.96	

* $P < 0.1$

** $P < 0.05$

*** $P < 0.01$.

Table 3

Second-stage results, determinants of net worth for males and females aged 50 or older, instrumental variables approach and exogenous approach.

	Males				Females			
	IV model		Exogenous model		IV model		Exogenous model	
Endogenous explanatory variables [a]								
Age at marriage	0.011		0.005		0.016	*	0.022	***
Education (years)	0.134	**	0.094	***	0.118	*	0.112	***
Individual-level explanatory variables								
Age	0.177	***	0.144	***	0.279	***	0.274	***
Age-squared	–0.001	***	–0.001	***	–0.003	***	–0.003	***
Poor health around age 10	0.091		0.059		–0.158		–0.140	
Had toilet around age 10	–0.455	*	–0.107		–0.280		–0.088	
Urban residence	–0.305	**	–0.102		–0.351	**	–0.232	**
Number of marriages	–0.123	**	–0.105	*	–0.112		–0.132	
Number of children	0.035	***	0.050	***	0.045	***	0.068	***
Highest education of children	0.110	***	0.095	***	0.089	***	0.069	***
Age at first job	0.006		–0.004		–0.006		–0.007	
% of life worked	0.095		0.121		–0.777	***	–0.722	***
Job type (reference = agriculture or not employed)								
Upper white collar	0.868	***	0.259		1.154	***	0.467	*
Lower white collar	–0.002		–0.250		0.592	**	0.228	
Upper blue collar	0.235	*	0.115		0.556	***	0.465	**
Lower blue collar	–0.286	**	–0.304	***	–0.357	**	–0.302	**
Former U.S. migrant	0.312	***	0.317	***	0.391		0.340	
Number of observations	5384		5381		6487		6484	
R-squared	.087		.096		.088		.095	

* $P < 0.1$

** $P < 0.05$

*** $P < 0.01$.

[a] Endogenous explanatory variables included in the IV Model are estimated variables.