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Abstract[1]

Peruvian society has achieved significant improvements in terms of lower fertility and mortality over the last forty years, which has brought down population growth rates to less than 1.2% a year. These improvements have led, on average, to a demographic transition with lower dependency ratios. In general, this transition increases the ability of the society to take proper care of its non-working population groups, children and the elderly, which may be reflected in changes in household structure.

We identify stylized facts about the implications of these changes at the micro level through the use of pseudo-panels from household-level data for Peru. We calculate age, cohort and year effects for variables related to household structure, educational attainment, labor force participation and savings.

We find some evidence that suggests differences, by educational level, in the Peruvian demographic transition. Household size is smaller for the younger cohorts in all households but those with less educated heads. We argue that these different profiles are explained by the fact that reductions in fertility have not reached the less educated. On the one hand, these differences in household size patterns are similar to those in the number of children. On the other hand, cohort patterns in family living arrangements—i.e., households with extended families—are similar across educational groups.

However, family living arrangements change throughout the life cycle, in the sense that extended families are more common for households with very young (under 25) and elderly (over 60) heads. These changes in family arrangements over the life cycle add confusion to the meaning of headship, since in some cases the household reports as its head the older member and in other cases the main income earner.

We also find that younger cohorts are more educated, are larger than older ones, and show lower returns to education. This is consistent with an increase in relative supply of educated workers that outpaces the increase in relative demand induced by economic growth, under the assumption of imperfect substitutability between equally educated workers of different cohorts.

Finally, we show that intergenerational family arrangements over the life cycle limit the ability of the life cycle hypothesis (LCH) to explain household savings behavior. We find evidence that Peruvian households, especially the less educated, smooth consumption over the life cycle, not only through the typical saving-dissaving mechanism, but also by smoothing income. Net cash transfers, or living arrangements between parents and their offspring, play an important role in this income smoothing.

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1. Introduction

Countries all over the world have moved from a relatively high fertility-high mortality scenario towards a low fertility-low mortality scenario over the twentieth century.[2] At different times and paces, they have all moved in that direction, although huge differences remain. Industrialized countries, for instance, currently enjoy an average life expectancy of 75 years, and a fertility rate of about 2 children per woman (UNICEF, 1995, 1996). Four decades ago, these countries already had a life expectancy of 68 years and a fertility rate of 2.6, figures most of the developing world have not reached even during the 1990s, despite spectacular advances in many developing countries.

How do these demographic changes affect the social and economic performance of a country? A direct demographic effect is the change in the age composition of the population. With high fertility and high mortality, population grows faster and each new generation is larger than the previous one, resulting in a very young population.[3] Later, as fertility falls, and lower mortality implies that more people live longer, the population ages. Consequently, we move from a high children dependency rate towards a high elderly dependency rate. The demographic transition is characterized as a situation in which reductions in the number of newborn outweigh the increments in the number of the elderly, and this happens because the latter are a very small portion of the population at the beginning of the process. During the transition, though, total dependency rate, the sum of the two, is lower.

During the first stage, the most critical issue is how to deal with children, for instance, in terms of investments in their nutrition, health, and education. During the demographic transition, the total dependency rate is relatively low and resources can be used to improve the welfare of all the population. As the final stage approaches, the issues move towards how society will manage to sustain the elderly. This is a particularly

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[2] Generally, though, the decline in mortality rates has preceded the decline in fertility rates by several decades.

[3] Actually, if infant mortality is too large, or life expectancy is too low, in a country, then lower mortality means more children or more women living all the way through her fertile years. Thus, at very high mortality, reductions in mortality might actually imply a younger population. This effect does reduce the effect of mortality on aging but it is not that important at the current level of development of most countries.

important challenge in the future of developing countries considering that the proportion of the population under any kind of formal pension system is not that high.

The demographic transition does not only affect the patterns of inter-generational transfers (see Duryea and Székely, 1998), but also intra-household production, investment and consumption strategies. With lower fertility rates, households on average might have more resources per child, and that might result in higher investments per child in education, for instance. Also, as women have to devote less time to child rearing activities, they might also invest more in their education and participate more in the labor market.

An important issue in developing countries is that, in the absence of an efficient public system of social security, households have implemented social networks to reduce the effect of shocks and care for dependent family members. These social networks make it possible to implement inter-generational transfers in the form of cash, or they may imply changes in household structure (Subbarao *et al*., 1995). For instance, family arrangements may include mechanisms such as the junction of two families in one household. A young married couple might decide to live with their parents in order to offer proper care to their offspring. Alternatively, elderly parents might join their children's household so that they can support them during his/her retirement years. An important question, less treated in the literature, is how these arrangements would be affected by the demographic transition described above.

The goal of this paper is to identify the *stylized facts* of the Peruvian demographic transition and of its differentiated effects by level of education. We focus on the analysis of changes in household structure, investments in education, female labor force participation, returns to education and savings. For this purpose we use four nationwide household surveys (Peruvian Living Standards Measurement Surveys—PLSMS) applied in 1985, 1991, 1994 and 1997. We do not use the small panel that could be constructed with those databases, but instead construct a pseudo-panel by following each cohort over time. Differences across cohorts are the ones more directly related to the demographic transition, so that we need to identify them separately from the age and year effects that come with the data. Nevertheless, while doing so, we also analyze the life cycle patterns in the variables under analysis, which provide important additional insights.

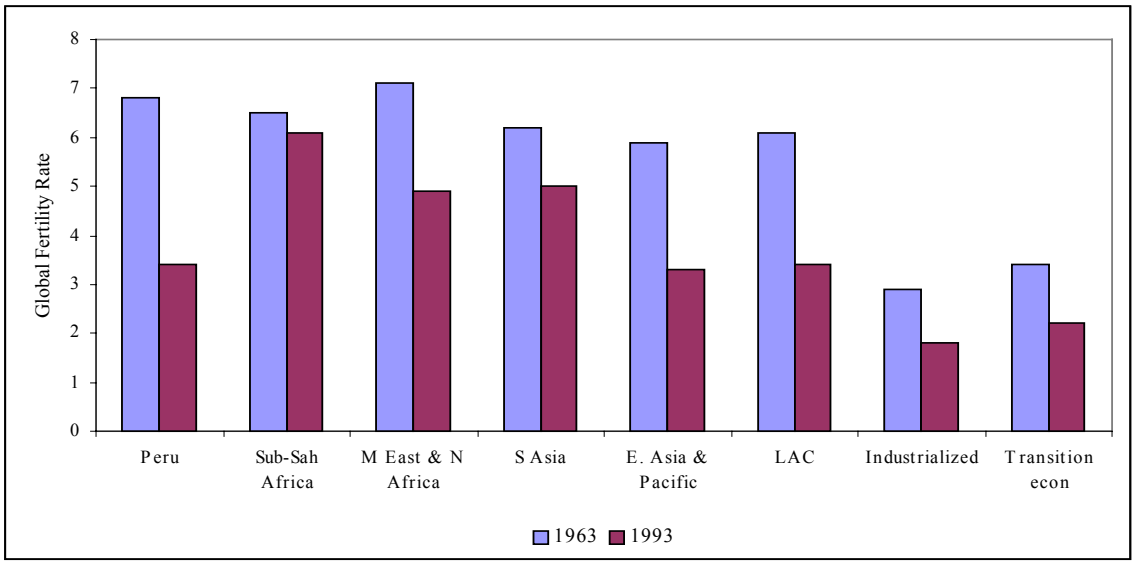
The rest of the document is organized as follows. Section 2 locates the Peruvian demographic transition, in terms of fertility and infant mortality, vis-a-vis the process in the rest of the world, in particular, East Asian countries and the rest of Latin America. Next, Section 3 discusses the nature of the age, cohort and year effects, as well as the identification problem, and presents the identification strategy proposed in this document, which is based on Heckman and Robb (1995). Section 4 describes the construction of the database used in this study, that is, the general characteristics of the constructed pseudo-panel. Sections 5-7 discuss the findings of this study in terms of the age and cohort effects for household structure, individual educational attainment and performance in the labor market (labor force participation and returns to education) and household savings. Section 8 concludes with a summary of findings and some final remarks.

2. The Demographic Transition in Peru

The demographic transition experienced by a country or a group of countries over time can be described by a number of indicators such as fertility, infant mortality, life expectancy, and population growth, among others. Here, we use the evolution of fertility and infant mortality to locate the Peruvian demographic transition in relation to those in other parts of the world.

Figure 1 shows that the fertility rate in Peru has dropped from 6.8 children per woman in the early 1960s to 3.4 in the early 1990s. This transition was similar to the average in Latin America and East Asia and the Pacific, although fertility in Peru was slightly higher in the 1960s. The reduction in fertility in industrialized and transition economies was smaller, but their levels in the 1960s were already small (2.9 and 3.5, respectively). On the other hand, countries in the Middle East, Africa, and South Asia are still behind in the demographic transition process, with higher fertility rates in the 1990s and smaller observed changes during the last three decades.

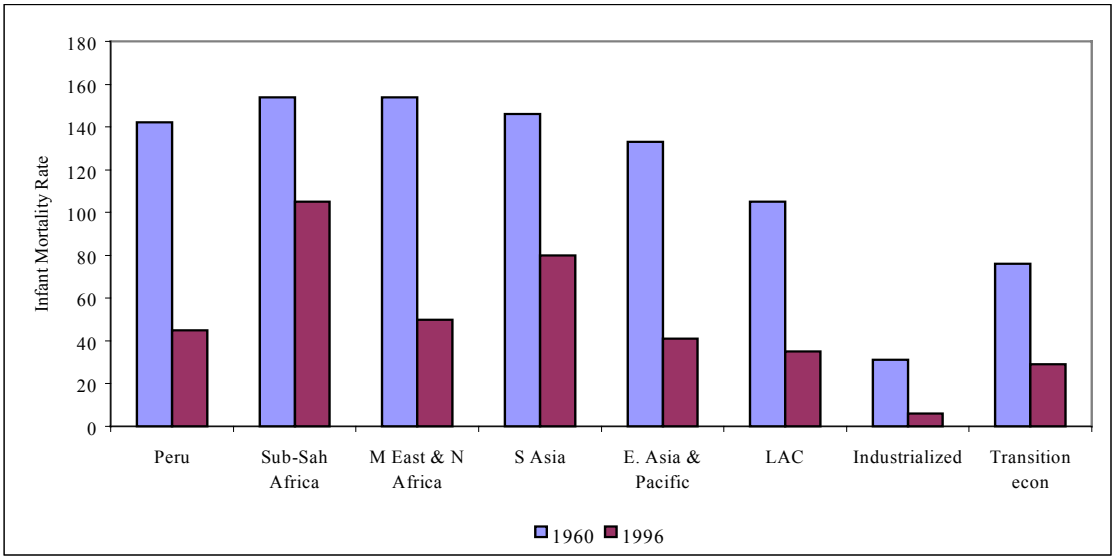
Figure 1. Global Fertility Rate, 1963-1993
(In number of births per woman)



Source: UNICEF.
Note: Regional averages are unweighted averages of country-level data.

Figure 2 shows that infant mortality in Peru also fell significantly between the early 1960s and the early 1990s. In 1960, 140 infants died out of every 1,000 live births. That number has dropped to 42 in 1996. As in the case of fertility, this transition is similar to that of the average in Latin America and East Asia and the Pacific, although in the 1960s mortality rates in Peru were higher than the Latin American average and approaching those in Southeast Asia. Industrialized and transition economies are ahead in the demographic transition, while African, Middle Eastern and South Asian countries remain significantly behind.

Figure 2. Infant Mortality Rate, 1963-1993
(per 1,000 live births, children under 1 year)



Source: UNICEF.

Reductions in mortality have actually affected all age groups resulting in higher life expectancy at birth. In Peru, life expectancy for males has increased from 57 to 60 years over the last 20 years. The corresponding figures for females are 66 and 71 (see WHO, 1999). With life expectancy for Peruvian females already above fertile years, further improvements will indeed imply aging of the Peruvian population.

Overall, the Peruvian demographic transition seems to be very similar in timing and speed to that of East Asian and Pacific countries. This result is interesting in the sense that several studies have recently focused on the effects of these changes over the social and economic behavior of individuals and families in countries of that region such as Taiwan (Lee *et al*., 1998; Deaton and Paxson, 1993, 1998). The main difference between Peru and Taiwan is the respective growth rates of their economies during the period of analysis. While Taiwan experienced very high growth rates over the last four decades, the Peruvian economy displayed, by the end of the 1990s, a level of per capita GDP similar to that of twenty years before. The lack of growth may imply different effects of the demographic transition on dynamic economic behavior by Peruvian households.

The observed changes in fertility and mortality generate a change in the age structure of the population. According to the last two National Censuses the proportion of young people has started to diminish. As shown in Table 1, the proportion of children under 15 years old fell from 38.6% to 34% between 1981 and 1993. Meanwhile, the proportion of people over 60 years old increased from 5.6% to 6.8% in the same period. Consequently, the Peruvian population is already aging. Even if the reduction in the size of younger cohorts implies a reduction in supply pressures in the labor market, the increase in the proportion of older workers will imply a serious burden on younger cohorts. Moreover, people who in the 1990s were 50 years or older have their pensions tied to the old pay-as-you-go system and have higher life expectancy rates.

Table 1. Basic Demographic Indicators

	Census data					
	Female		Male		Total	
	1981	1993	1981	1993	1981	1993
Total population (in thousands)	8515	11092	8489	10956	17005	22048
% of children (<=15)	40.7	36.2	41.8	37.8	41.2	37.0
% of adults (16-60)	53.0	56.6	52.4	55.4	52.7	56.0
% of old people (>60)	6.3	7.2	5.8	6.8	6.1	7.0
Youth dependency ratio*	----	----	----	----	0.78	0.66
Elderly dependecy ratio**	----	----	----	----	0.11	0.13

Source: Peru's Living Standards Measurement Studies Household Surveys 1985, 1991, 1994 & 1997.
* Number of children / Number of adults
** Number of old people / Number of adults

With these figures, the youth dependency ratio (ratio of people with less than 14 years with respect to the working age population, between 15 and 65) fell from 0.78 to 0.66 according to the Census. The old age dependency ratio, the ratio of those aged more than 65 to the working age population-shows a downward trend, both in the Census—from 11.5% to 12.6%—and using the LSMS data.

Before the analysis of the changes in household structure, labor force participation, educational attainment, returns to schooling, and savings in Peru, we discuss the nature of the age, cohort and year effects at hand, and describe the strategy followed to identify them separately in each case.

3. Disentangling Age, Cohort and Year Effects

As indicated in the previous section, the idea in this paper is to infer the life cycle path and cohort differences for variables such as household size, educational attainment, labor force participation, returns to education and savings. It is clear that we cannot obtain cohort and life cycle (age) effects from a cross-section of individuals or households, since in that case we observe each generation at a certain age. A panel would be the best case, since we observe each individual at different ages, although we still need to consider that part of the differences across cohorts may be explained by differences in the characteristics of the individuals. The issue is more complicated here since the data available (LSMS) is not a panel but four repeated cross-sections (1985-86, 1991, 1994 and 1997). In what follows, we first describe the factors that are understood to be behind the age-cohort and year effects, and then explain the strategy followed to identify them depending on the characteristics of the variable.

3.1 Understanding the Age, Cohort and Year Effects

The age effect is associated with varying abilities or preferences of individuals over the life cycle. For instance, we would expect a hump shape profile for individual log income over the life cycle. Initially, log income increases with productivity as a result of accumulated experience. The marginal increase diminishes the more experienced the individual, and as the individual ages he may lose some of his ability to perform certain activities. Consequently, at a certain age, income may start to decrease with age, retirement being the consolidation of such a process. In the case of the labor force participation of females over the life cycle, fertility decisions are identified as crucial in the expected nature of age effects.

The identification of the cohort effect is more subtle. The more direct components of the cohort effect refer to behavioral changes, such as those of females from younger cohorts who tend to stay longer in school, have fewer children and work more. For productivity or earnings, the empirical literature for developed countries seems to relate the cohort effect with aggregate factors that affect certain cohorts relatively more. Examples of such factors include:

i) *demographic changes affecting the cohort's size*. The idea is that labor markets for different cohorts are not totally integrated, so individuals that belong to larger cohorts may face more competition, which may have a negative effect over earnings (MaCurdy and Mroz, 1995) This factor has been particularly important in the case of the American *baby boom*, but also in developing countries with an important rural-urban migration process.

ii) *differences in the access and quality of productivity-enhancing public and private goods*. Access and quality of education and health services and nutritional standards during childhood may vary across cohorts as a result of changes in public investments in human capital, or in the economic welfare of the previous generation. Differences in education, health and nutritional investments can permanently affect the productivity of individuals (Deaton and Paxson, 1993). In the case of Peru, migration to urban areas and the deterioration in the quality of public education and health services would play an important role in the determination of cohort effects among Peruvian households.

Finally, year effects generally capture macroeconomic effects that condition the income generating capabilities of all individuals and households. For the Peruvian data used here, this effect is particularly important since a major long recession occurred between 1985 and 1994. In that sense, the data of 1991 implies lower income and expenditures for all households.

3.2 Identifying Age, Cohort and Year Effects

We first discuss here the simplest case, the one in which there are none or negligible age and year effects. That would be the case, for instance, of educational attainment by adult individuals, considering that formal schooling is normally pursued during the first 25 years.[4] We may assume, then, that for individuals older than 25 years old there will not be further changes in educational attainment. Consequently, for these types of variables, we can concentrate on the cohort differences without any concern for age and year effects.

[4] Excluding training activities that usually continue through adulthood. College education might also continue after that age, but the size of that group is negligible in the sample.

The second case is that of variables that would arguably have age and cohort effects, but negligible year effects. For instance, differences in the number of children among women may come as a result of age differences, since fertility years go from, say, 12 years to about 45 years old, but also as a result of fertility decisions associated with differences in information and preferences across cohorts. Although the timing of births may be affected by the economic situation of the family in a particular year, that would arguably be less true for the number of children.

What we can do in that case is to mimic a panel by following the different cohorts over the years. By pooling the individuals who were born in 1975, as well as those who were 20 years old in 1985, we can follow the same cohort when they are 26 in 1991, 29 in 1994 and 31 in 1997. We can do the same for the individuals born in 1974, who are 21 in 1985, and so on. Then, we can plot the cohort averages on the age of the individual. This kind of plot does indeed reveal important information on the life cycle path of the variable of interest as has been shown extensively in the literature. (see, for instance, Browning, Deaton and Irish, 1985). Formally, we can obtain the age and cohort effects by running a regression based on the following expression:

$$y(a,c) = \alpha_c D^c + \alpha_a D^a \qquad (1)$$

where D^a and D^c are vectors of dummies identifying the age group and cohort, respectively, to which the individual or household head belongs.

The issue is that the life cycle path obtained this way is somewhat distorted by the simultaneous presence of cohort and year effects, which may be very important for variables such as labor force participation, returns to schooling, or household savings. In order to estimate a clean life cycle path, we need to control for these other effects. However, that correction is not that simple because of an identification problem that we describe below.

The Identification Problem

The empirical identification of age, cohort and year effects has been vastly discussed in the literature. In general, the empirical analysis is based on the estimation of an expression such as (2),

$$y(a,c,t) = \alpha_c D^c + \alpha_a D^a + \alpha_t D^t \quad (2)$$

where D^a and D^c are defined as in (1), and D^t is a vector of dummies identifying the year in which the household was interviewed. The identification problem is associated with the fact that the three effects are linearly dependent; that is, once we know the cohort to which the individual (household head) belongs and the year in which he/she was interviewed, we also know exactly his/her age $(a = t - c)$.

A popular solution to this identification problem is to restrict the year effects (α_t). Work by Deaton and Paxson (1993) and Attanasio (1998), for example, forces the year effects sum to zero and to be orthogonal to deterministic trends.[5] By doing that, we guarantee that any deterministic time trend would be attributed to age and cohort effects and not to time. The limitation of this approach is that it does not make any specific use of all the available information about the nature of age, cohort or year effects for the different variables under analysis. In what follows, we discuss the strategies followed to identify these effects for the variables of interest.

The Proposed Identification Strategy

Business cycle fluctuations are the most common source of the year effect associated with variables such as labor force participation, returns to schooling and savings. Peruvian and international empirical literature presents clear evidence on the procyclical nature of fluctuations in these variables. For the Peruvian case, the procyclicality of labor force participation is documented in Terrones and Calderón (1993) and in Saavedra (1998). Saavedra and Maruyama (1999) also report evidence of procyclical fluctuations in returns to education.

In this sense, it could be argued that the year effect is closely related to the evolution of per capita GDP. If per capita GDP has a trend over the period of analysis, the incorporation of this information may generate estimated age and cohort effects significantly different from those obtained using the identification restriction of Deaton and

[5] Actually, Attanasio's procedure is slightly different from that derived from (2), since he assumes a specific functional form for the age effect, a five-degree polynomial on age. See also Attanasio and Székely (1998).

Paxson (1993) and Attanasio (1998). Heckman and Robb (1995) show that the latent variable model would provide an appropriate framework to operationalize the inclusion of this type of information. We could first generalize (2) as follows,

$$y(a,c,t) = P_a + E_c + M_t \tag{3}$$

where P_a denotes the age effect, E_c denotes the cohort effect, and M_t denotes the year effect, which are assumed to be linearly dependent. Although all these effects are actually unobservable, we may know their functional form, say, those in (4)-(6).

$$P_a = f(Z_a;\theta_a) + \eta_a \tag{4}$$

$$E_c = g(Z_c;\theta_c) + \eta_c \tag{5}$$

$$M_t = h(Z_t;\theta_t) + \eta_t \tag{6}$$

where Z_a , Z_c , and Z_t denote the vectors of observable variables that affect the age, cohort and year effects, respectively. η_a, η_c, η_t are the error terms associated with unobservable variables or measurement error, $E(\eta_j / Z_j) = 0,\ j = a,c,t$, and $E(\eta'\eta) = \sum$. Since we do not observe the age-cohort-year effects, we cannot run the regressions in (4)-(6). What we can do, though, is to replace them in (3) and estimate the reduced form equation. We do that here by specifying the functional forms for the three effects as presented in (4′)-(6′):

$$P_a = \alpha_a D^a + \eta_a \tag{4′}$$

$$E_c = \alpha_c D^c + \eta_c \tag{5′}$$

$$M_t = \alpha_t Y_t + \eta_t \tag{6′}$$

where Y_t is the log per capita GDP for year t. That is, we assume no specific functional form nor specific observable variable associated with the year and cohort effects. We do solve the identification problem in (2) by assuming that the log of per capita GDP is a good proxy for the year effect. Then, we estimate the age and cohort effects by running the following regression:

$$y(a,c,t) = \alpha_a D^a + \alpha_c D^c + \alpha_t Y_t + \eta_{act} \tag{7}$$

where $\eta_{act} = \eta_a + \eta_c + \eta_t$.

We use this particular identification strategy but add more structure to the econometric models to control for certain important other effects. For instance, the age and cohort effects for family size and savings are obtained by estimating a variant of (7) that considers differences across levels of education (3 in the case or urban households and 2 in the case of rural households). We also allow for different year effects, as approximated by the log per capita GDP, depending on the nature of the "centro poblado" (urban/rural). The estimation of age and cohort effects for the returns to schooling adds additional controls, such as individual experience, among others.

Another issue is that, for certain variables, the relevant unit of analysis is not the individual but the household. That would be the case, for instance, for savings. In such a case, we can use the age and cohort of the household head as reference, but such a solution is affected by household formation decisions over the life cycle. Changes in household size as a result of the birth of a child, or the moving away of an older son/daughter as a result of marriage, can potentially affect the life cycle path. This issue is addressed later where necessary.

4. The PLSMS Pseudo-Panel

We first pool the four cross-section surveys at both individual and household level, considering that the unit of analysis would vary according to the nature of the variable under consideration. Then, we stratify the data based on age, cohort, education and gender. First, we defined the interval for the age and cohort groups to be 5 years, partly based on the limitations of the sample size but also on the length of the time interval between surveys. We distinguish three educational levels: up to six years of schooling (primary school—educ = 0), up to 11 years of schooling (secondary school—educ = 1), and with more than 11 years of schooling (at least some post-secondary school—educ = 2). For the household-level pool, the sample is stratified based on the characteristics of the self-reported household head.

Table 2[a]. Sample Size by Cohort and Level of Education
Household Level Pseudo-Panel—PLSMS 1985, 91, 94 and 97

Cohort	Age in 1985	Educ = 0	Educ = 1	Educ = 2	Peru
1	20-24	208	326	95	629
2	25-29	358	447	216	1,021
3	30-34	478	718	315	1,511
4	35-39	719	665	330	1,714
5	40-44	795	552	304	1,651
6	45-49	873	378	250	1,501
7	50-54	1,006	313	161	1,480
8	55-59	945	252	110	1,307
9	60-64	710	189	106	1,005
10	65-69	542	135	65	742
11	70-74	388	69	24	481
12	75-79	214	36	19	269
Total		7,236	4,080	1,995	13,311

The household-level pool has been restricted to "normal" households. In that sense, we excluded one-person households and households with single heads. It is usually argued that this type of households will not necessarily fit the typical behavior pattern assumed for the LCH (see, for instance, Attanasio and Browning, 1995). Still, we included households whose heads had a present partner, even when they were not married, as well as households with widowed, divorced or separated heads. Also, we decided to keep households with heads employed as independent workers. These households have often been excluded because it is difficult to separate the expenses of the household as a firm from the household's consumption. Nevertheless, had we excluded this group, our sample size would have been reduced too much, limiting our ability to differentiate our analysis by levels of education.

The other discriminating criterion was the age of the household head. Generally, it is argued that households with heads approaching retirement change their saving patterns away from the life cycle motive. We decided to limit the analysis to cohorts 79 years of age or younger in 1985. After all these discrimination procedures, the sample is reduced to a total of 13,311 observations, distributed in twelve five-year cohorts as follows:

Table 2b. Sample Size by Cohort and Level of Education
Individual Level Pseudo-Panel—PLSMS 1985, 91, 94 and 97

Cohort	Age in 1985	Educ = 0	Educ = 1	Educ = 2	Peru
1	15-20	1,496	3,153	1,148	5,797
2	20-24	1,267	2,247	1,208	4,722
3	25-29	1,255	1,785	985	4,025
4	30-34	1,523	1,342	744	3,609
5	35-39	1,531	969	508	3,008
6	40-44	1,539	612	375	2,526
7	45-49	1,647	492	244	2,383
8	50-54	1,471	379	156	2,006
9	55-59	1,180	294	150	1,624
10	60-64	888	215	91	1,194
11	65-+	1,650	227	84	1,961
Total		15,447	11,715	5,693	32,855

5. Household Structure Decisions

We analyze here the age and cohort patterns of household size and age composition, as well as other important household decisions. In particular, we analyze the household decision to host more than one nuclear family, and in that case, the decision on who is reported as the head of the household.

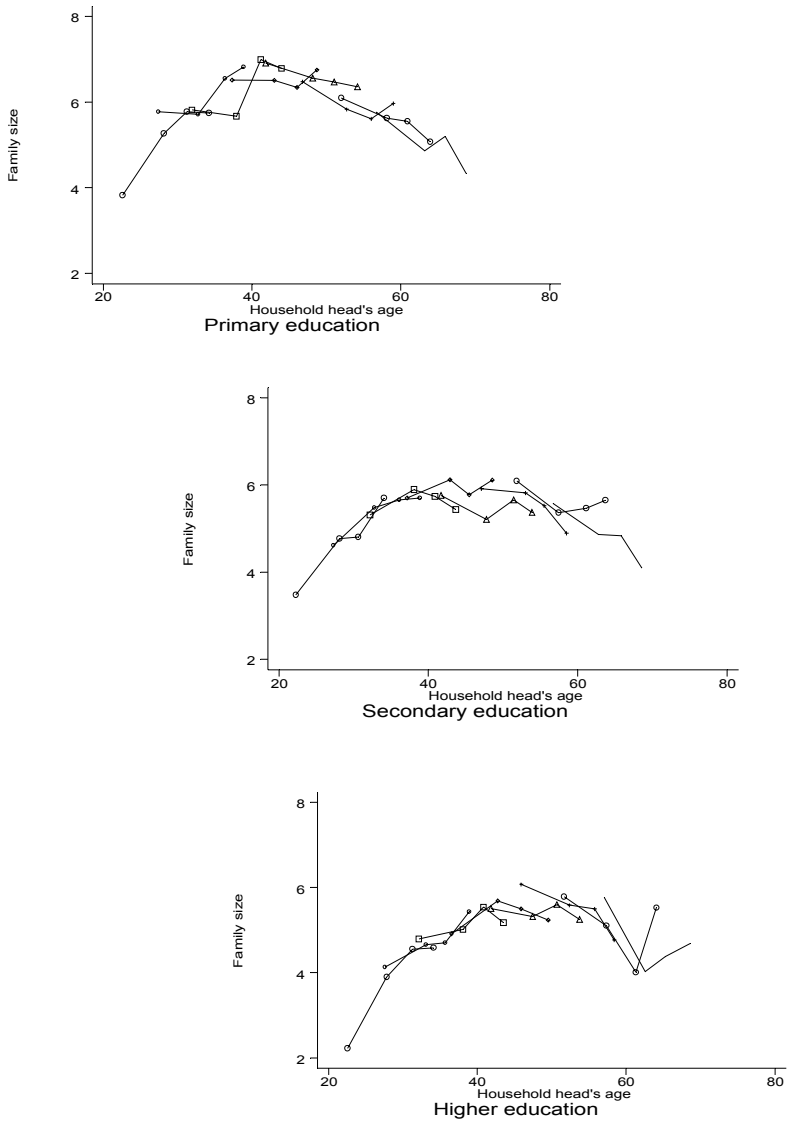
5.1 Household Size

We can imagine that changes in family size can hardly be associated with year effects. Aggregate shocks may indeed generate changes in the number and age composition of household members, but that would probably not occur on a year-to-year basis. In that sense, the figure with the age-cohort averages would show the life cycle pattern rather clearly, and the vertical differences between line segments would be related to cohort effects.

The first panel in Figure 3 shows that family size grows sharply with age until the household head is around 42 years old, and from then on it starts to fall. Education plays a significant role in explaining family size patterns. Heads with primary education have larger families than heads with secondary education, which in turn have larger families than college-educated workers. Less educated heads have more children and earlier in their lives when compared with more educated heads. Family size for the former reaches a peak of

about 7 members at age 43. For the more educated, the peak is reached slightly later, and it is of only 6 members.

Figure 3. Life Cycle Pattern of Household Size by Educational Level



Although we can see from Figure 3 that cohort effects are non-negligible, it is rather difficult to measure their magnitude. To better observe them, we assume that year effects are unimportant for this variable. Following the general methodology in Section 3.2, we estimated the following regression for each educational level:

$$FS = \alpha_0 + \sum_i \alpha_{1i} A_i + \sum_i \alpha_{2i} C_i \qquad (8)$$

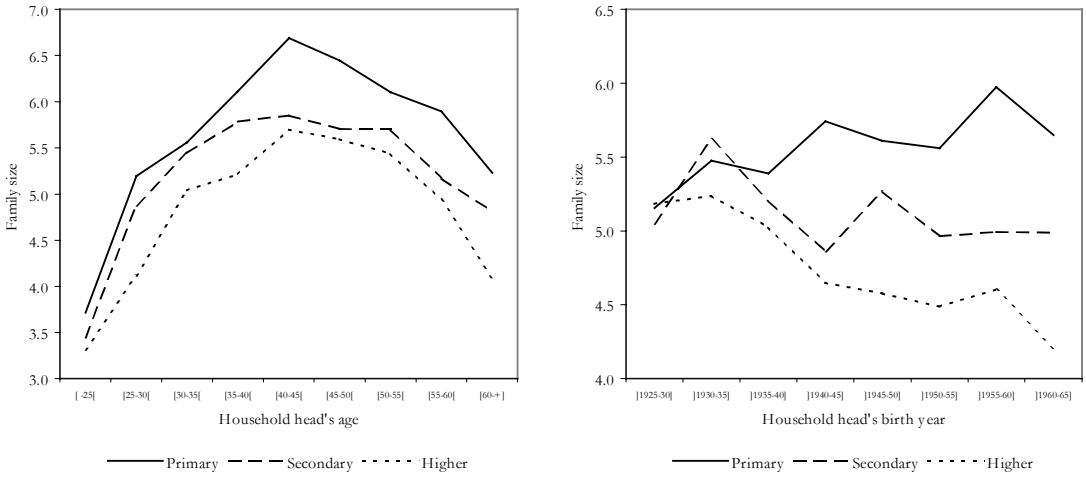
where FS = Family size

A_i = Age dummies

C_i = Cohort dummies.

Figure 4 shows the estimated age and cohort profiles for household size. First, notice that the estimated age effects in the left panel are very close to the profiles described above from the averages in Figure 3. The cohort effects are shown in the right panel of Figure 4. They indicate a clear decreasing trend in household size among the households with more educated heads; that is, younger cohorts tend to live in smaller households. This result is consistent with the important reductions observed in the aggregate fertility rate. Nevertheless, it is rather surprising to find that households whose heads have at most primary education present an increasing pattern. Since the LSMS does not include the history of pregnancy and births by women, we are not able to identify to which extent this pattern corresponds to changes in fertility, or the lack thereof. Alternatively, we can think that younger cohorts live in larger households because they tend more to live with extended families. This issue is addressed indirectly in the next sub-section, when looking at the age composition of the household members.

Figure 4. Age and Cohort Effect on family Size by Educational Level



Source: 1985, 1991, 1994 & 1997 Peruvian LSMS Household Surveys.

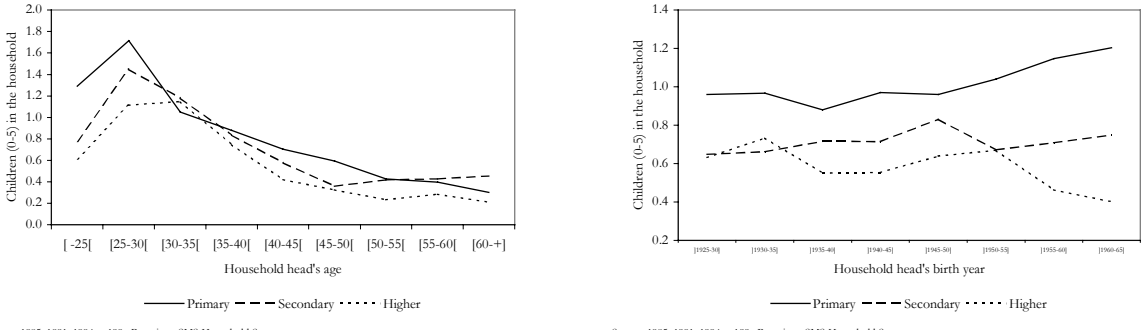
5.2 Children and Elderly in the Household

According to the LSMS data, the average number of children per household is the largest if the head has only primary education (1.0) and lowest if he/she has university education (0.7). Trying to analyze the age composition patterns for household members through the life cycle and across cohorts, we go directly to the regression analysis, based on the similarities already observed between the age effects in Figures 3 and 4. Using the same regression methodology as in household size, we analyzed life cycle and cohort patterns for the number of young children (0 to five years old), older children (6 to 15 years old) and the elderly (60 years or older).

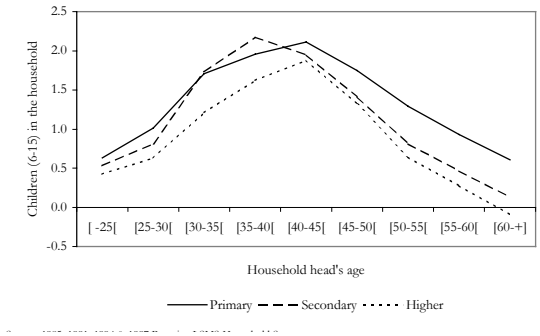
Figure 5 shows that the number of children peaks between the age of 25 and 30 and falls monotonically. Differences across levels of education are observed at young ages, with primary and secondary educated workers having more young children in their twenties. After the thirties, all education groups have roughly the same average number of young children. Regarding cohorts, there are important differences among younger cohorts. While for secondary and primary educated workers the number of young children is stable or increases the younger is the cohort, for university-educated workers there is a clear downward trend.

Figure 5. Household Demographics by Educational Level, Age and Cohort Effects

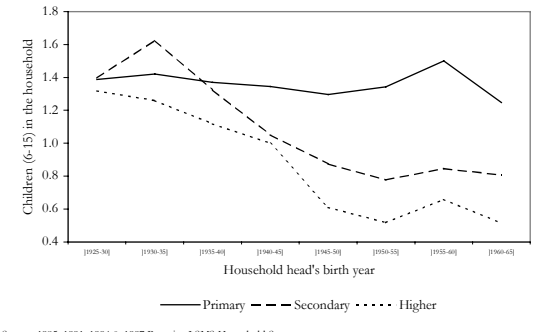
5.a. Proportion of children (less than 6 years old)



5.b. Proportion of children (6-15 years old)



Source: 1985, 1991 & 1997 Peruvian LSMS Household Surveys



Source: 1985, 1991 & 1997 Peruvian LSMS Household Surveys

Regarding children aged 6 to 15, the life cycle peak is in the early forties. The life cycle pattern for families with college-educated heads is clearly below the other groups and with a peak at a later age. The cohort analysis reveals a clear reduction in the number of teenagers in educated families and a stable pattern among the less educated, consistent with the findings regarding household size.

These results would still be consistent with the idea that the cohort differences observed in household size among the less educated would be at least partially explained by differences in the number of children, a variable closely connected to fertility trends. We now proceed to see what are the trends for household with extended families.

5.3 Types of Households

As shown in Table 3 more than half of Peruvian households are made up by couples with children (nuclear households), while extended households (couples or single parents with or without children that live with relatives) represent around 35% of Peruvian households[6]. Little more than a third of those households do not have children.

[6] Extended families are those in which, in addition to the parent or parents and children younger than 24, there is an additional family member. Note that a son that is older than 24 and live with his /her parents is considered from an extended family.

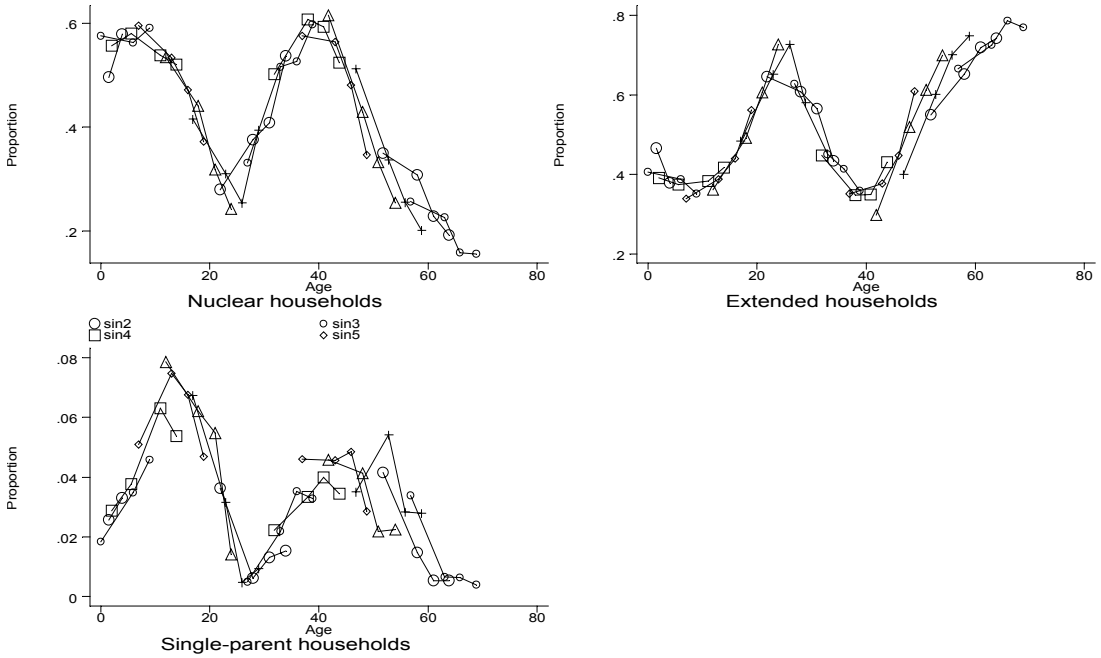
Table 3. Household-Level and Individual-Level Structure by Household Type*

	Household-level structure				Individual-level structure			
	1985	1991	1994	1997	1985	1991	1994	1997
Couple with children	55.8	56.5	52.9	54.5	56	56	52.7	53.5
Single father with children	1.3	0.9	1	0.7	1.1	0.5	0.7	0.5
Single mother with children	4.8	4.7	3.7	3.5	3.5	3.7	2.7	2.6
Couple without children	2.1	2.1	2	1.9	0.7	0.8	0.7	0.7
Extended families	34.1	35.3	39	38.3	36.4	38.4	41.6	41.5
Couple or single parent with children plus other relatives	23.9	24.8	25.4	26.5	28.6	30.4	30.6	31.8
Head or couple without children plus other relatives	10.2	10.5	13.6	11.8	7.8	8	11	9.7
Other	1.9	0.6	1.3	1	2.4	0.6	1.5	1.1

Source: 1985, 1991, 1994 & 1997 Peruvian LSMS Household Surveys.

Figure 6 shows the proportion of nuclear and extended households along the life cycle. It suggests that people increase their probability of living in an extended household from their early twenties and until their mid thirties, when it is more likely that older children stay with their parents and bring their own offspring to their parents' home. The likelihood of living with relatives increases again as heads approach their fifties, as they start to live with their children's families. If the head's children just left the household to form a new family, there would be no obvious reason for a clear increase in the proportion of extended families as the head grows older. The observed pattern reveals that, in many cases, as the head ages, his/her children bring their own families to the household instead of leaving their parents. Alternatively, older parents stay with their children as a way of surviving.

Figure 6. Proportion of Individuals in Different Kinds of Households over the Life Cycle



We also analyze life cycle and cohort effects using a probit regression for the probability of being an extended family, including age and cohort dummies in the specification. As shown in Figure 7, there is an increase in the probability of constituting an extended family for 25 to 35-year-old individuals, and then there is a monotonic increase of the probability that reaches its peak at age 55. That is, these adjustments in household structure seem to be very important early and late in the life cycle of the head. The cohort effect shows a clear decreasing pattern for those born after the mid-forties, with no important differences between education groups. This similarity indicates that these types of adjustments in household structure cannot be behind the constancy of family size among the less educated younger cohorts, as reported in the previous section. It supports the notion that such constancy is related to the fact that the number of children is stable across these cohorts. Introducing demographic and other controls does not affect the shape of the age or cohort profiles.

Figure 7. Age and Cohort Effects on the Probability of Having an Extended Family

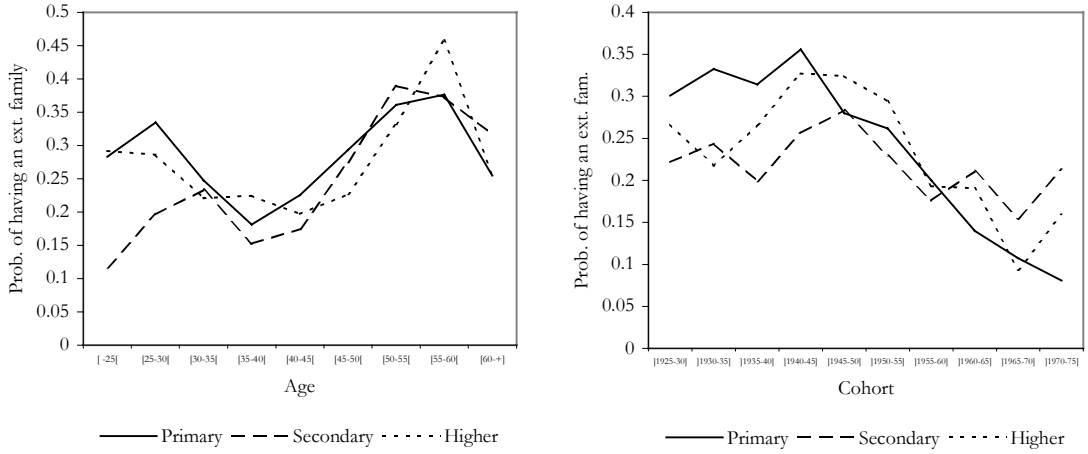


Table 4 shows who are the "other relatives" in extended families. Notice that these percentages do not need to add up to 100%, as there can be more than one "other relative" in the household (an older son and his wife, for example). Around 50% of the extended families have their old (24 or older) son or daughter in the household. The number of grandchildren is also important, rising to 40% in 1994, followed by parents or parents in law.

Table 4. Who are the "Other Relatives" in Extended Families?

	1985	1991	1994	1997
Son / Daughter	39	49	52	47
Son in law / Daughter in law	14	11	16	17
Grandchildren	35	29	42	41
Parents / Parents in law	21	27	20	23
Other relatives	33	29	24	25

Source: 1985, 1991, 1994 & 1997 Peruvian LSMS Household Surveys.
*

5.4 Who is the Boss?

The previous analysis relies on the self-identification of the head of the household, considering that he/she is the one leading the decision process within the household. This assumption would be particularly harmless if the self-reported head is at the same time the

main income earner. This need not be the case here, considering that Peruvian households tend to host extended families, as shown in the previous section. Extended families tend to host adults other than the head and his/her spouse. Figure 8 shows clearly the increasing pattern of this type of members over the life cycle. The question is whether the older male or female adult remains as the self-reported head, or whether this changes when another adult becomes the main income earner.

Figure 8. Adults other than the Head and Partner over the Life Cycle

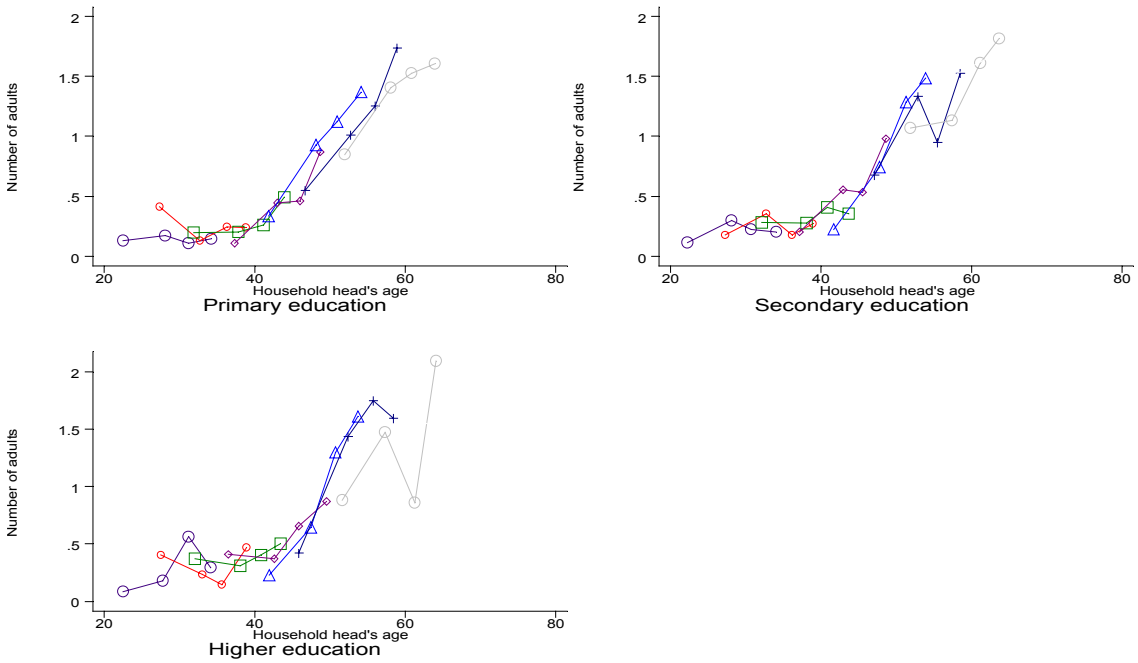
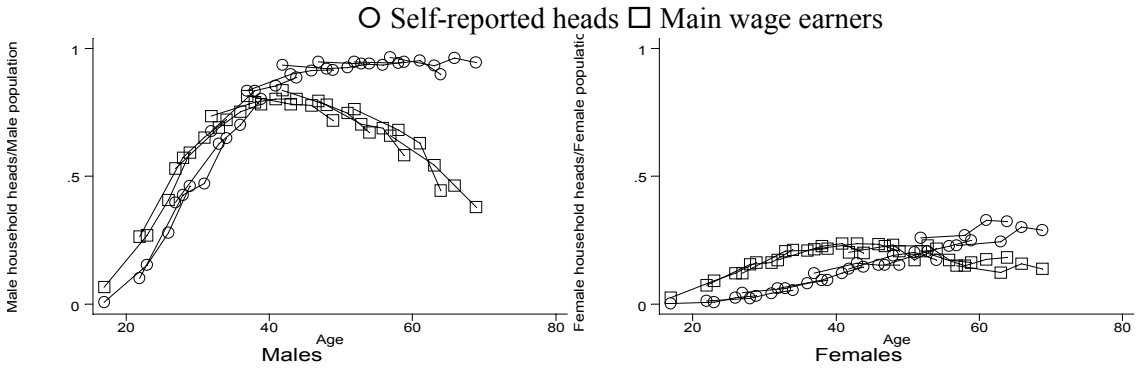


Figure 9 shows the proportion of individuals of each age group who are identified as household heads. This proportion increases steadily over the life cycle for both genders, but the likelihood of a male being identified as a household head is substantially greater. About 90% of males above 50 years old are identified as such, while the corresponding figure for females is only 25-30%. The issue is that these older members are not always the main income earners in the household, especially for heads older than 40 years old. The proportion of adult males (females) who are main income earners reaches a peak at about 75% (25%) when they reach approximately that age. (40) At about age 70, though, this proportion falls to only 45% for males (about 15% for females). Peruvian households, then,

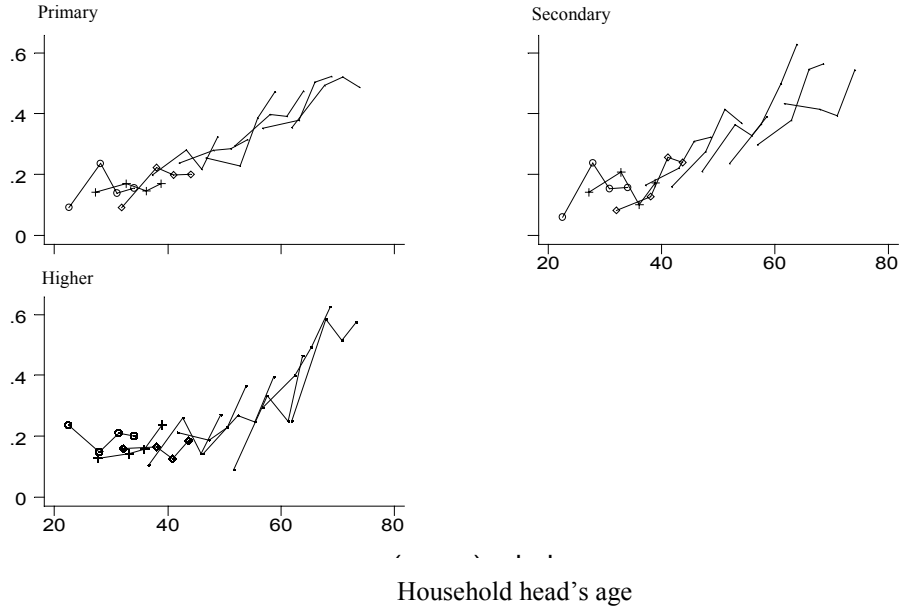
tend to identify the older male adult as the head of the household, even long after he stops being the main income earner.

Figure 9. Proportion of Household Heads over the Life Cycle by Gender



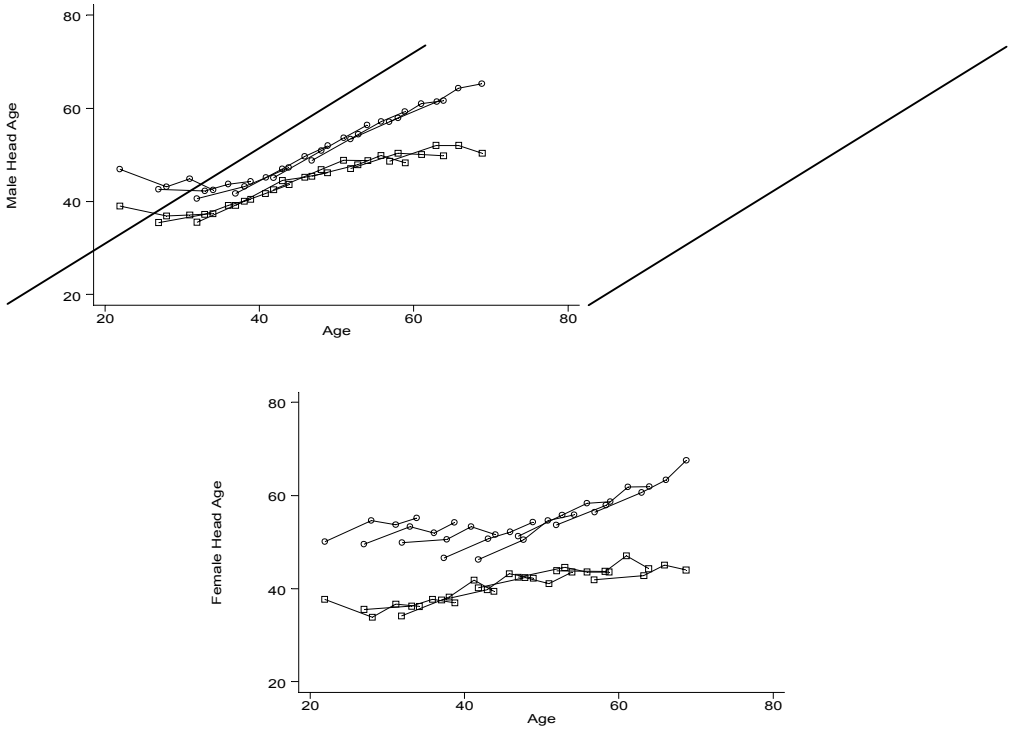
This can also be analyzed by looking at the proportion of self-reported heads who are not the main household earners. Figure 10 indicates that the proportion seems to be flat at around 15% until age 40 and then increases steadily. One possible explanation for this feature is that the probability of change in headship increases when the self-reported head—one of the parents—is less educated than at least one of their children. Even if differences in labor market experience give earnings advantage to the parent, eventually the more educated son or daughter may catch up. A somewhat surprising finding, however, is that there does not seem to be major differences by level of education.

Figure 10. Proportion of Self-Reported Household Heads Who Are Not Main Earners



The next question is to analyze who are "not the bosses," or what are the characteristics of the families in which the family head stops being the main supporter of the household and in which case the main supporter is one of his/her adult children. Figure 11 shows that the member who becomes the main income earner is always younger than the self-reported head. Moreover, it is clear that after the self-reported head reaches about 45 years, the age difference between him/her and the main income earner grows further apart, in particular among male household heads, a pattern that is consistent with those shown in the three previous figures.

Figure 11. Family Member's Age Compared to Household Head's Age by Gender of the Head.



○ Self-reported heads □ Main wage earners

In Table 5, we analyze the characteristics of households where the self-reported head coincides with the main earner and those in which it does not. In households where there is no coincidence, the self reported head is more likely to be a woman, older and less educated than in households where there is coincidence. In those households the alternative head is younger and more educated. In all the surveys, in households where there is coincidence of heads, heads are more educated than the self-reported head in households where there is an alternative head. For instance, in 1997 in the former, 20.7% of heads had higher education, while in the latter this figure was 16.2%. In households where there is no coincidence of heads the difference in education between the self-reported head and the alternative head is much larger than the difference between the head and the second earner of the household in those households where there is coincidence.

Results not reported show that the proportion of heads who are not main earners rises throughout the life cycle when the (self-reported) head has primary or secondary

education, while in the case of post-secondary educated heads the rise seems to start only at age 50.

Table 5. Characteristics of the Self-reported Head and the Household's Main Earner (When Different)

Self reported head is...	Main Earner				Not Main Earner			
	1985	1991	1994	1997	1985	1991	1994	1997
Self-reported head								
% of men	85	87	86	88	73	73	71	75
Age	45	45	47	45	54	55	56	56
% Primary education	57	44	46	41	72	58	57	52
% Secondary education	30	37	34	38	19	32	31	32
% Higher education	14	19	20	21	9	10	13	16
% Salaried workers	42	43	38	45	29	32	35	33
% Self-employed workers	57	56	61	54	68	66	63	65
% Other workers	2	1	1	1	3	2	2	2
Main earner other than self-reported head								
% of men	28	29	32	30	51	44	50	44
Age	31	32	31	31	32	34	34	34
% Primary education	45	27	31	31	38	27	26	28
% Secondary education	40	46	42	45	40	47	42	40
% Higher education	15	27	27	24	22	26	33	32
% Salaried workers	41	48	50	43	49	49	55	52
% Self-employed workers	57	50	46	54	48	48	48	48
% Other workers	2	2	4	3	3	2	2	2
Household								
% Urban areas	67	69	69	74	74	75	82	83
Size	5	5	5	5	6	6	6	5
# of men	2	2	2	2	3	3	3	3
# of women	3	2	3	3	3	3	3	3
# of children [0-6[	1	1	1	1	1	1	1	1
# of children [6-16[	1	1	1	1	1	1	1	1
# of young people [16-25[	1	1	1	1	1	1	1	1
# of adults [25-60[	2	2	2	2	2	2	2	2
# of old people [60-+]	0	0	0	0	1	1	1	1

Source: Peru's Living Standards Measurement Studies Household Surveys 1985, 1991, 1994 & 1997.
* Does not include rural coastal regions and jungle regions.

The main earner's relationship with the self-reported head is shown in Table 9. In more than half of the cases where the head does not have the highest income, the main earner is one of his/her children. In around 30% of the cases it is the spouse who has the household's highest income. These proportions were basically the same during the last

years and only the percentage of cases where the main earner is the head's son/daughter increased slightly between 1985 and the 1990s.

Table 6. Main Earner's Relationship with Self-Reported Head 1985-1997

	1985	1991	1994	1997
Spouse	28.0	31.0	27.5	30.5
Son / Daughter	54.0	51.2	52.8	50.6
Son in law / Daughter in law	6.6	9.2	8.8	8.3
Grandchildren	1.8	1.0	2.0	1.4
Parents / Parents in law	0.5	0.9	0.6	0.9
Other	8.5	6.6	8.2	7.8
Non-related	0.7	0.0	0.1	0.4

Source: 1985, 1991, 1994 & 1997 Peruvian LSMS Household Surveys.
*

Summarizing, the main findings in this section are the following. Household size has decreased significantly for younger Peruvian cohorts with relatively more educated heads, but this is not true for households with less educated heads. The slight increase in family size among the less educated seems to be related to differences in the number of children in the household—a variable related to fertility. It is not related to differences in household living arrangements, because we find that the proportion of extended families has been decreasing for the younger cohorts regardless of educational level. Still, extended families remain an important feature of family arrangements in Peru over the life cycle, in particular when the individual is in her early twenties and later as she approaches retirement. This household strategy affects the meaning of headship, since the self-reported head stops being the main income earner as he ages. In the following sections, we explore the possible implications of these adjustments in household structure upon labor market participation, investments in education and savings.

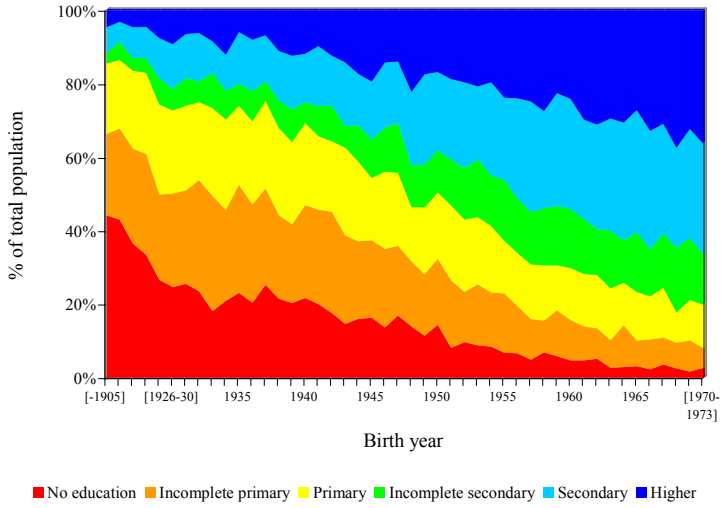
6. Education and Labor Market Performance

6.1 Educational Attainment and Returns to Education

In this section we present estimates of educational attainment by birth cohort, the evolution of average years of schooling by region and gender and changes in inequality of schooling attainment. Finally, we present estimates of returns to education, considering differences in returns across cohorts, age groups and time.

Figures 12 and 13 show the steady progress the country has made in terms of increasing educational attainment. Only 25% of those born in the 1930s had secondary or higher education, while half of that cohort had no education or incomplete primary. The cohort born in the early 1970s, four decades later, is, on the other hand, clearly more educated: only 20% has primary education or less, while a quarter of the population belonging to that cohort has secondary education and another quarter some higher education. Nevertheless, it should be noted that 20% of the youngest adult cohort still has only 6 or fewer years of schooling. As suggested in Section 3.1, these improvements might be strongly associated to improvements in education-related public infrastructure and the important rural-urban migration flows that happened in Peru beginning in the 1950s.

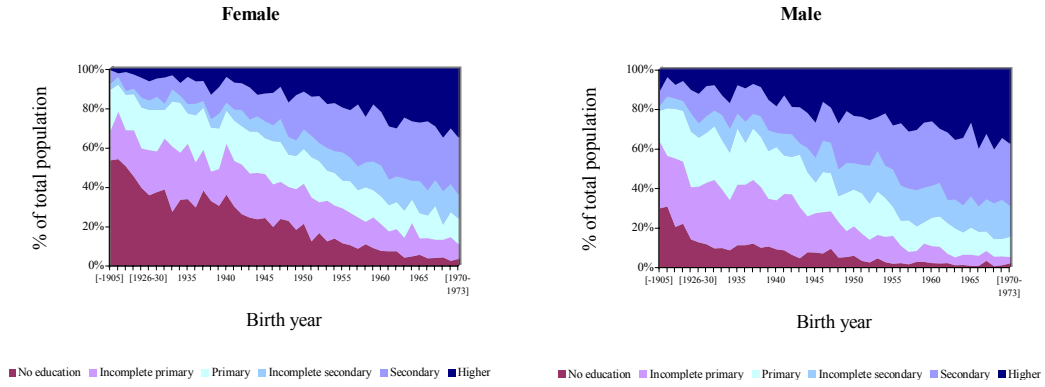
Figure 12. Population Structure by Level of Education and Birth Year



When looking at gender differences in educational attainment, we find that they have almost vanished over the period. 40% of females born in the 1930s have no education

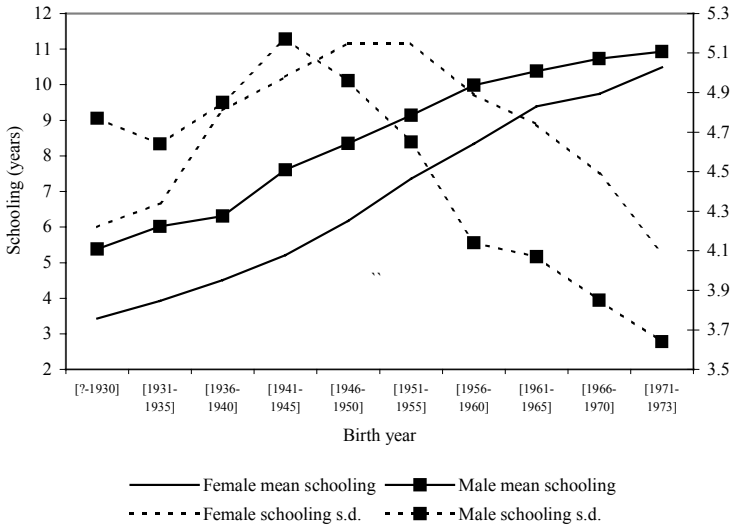
at all, while that figure was just 15% for males. On the other hand, in the youngest generations, there are almost no uneducated individuals, regardless of their gender. Figure 12 shows that something similar happens for all educational levels.

Figure 13. Population Structure by Level of Education, Birth Year and Gender*



These changes may also be analyzed using the average number of years of schooling and the standard deviation of schooling (Figure 14). The average level of schooling has risen faster for females, and they have indeed almost caught up with their male counterparts. For the cohort born in the 1970s, the gender gap in schooling years is less than 0.5 years. On the other hand, the evolution of the dispersion in schooling shows a clear inverted U-shape for both males and females. Gender differences appear more persistent in this case, as the standard deviation in schooling years is still much lower for males. Among males, the turning point was reached earlier, and dispersion started falling since the cohort born in the 1940s; this turning point was observed a decade later among females.

Figure 14. Schooling Mean and Standard Deviation by Cohort, Area and Gender



6.2 Labor Force Participation

In this section we analyze age and possible cohorts effects in the recent evolution of labor force participation (LFP). The most important stylized fact is the clear long-run increase in LFP among females during the last three decades, rising from 30.5% in 1970 to 34.3% in 1980 and 38.2% in 1990, while for males the figure has been stable, 81.5% 80% and 79.2% respectively. A look at aggregate trends shows that in the last 12 years, the LFP has moved in a procyclical fashion.[7] According to the LSMS, data, it fell between 1985 and 1994 and then increased by 1997. Among males the trough was in the early 1990s, coinciding with the lowest point of economic activity, immediately after the period of hyperinflation and the beginning of the Fujimori macroeconomic stabilization program. Using annual surveys from Metropolitan Lima, these trends are confirmed, as it is possible to show that LFP fell from the mid-1980s until 1991 in the case of males and until 1993 in the case of females, increasing thereafter (Saavedra, 1998).

[7] See Saavedra (1998) for an extensive analysis of the procyclicality of LFP.

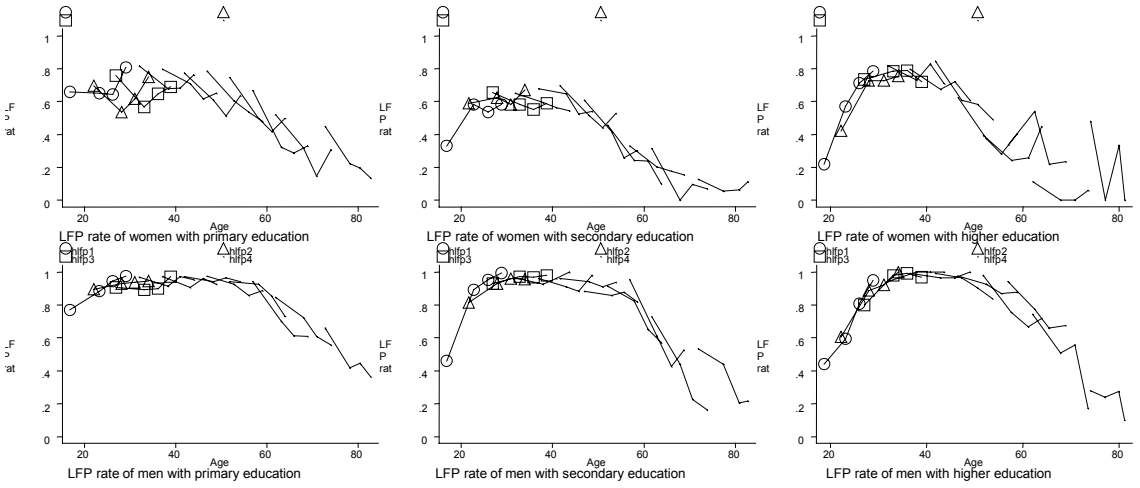
Table 7. Basic Labor Market Characteristics

	Female				Male				Total			
	1985	1991	1994	1997	1985	1991	1994	1997	1985	1991	1994	1997
Employed (in thousands)	2870	3030	3000	3770	3595	4264	4362	4921	6465	7294	7362	8691
Unemployed	116	140	150	207	112	194	215	246	228	334	365	452
Inactive	2176	3450	3712	3060	1090	1741	1672	1300	3266	5191	5384	4361
Labor force particip. rate (%)	57.8	47.9	45.9	56.5	77.3	71.9	73.2	79.9	67.2	59.5	58.9	67.7
Employment/population ratio	0.56	0.46	0.44	0.54	0.75	0.69	0.70	0.76	0.65	0.57	0.56	0.64
Unemployment rate (%)	3.9	4.4	4.7	5.2	3.0	4.3	4.7	4.8	3.4	4.4	4.7	4.9

Source: Peru's Living Standards Measurement Studies Household Surveys 1985, 1991, 1994 & 1997.
* Does not include rural coastal regions and jungle regions.

Figure 15 shows the life cycle pattern of LFP for males and females. As expected, LFP reaches almost one for men between 35 and 50, and it falls steadily thereafter. Consistent with human capital investment patterns, LFP rises faster along the life cycle for less educated males, but reaches higher levels for more educated ones. Among females, the data reveals a smooth increase until the early forties, after which LFP falls faster than for men. In the case of college-educated females, although they start participating later, LFP reaches higher rates than for the other educational levels.

Figure 15. Labor Force Participation by Gender and Education over the Life Cycle



Urban Self-Employed and Wage Earners

Self-employment is not always a last resort, as is sometimes stated in the literature about self-employment and the informal sector. As shown in Figure 16, the proportion of self-employed is very low at early stages of the life cycle and moreover, it increases throughout the lifetime. By contrast, salaried work decreases since early stages of the career and after that it falls monotonically. Analysis of informality and self-employment done by Saavedra and Chong (1999) shows that informal salaried work is the first job for many young workers, who afterward engage in formal salaried work or in self-employment.

Figure 16. Proportion of Salaried and Self-Employed Workers by Gender

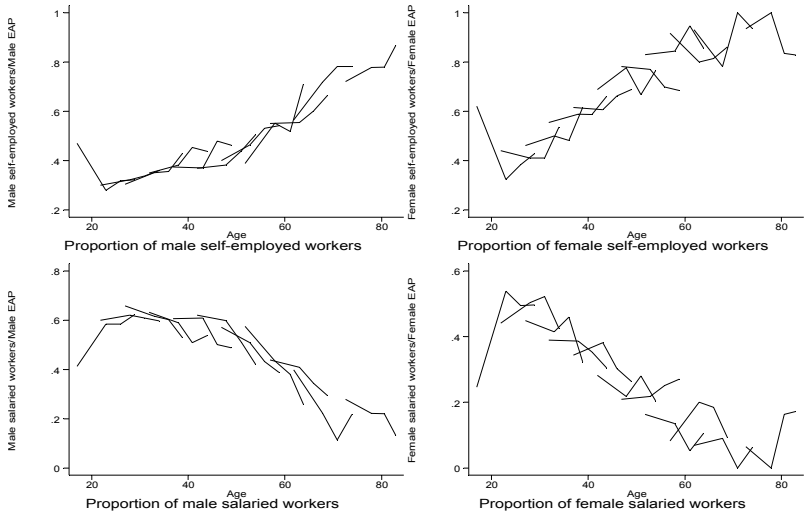
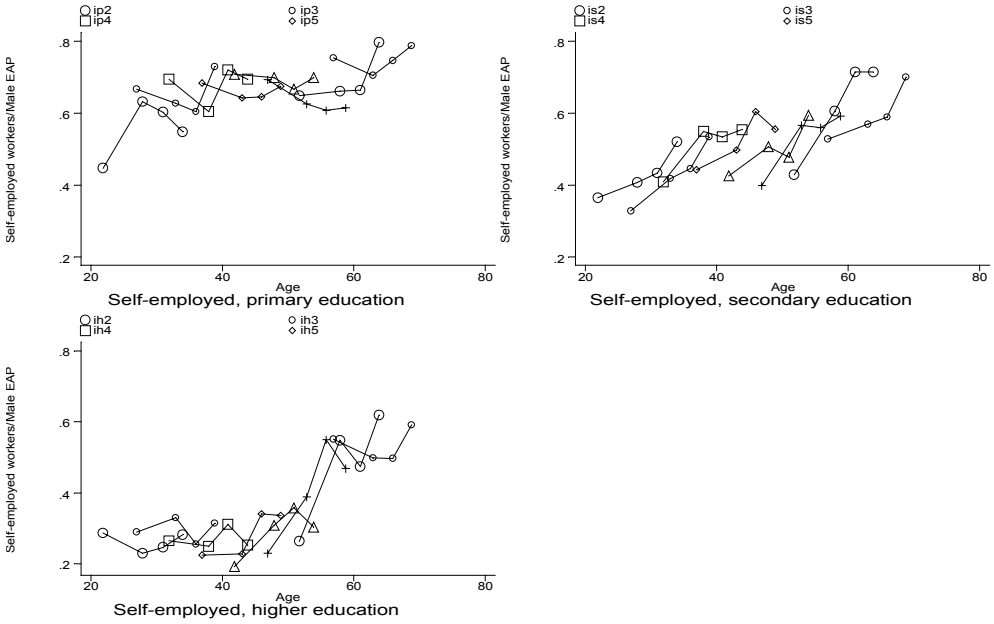


Figure 17 shows that at higher levels of education the proportion of young people working under self-employment is lower. For primary and secondary educated workers the increase in this proportion follows a slightly increasing trend throughout the life cycle, while among workers with higher education there is a slight decrease until their forties, when the curve turns upward sharply. Inverse trends can be seen when the proportion of salaried workers by educational level is analyzed.

Figure 17. Proportion of Self-Employed Workers by Educational Level



6.3 Returns to Education

Finally, we analyzed the life cycle evolution of returns to education and the pattern observed across cohorts. Using a pseudo panel sample the following regression was estimated for men and women separately:

$$\ln y = \alpha_0 + \sum \alpha_{1m} L_m + \sum \alpha_{2i} C_i + \sum \alpha_{3t} Y_t + \sum \alpha_{4j} A_j + \sum \alpha_{5mi} (L_m \times C_i) + \sum \alpha_{6mt} (L_m \times Y_t) + \sum \alpha_{7mj} (L_m \times A_j) + \sum \alpha_n X_n$$

where y = Real labor income

L = Educational level dummies

C = Cohort dummies

Y = GDP level of the survey year

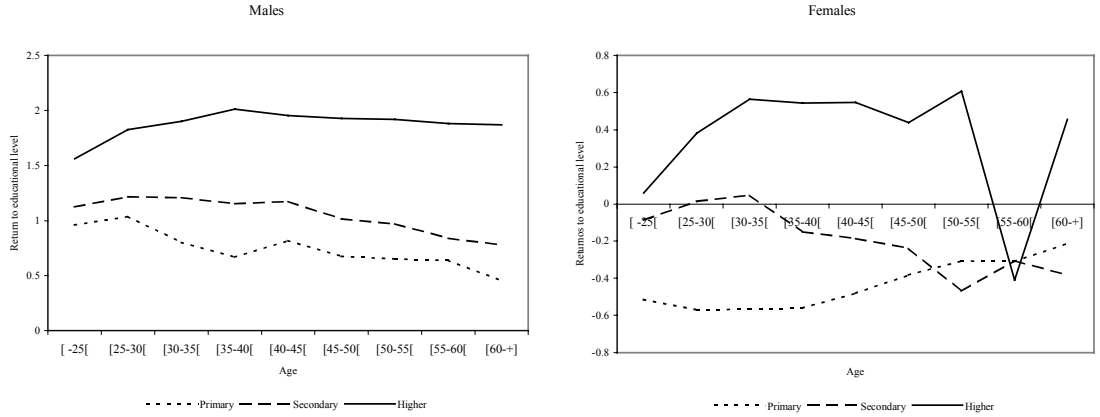
A = Age dummies (45 dummies)

X = Other control variables (marital status, living area, training, tenure and its square).

Using the coefficients of the educational dummies and its interactions, we calculated the life cycle evolution of the educational earnings differentials. It should be noted that we report educational premia, i.e., the educational earnings differential between a

specified educational level and the control level—no education. As shown in Figure 18, returns to higher education among males increase up to 45 years of age and then start decreasing. Returns to primary and secondary education show a downward trend throughout the lifetime. Among females, the pattern of returns to higher education is similar but somewhat more pronounced. The life cycle pattern of returns to primary education is increasing, while that of secondary education is decreasing.[8]

Figure 18. Age Effects on Returns to Education by Gender

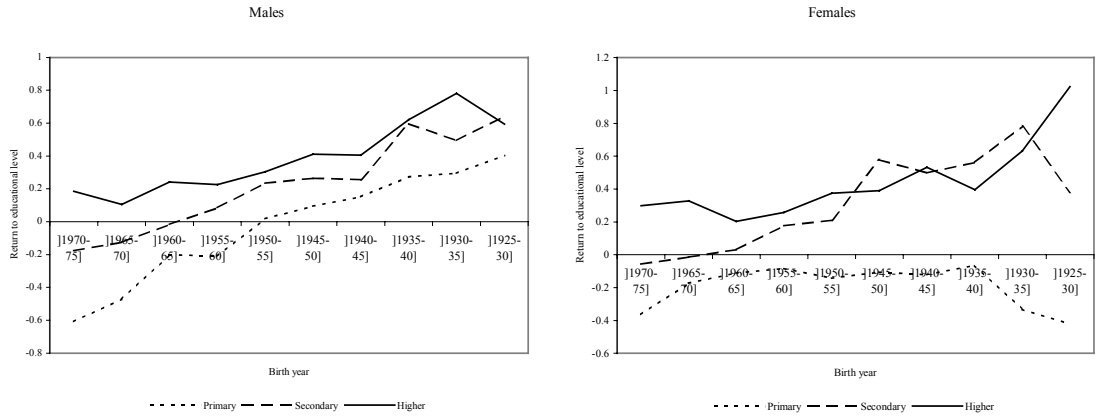


As shown in Figure 19, older cohorts have much higher returns than the younger ones for all educational levels. Among females, the same decreasing pattern is observed, except for primary-educated workers, whose returns are constant across cohorts. The reduction in educational premia for younger cohorts may be related to changes in the quality of the educational system, but also to the significant increases in educational attainment reported in Figures 12-14. In a model with imperfect substitution between individuals with the same level of education who belong to different cohorts, an increase in the rate of growth of educational attainment leads to a reduction in the returns to education.[9] Actually, the appeal of this story grows when we compare the cohort patterns for different levels of education. The smaller decreasing trend in the cohort effect for the returns to

[8] It should be noted that the level of the educational earnings differentials shown in the graph is affected by the mean values of the variables in the regression. Sample averages were held constant for all groups.
[9] See, for instance, Card and Lemieux (2000) for the details of a model of that sort.

college is consistent with the fact that the supply of college-educated individuals has grown less over the past 4 decades (see Figures 12-13).

Figure 19. Cohort Effects on Returns to Educational Level by Gender



7. Household Savings

One of the predictions of the life cycle model is that the causal relationship goes from productivity growth to a higher savings rate. In the simplest version of this model, the young save while the old dissave. If the income of the young is the same as the income of the old, savings and dissavings cancel out. With productivity growth, though, the young will be richer than were their parents at the same age and net savings become positive. The same is true for population growth. Even with productivity constant, if the young outnumber the old, net savings will also be positive. In both cases, the faster the growth, the higher the saving rate.

But this neat implication from the simplest life cycle model is not so clear when the model is complicated. For instance, concentrating on population growth, if the income path has a hump shape, young individuals may want to borrow instead of saving early in their careers. Also, if the individual has three stages in life: childhood, young adulthood and older adulthood, and children live with their parents, these young adults will tend to borrow for consumption instead of saving at that point in their lives. Then, it will be not so clear that aggregate savings will go up under high population growth since the increase in the ratio of children to young adults could partially compensate for the previous positive effect.

The demographic transition described in Section 2, and its impact upon household structure, analyzed in Section 3, makes the evaluation of savings patterns over the life cycle and across cohorts by Peruvian households particularly appropriate. Under the demographic transition, the trends of the dependency rates will benefit growth in saving rates. As the number of working individuals reaching their peaks in income increases faster than the number of children and old people, the aggregate savings rate will be higher. The possibility of this *window of opportunity* opening for a country like Peru raises the importance of evaluating the empirical validity of the life cycle model in Latin American economies.

Recent empirical evidence supports the view that household current consumption and income are highly correlated over the life cycle. (see, for instance, Deaton, 1992). One of the key factors raised to explain this result is that consumption grows with household size, which also presents a hump shape over the life cycle (see Figure 3 in Section 6.1). When controlling for these demographic changes over the life cycle, the savings pattern recovers the hump shape predicted by the LCH. The issue here is that, as seen in Section 5.2, Peruvian households tend to host extended families as the self-reported head ages, including other younger income earners. In this context, we need to evaluate the effect of these household strategies on the life cycle pattern of household income, since the previous argument also relies on household income having a hump shape over the life cycle.

In this section, we analyze the patterns of household savings over the life cycle and across cohorts. Households are identified according to the age of the household head, and we take into account the important changes that occur within the household over the life cycle in terms of the number of income-generating members. In particular, we analyze household savings, as measured by $\tilde{s} = \ln y - \ln c \approx s / y$.[10] Figure 20 displays the age-cohort averages for this measure of household savings, by level of education of the self-reported household head.[11] These averages do not show any clear pattern over the life cycle,

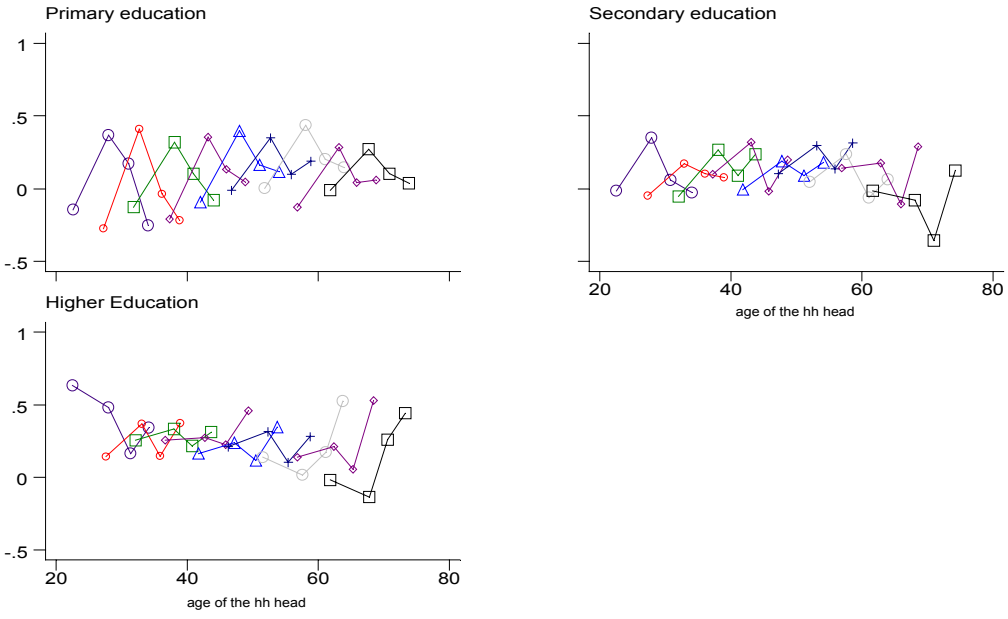
[10] Household consumption excludes expenditures in durables, education and health. See Appendix A for details on the construction of the series for household income and consumption.

[11] As indicated in Section 3, we drop from the sample households whose heads are younger than 20 years old or older than 79 at the moment of the interview. Pooling all households together would generate biases if they differ not only on their income levels but also on their life cycle paths (see Attanasio and Székely, 1998)

except for households with more educated heads (more than 11 years of schooling) for whom a clear decreasing trend is observed.

Since the year effect cannot be considered negligible a priori for savings, these plots do not help us much to capture the age and cohort effects. Figure 21 presents the age and cohort effects estimated by running the regression in expression (7) for each level of education.[12] Cohort effects appear very flat for households with less educated heads, but become decreasing when we switch to the more educated ones indicating that older educated cohorts tend to save substantially less than their younger counterparts. Indeed, households whose heads were about 60 years old in 1985 save about 40 points less than those that were about 20 that same year. This result is actually fairly consistent with previous findings for other Latin American countries such as Mexico (see Attanasio and Székely, 1998, Figure 14), and also indicate that some long-term changes seem to have affected educated households more.

Figure 20. Log Savings over the Life Cycle

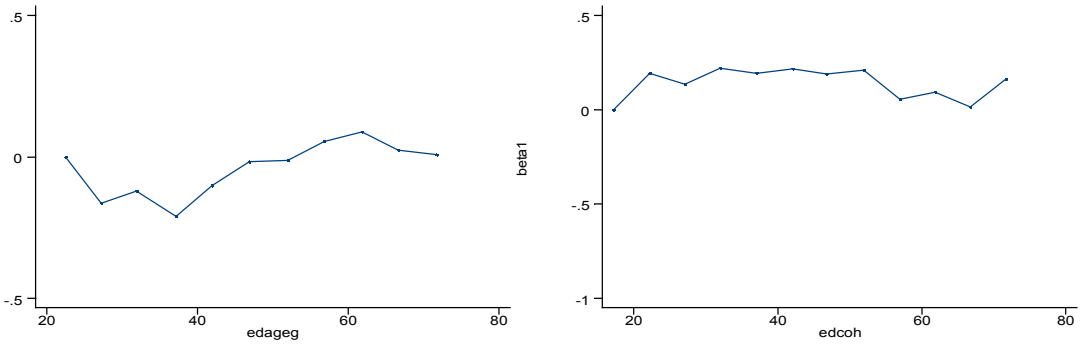


[12] As indicated in Section 3, we do allow for the year effects to be different for households living urban and rural "*centros poblados*." Appendix B presents the estimated age and cohort profiles when using the traditional identification strategy described for the estimation of expression (2) in Section 3.2.

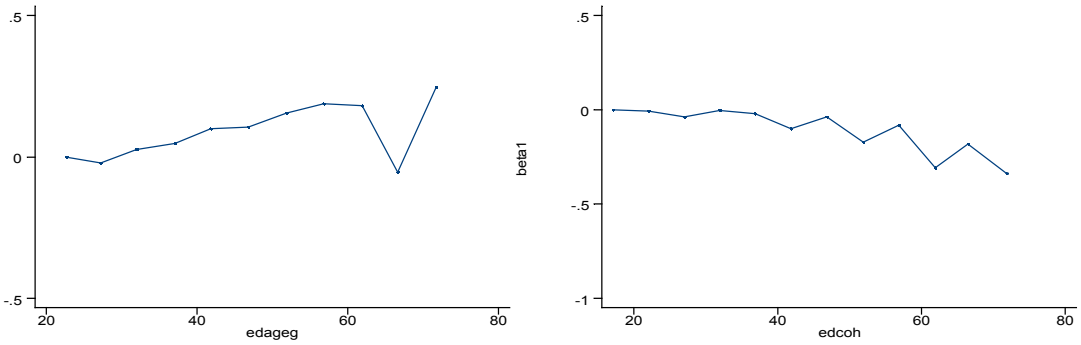
The estimated age effects do not show a monotone pattern, but a rather inclined J shape at least until heads become sixty, when it becomes flat. Indeed, the peak in the savings rate is around that age for less educated heads, although it seems to be 65 for heads with some college education. The bottom is reached at about 35 years for the less educated household heads but at 25 for heads with some college education. Also, the savings rate at the peak is only 10 or 15 points higher than at the beginning of the life cycle but 25-30 points higher than at the bottom. These age effects do not match with the predictions of the simplest life cycle theory, that is, we do not observe a hump shape over the life cycle of savings by Peruvian households. The strong decreasing trend early in the life cycle seems to be generated by consumption pressures, probably as a result of the increases in the size of the household. The non-decreasing pattern of household savings as the head reaches his/her retirement years might indicate that a bequest motive is important to explain savings by Peruvian households.

Figure 21. Total Savings Rate—Age and Cohort Effects by Level of Education

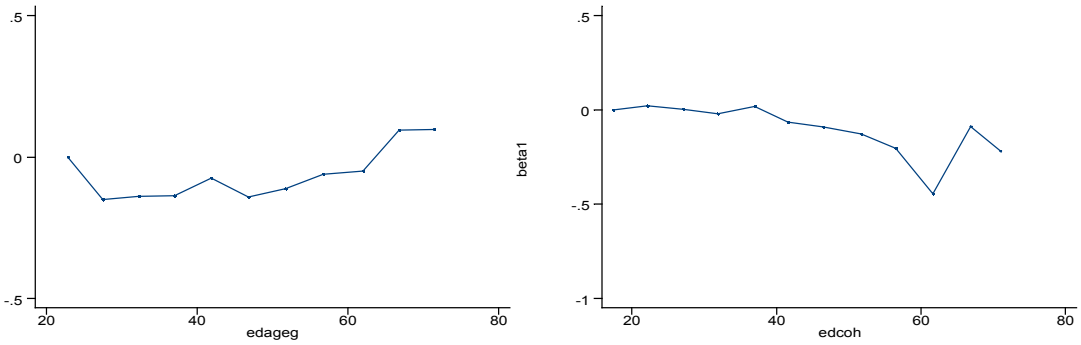
21.a. Primary



21.b. Secondary



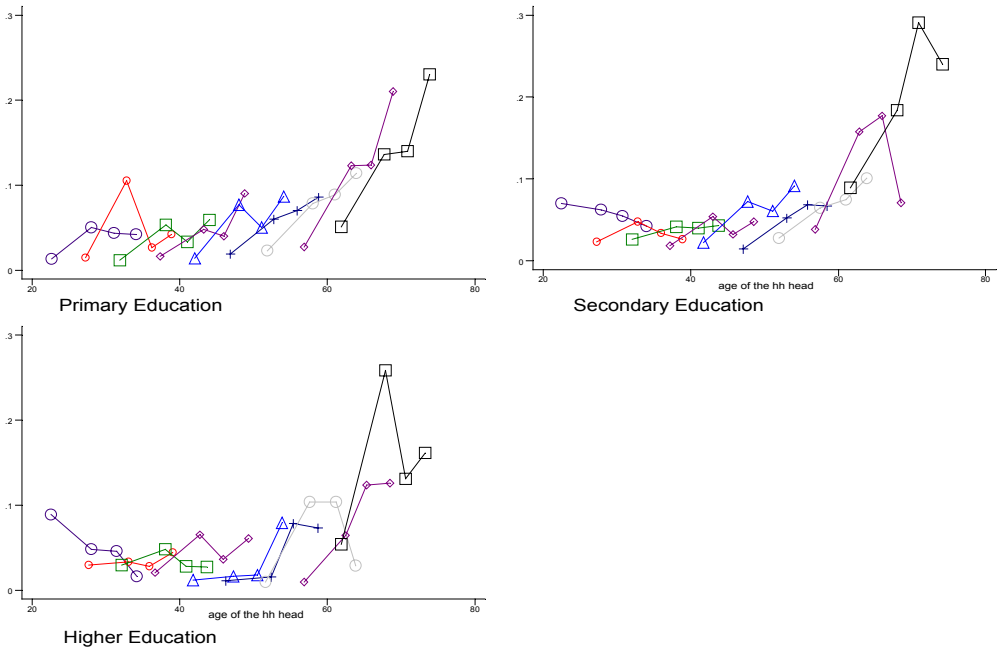
21.c. Higher



Still, these implications need to be taken with care since the definition of savings used here might not be the appropriate one for Peruvian households as a result of the family arrangements that these households generate to overcome the lack of formal pension arrangements. We have seen in section V that the number of income generating members in the household increases with the age of the self-reported household head. (Figure 8) The incorporation of other income earners could potentially affect the shape of the household income pattern over the life cycle. Moreover, the fact that these additional income earners become the household´s main source of income and that they are increasingly younger (Figure 11) could affect the way the decisions are taken within the household.

Another related issue is that the inclusion of net transfers from relatives and friends in the construction of household income might be over-estimating savings, especially late in the life cycle. Figure 22 shows the life cycle pattern for this variable as a proportion of household income. These transfers show a relative flat pattern until the head reaches about 50 years old, but after that they increase sharply to become up to 25% of household income. These two family arrangements need to be considered carefully before stating any conclusions.

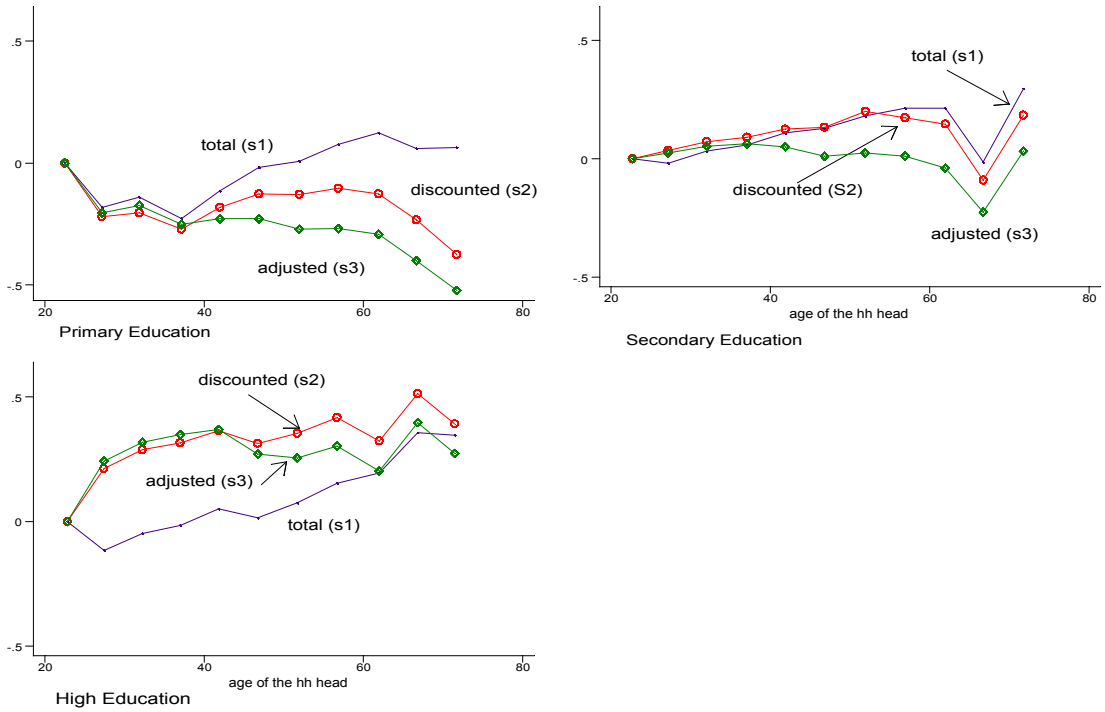
Figure 22. Net Transfers over the Life Cycle



To evaluate the role of these family arrangements on the age effects for Peruvian household savings, we compare three differently estimated age profiles over the life cycle for the household savings rate (Figure 23). The first is the unadjusted-undiscounted age profile for s_1 already shown in Figure 20, which includes net transfers from relatives and friends as income. The second profile is obtained from $s_2 = \ln \hat{y} - \ln c$, where $\hat{y}$ denotes the discounted household income (net of transfers). Finally, the third age profile (s_3) is also obtained from s_2, but demographic controls are included in the associated regression (7).[13]

[13] The results in Figure 23 include household size, the proportion of children and elders as demographic controls. We also tried including an indicator variable for households with extended families, and other alternatives, obtaining basically the same results.

Figure 23. Age Profiles for Total, Discounted (Net of Transfers) and Adjusted (by Household Structure) Saving Rates



The comparison is quite interesting. It shows that family arrangements are quite important as an strategy to smooth income over the life cycle among Peruvian households. The effects of those strategies differ across levels of education, though. In the case of the less educated heads (educ=0), both types of arrangements seem to become important only after the head reaches about 35 years old. From then on, savings do present a hump shape when we omit transfers from income (s_2) with a sharp decline after the head reaches 60 years of age. The inclusion of demographic controls, though, generates a declining pattern for savings over all the life cycle.

The effects are quite different for households with more educated heads. In the case of heads with some secondary education (educ=1), only adjustments in household structure seem to be important and generate a flat pattern over the life cycle. For household heads with some college education, only transfers from relatives and friends seem to play an important role for savings, especially in the early stages of the life cycle. When omitting transfers from income, we find a sharp increase in savings from the beginning, although no

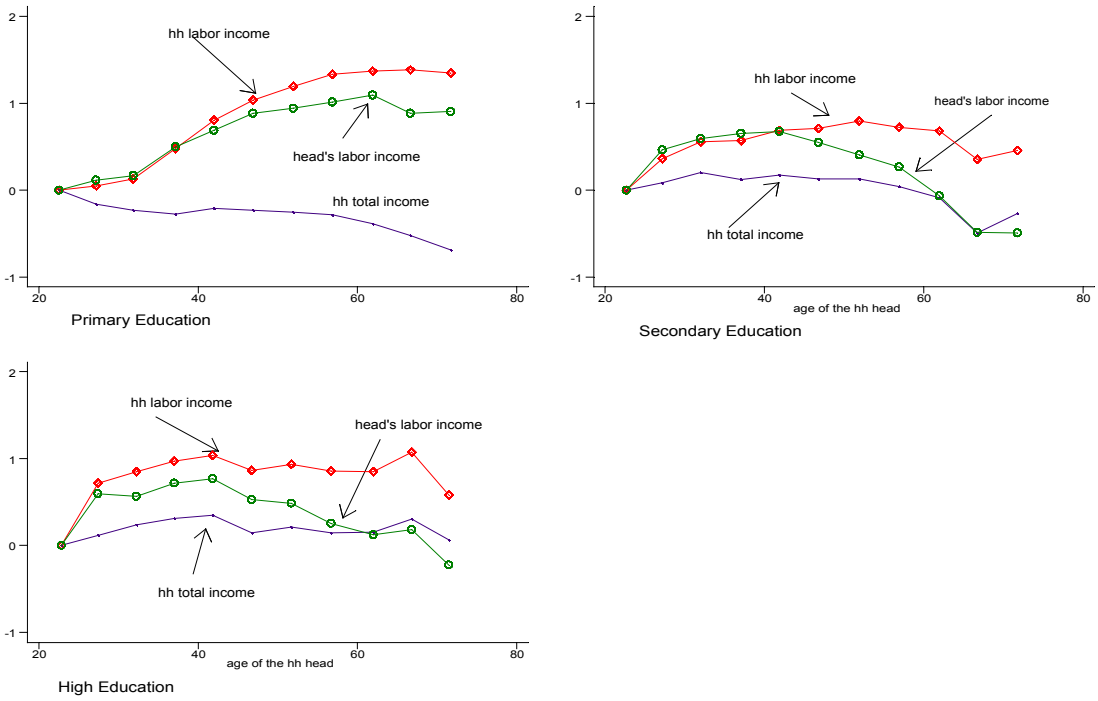
major drop in savings appear as he/she approaches retirement years. But this last finding needs to be taken with care, considering the limitations of the sample size for this group, especially as the head reaches the retirement years. (see Table 1 in Section 4)

The differences observed in Figure 23 suggest the importance of household demographics and transfers from relatives over the age pattern for household savings. The relative importance of each of these effects varies across educational groups. The adjustment in income—the exclusion of transfers—only generates the expected hump shape pattern for savings in the case of households with more educated heads. One possible explanation is that there are further income-related adjustments.

One way to indicate the importance of the latter is to compare household total income with the household labor income and the labor income of the head. Figure 24 shows the estimated age patterns for these three income variables, obtained using the log of GDP to identify the year effects, as before. First, we notice that total household income presents no significant age patterns. On the other hand, the labor income of the head does show a clear hump shape for households with more educated heads, with the peak reached at about forty years old. The age pattern for heads with less than primary education is strictly increasing until age sixty and remains constant after that. Another clear point is that the differences between these three income variables increase with the age of the household head, regardless of their level of education. It is relatively clear, then, that Peruvian households use several family arrangements over the life cycle and that they affect income patterns over the life cycle. Indeed, these arrangements eliminate any age patterns for total household income, regardless of the educational level of the head.

In conclusion, age patterns of savings by Peruvian households are partially consistent with the implications of a life cycle model when we take into consideration family arrangements, especially for those with more educated heads. For households with less educated heads, the flatness of the age pattern of savings may be related to the fact that families have flat income patterns over the life cycle. In other words, Peruvian households do smooth consumption over the life cycle, not only by the typical saving-dissaving mechanism, but also by smoothing household income.

Figure 24. Age Effects for Total Income, Labor Income and Income of the Head, by Level of Education



We ought to model the decisions on the adjustments in household structure, and its effect upon savings, before we can state a more definitive answer in this regard. That is, we need to understand the factors household members consider when they decide to incorporate or retain adults, what makes an elderly parent join the household of her offspring, and which of them is the one that shares the household with their parents, and who is *only* bounded to remit. An alternative research agenda would go in the direction of Deaton and Paxson (1998), who obtain individual savings profiles and compare them with the ones of the household.

Disentangling these issues, for each educational level of the head, would very likely be an important step towards understanding the household decision to save, and to determine the potential impact of the demographic transition on aggregate savings. The results presented here would clearly indicate that we need to look not only at consumption adjustments as a result of demographic changes, but also at the income smoothing

implications of the family arrangements that Peruvian households implement over the life cycle.

7. Summary and Final Remarks

Demographic changes in Peru have been slightly faster than the Latin American average. The Peruvian population is already aging, with youth dependency ratios falling and elderly dependency ratios already slightly increasing. These changes are very promising in the sense that they improve the ability of the Peruvian economy to take proper care of children and the elderly. Nevertheless, the differences in these achievements by level of education, reported in this study, raise important policy concerns relating the future trends of income distribution in Peru.

Household size has decreased significantly for younger Peruvian cohorts with relatively more educated heads, but this is not true for households with less educated heads. The slight increase in family size among the less educated seems to be related to differences in the number of children in the household. The connection of this variable with fertility would suggest an important role for family planning programs among the poor.

The previous result is not related to differences in household strategies since we find no significant differences in the proportion of extended families by educational level of the head. Indeed, this proportion has been decreasing for the younger cohorts for all household types. Still, junctions with relatives remain an important feature of family arrangements in Peru over the life cycle, in particular when the individual is in her early twenties and later as she approaches retirement. This household strategy affects the meaning of headship, since the self-reported head stops being the main income earner as he/she ages.

An analysis of educational attainment across cohorts shows that younger cohorts are clearly more educated, and gender differences have decreased substantially. Still, 20% of individuals belonging to the cohort born in the 1970s have not gone further than primary education. Also, the variance in schooling years remains high, in particular for younger female cohorts. Returns to education are lower for the younger cohorts. This may be related to changes in the quality of the educational system, and/or to the significant increases in

educational attainment achieved in the past decades. Normally, the increase in the relative supply of educated workers effect is partially offset by economic growth, as that generates an increase in relative demand. In that sense, the observed decreasing trend would indicate that supply pressures have dominated over the past fifty years.

Finally, the analysis of household savings patterns across the life cycle shows that family arrangements by Peruvian households affect income patterns over the life cycle. We argue that Peruvian households do smooth consumption over the life cycle, but not only by the typical saving-dissaving mechanism, but also by smoothing household income. Under these circumstances, it is not easy to predict the implications of the demographic transition on aggregate savings in Peru. If anything, these initial findings on the savings age and cohort profiles stress the importance of additional research on the decisions on household structure over the life cycle in Peru. Another important issue is that the optimality of this income smoothing by Peruvian households over the life cycle may be related to the lack of development in Peruvian long-run capital markets. Again, we need to understand better this connection before trying to understand the potential effects of reforms in the pension system.

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Appendix A

The operational definition of income is based on net labor income, including in-kind payments, property rents, capital gains plus other non-labor income. We tried to include contributions to a pension system as income, but unfortunately, the PLSMS does not allow for the identification of such a variable. On the other hand, we did exclude pension payments because we wanted it to appear as negative saving for retired individuals or their relatives.

The operational definition for consumption is based on the expenditures on non-durables. The Instituto Cuánto identifies 9 groups of expenditures for the PLSM surveys:

Group 1: food, beverages and tobacco

Group 2: Clothing

Group 3: Household rent, payments and utilities

Group 4: Furniture and other household expenses

Group 5: Health

Group 6: Transportation and communications

Group 7: Education, entertainment and culture

Group 8: Net transfers

Group 9: Other

We constructed a different aggregate by excluding several sub-categories because they correspond to expenditures on durables. In particular, we excluded household rent and payments from Group 3. Household payments correspond to the purchase of the home, so it is definitely a durable. We also excluded rents since the collected information had several inconsistencies across survey runs.[14] We also excluded furniture from Group 4, education from Group 7 and all health expenditures (Group 7). Education and health expenditures were excluded because they are considered investments in human capital.[15]

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[14] In 1985, homeowners were asked about the estimated rent they would charge for somebody else to live in their house. After that, the question changed to the estimated rent they think they would have to pay had they not owned the house.

[15] As life cycle investments, expenditures in education and health have a strong pattern over the life cycle. That is, expenditures in education are higher when the household head is relatively young and has school-age children (Figure 4). In the case of health, also, it is known that households tend to spend more on health while

Figure 2 plots year-decile averages for log income (linc), and log of consumption (eg), as defined here, as well as two alternative expenditure aggregates on the year of the survey. g denotes the cohort averages for the total expenditures reported by Instituto Cuánto and fg denotes an aggregate that adds health and education expenditures to consumption (eg). The patterns across years for the two measures of expenditures and our measure of consumption do not seem to vary much, especially those of eg and fg. A somewhat puzzling feature is that household income seems to be less sensitive than expenditures to the crisis between 1985 and 1994, especially for households in the lower bottom of the distribution.

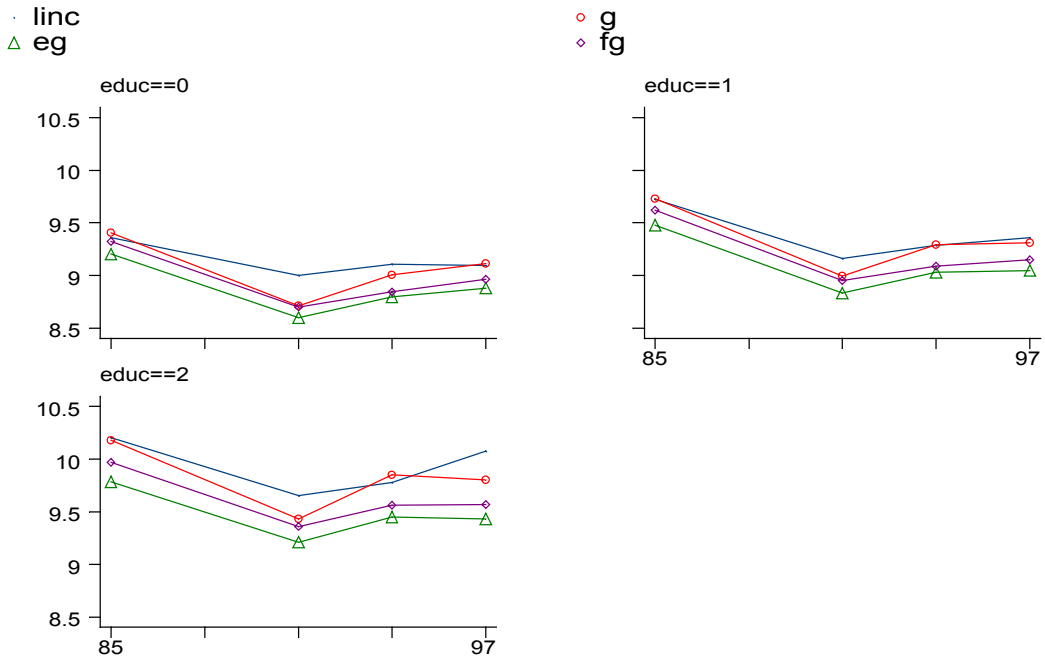


Figure A.1. Log Income, Log Expenditures and Log Consumption over the Years, by Level of Education

they have children younger than 5 years old. This would also be the time when expenditures on health would be more an investment in human capital (see Valdivia, 1999).

Appendix B

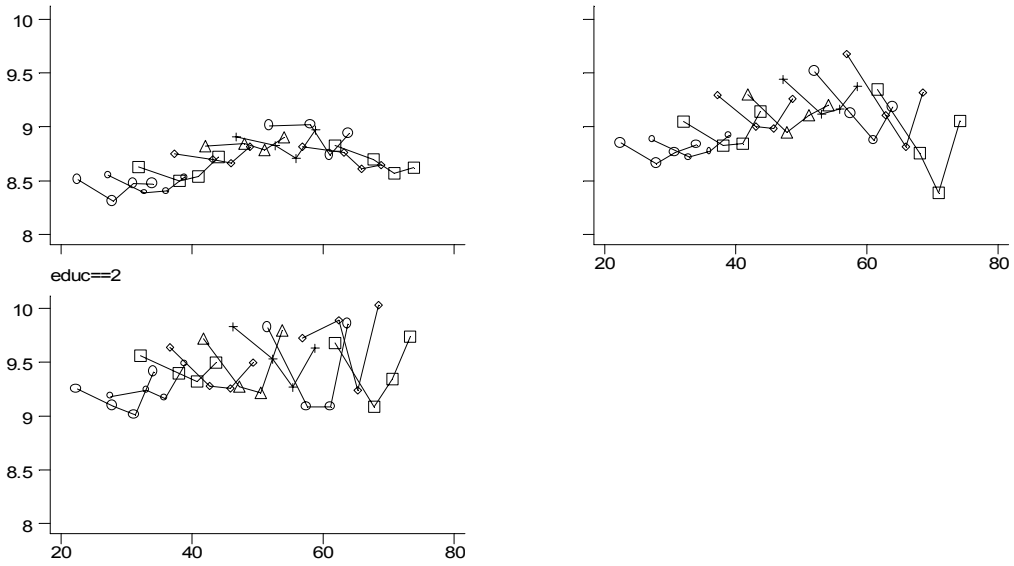


Figure B.1. Log Income over the Life Cycle

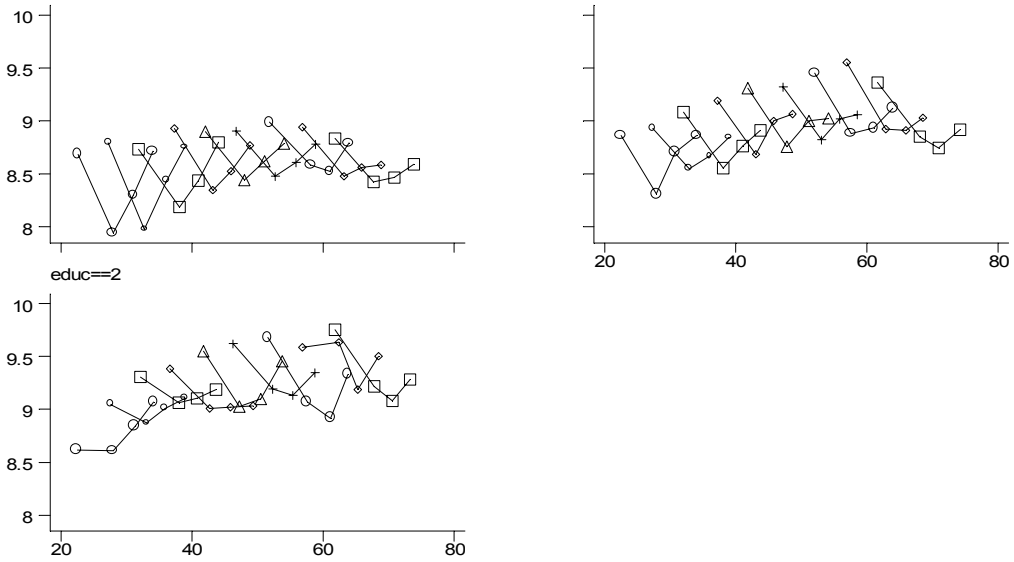
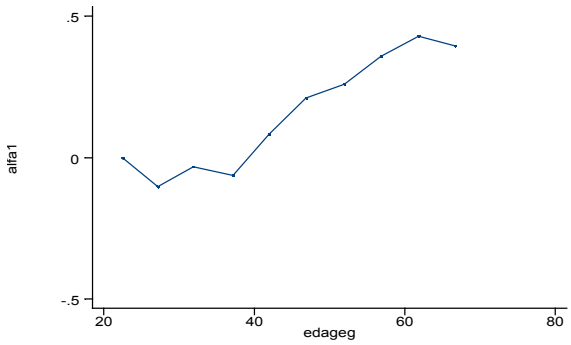


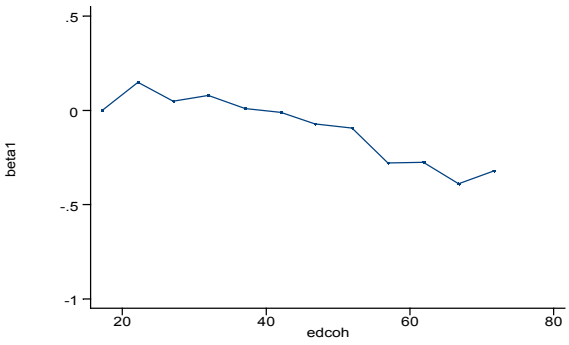
Figure B.2. Log Consumption over the Life Cycle

Appendix C

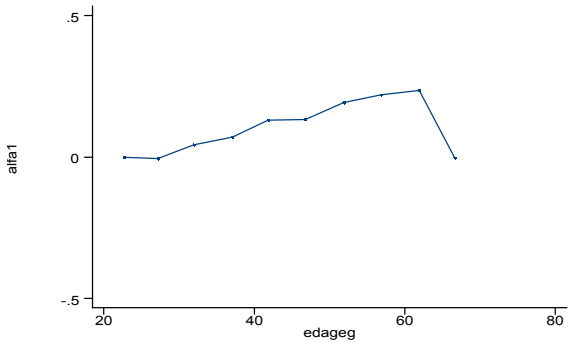
Log Savings—Age and Cohort Effects by Level of Education—Traditional Identification Strategy

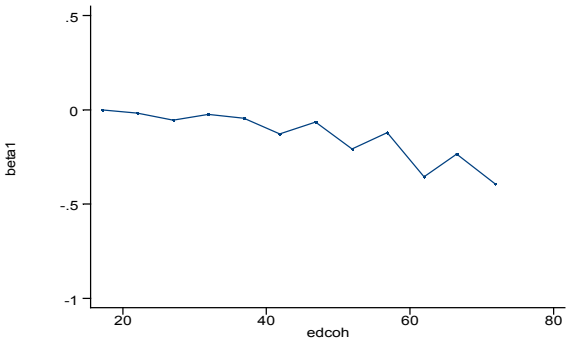
a. Primary





b. Secondary





c. Higher