Should we retire earlier to look after our parents? The role of immigrants

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Abstract

In this paper we focus on the determinants of early retirement in Italy, by extending the analysis of retirement decisions to consider the pivotal role of long-term care. Eligible to retirement workers may decide to retire earlier to devote time to their old parents. This possibility is more appealing for women, whose incentive for postponing retirement is lower than men. The market wage of care enters the retirement decision, as higher costs of care would induce workers to retire early to avoid that cost. In this respect, the recent boost of immigrants and the consequent reduction in the salary of the low-skilled workers, a sector where immigrants abound, have increased the opportunity cost of early retirement as the cost of formal care has become more affordable. Our study detects whether more years of work could be gained for workers with a more flourishing and cheaper market for the formal care, by using the flow of immigrants as the price for care. We disentangle the choices of retirement first modelling retirement choice by using a simple life-cycle framework where the care to parents is introduced in the choice set. We thus correlate the retirement choice with the gap between the foregone salary if early retirement is chosen and the price for formal care. Controlling for the endogeneity of immigrants and the potential selection mechanism the findings confirm the testable implications of our theoretical model: immigrants, especially its female component, contribute to postpone retirement decisions only of native females, particularly those with higher family commitments such as older living parents. According to our estimates we predict that a 5% increase in immigration would increase the retirement age for Italian women with older parents by over 1 year, with no impact on males.

Keywords: Age of retirement, international migration, long-term care.
JEL codes: J22, J26, F22.

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1 Introduction

In OECD countries generous pension policy schemes, particularly during the 1980s and early 1990s, have been advocated as responsible for the early retirement of workers from the labor force. And Italy stands out, among OECD countries, with the highest pension deficit: it was 14% of GDP compared to the average 7.2% ,and increased by 23% over the period 1995-2005 according to OECD. The Italian pension system is designed on a PAYG basis for the older workers - while the shift to the DC scheme affects the younger generations only. The structure of pension systems as such gives little incentive to work additional years, as pension benefits are weakly related to the contribution history. Old workers might be induced to go for an early retirement, as difference between salary and pension is not enough to justify remaining in work. The disincentive to work at old age exacerbates the financial burden on the pension debt due to an ageing population. Figure 1 plots the dependency ratio[1]: was 22% in 1992 and reached 30.5% in 2009 (ISTAT-Registry data). This upward trend has been fostered by a constant low fertility rate (Boeri, Del Boca ,and Pissarides (2005)) which was 1.25-1.37 over the period 2001-2007 (ISTAT).

There is a vast literature documenting how strong disincentives to continue working at old age are at work in many OECD countries: Brugiavini (1999), Brugiavini and Peracchi (2003, 2004), Alessie and Belloni (2008, 2010) provide evidence for Italy, whereas Gruber and Wise (2004) gather 12 country studies. The main framework utilized for estimating how incentives and disincentives work on retirement decisions is the Option Value model (Stock and Wise (1990)). According to this model, individuals compare, each year, the expected utility of current retirement versus the maximum utility corresponding to retiring at any future date. The option value is defined as the difference between the utility corresponding to immediate retirement with that of postponing retirement. The agent will rationally choose the option that guarantees the higher utility level, so the option value of postponing retirement will be negative for those choosing immediate retirement. The general aim of the above cited papers is to estimate the effectiveness of a set of incentives/disincentives (such as the change of a pension policy) on postponing retirement.
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Our paper looks at an innovative and unexplored question. Whether the implicit disincentive to continue working is affected ed e301(of)Tj13.4k9920Td(the)Tj20.51990Tsj58.68j2CD population ageing at an unprecedented high pace. Despite this demographic trend, little has been done to develop a formal market of the care for the elderly, the provision of in-kind long-term care is scarce and inadequate covering only 2% of those aged 65 and over[2].

Institutions for the elderly are perceived of very low quality and as sub-optimal with respect to having the parent living with the child or buying the services of a care giver who lives at home with the old person. The price of care is, therefore, determinant in the decision of whether to buy the care for the older relatives, which has been provided in the past by the young women within the family. Broad empirical evidence reports how the care to parents inevitably affects working and retirement decisions, particularly those of women, given their traditional role of care-givers in Italy. We argue that the recent boost of immigrants, their contribution to enlarge the size of the household services sector (formal long-term care, but also contributing to household chores activities) and to reduce its market cost have increased the opportunity cost of early retirement, by making the cost of formal care more affordable.

Italy has witnessed a massive increase of immigrants, nowadays reaching 7% of the total population. The female immigration has been mainly characterized by inflows of care-givers, which had an impressive role in fulfilling the unsatisfied demand of care and, in general, of house-keeping related services.

To our knowledge, the role of immigrations as a key factor explaining retirement decisions has not been analyzed yet, our aim is to fill this gap.

The rest of the paper is laid out as follows. Section 2 introduces the immigration's phenomenon and the institutional setting of the pension system in Italy. Section 3 provides a review of the relevant literature (3.1) and describes the theoretical model (3.2). Section 4 presents the data used. Section 5 reports the empirical strategy adopted and section 6 discusses the results obtained. Finally the paper concludes with a few conclusive remarks in section 7.

2 Immigration and Institutional Setting in Italy

Immigration to Italy is a quite recent and steadily increasing phenomenon, in 1991 resident immigrants represented only 0.6% of the total resident population and they have exceeded the number of 4 millions corresponding to 7% of the total population in 2010 (ISTAT). Figure 2 plots the trend in the stock of resident immigrants over the last 9 years disaggregated by macro-areas of origin. The upward trend is clearly shared by all countries, the only exception being two peaks for EU members and immigrants coming from eastern EU. The upward peak drawn by the stock of immigrants belonging to the EU represents the entrance of the group of eastern countries joining the EU25 in 2007, in fact this peaks is simultaneous to the downward trend experienced by the Eastern European group. The role played by immigrants in enhancing the size of the household services sector is clearly provided by Table 1 and figures 3, which show the incidence of immigrants in the domestic sector over the period 2003-2007 considering only workers ensured at the Social Security Archive (INPS). Table 2 reports the proportion of workers

[2]Own elaboration on INPS data

employed in the domestic sector by nationality. Immigrants are increasing their weight among those employed in the household services sector: they represented the 75% in 2003 and they have exceeded the 77% according to 2007 data. On top of that these percentages are an underestimation of the actual contribution of immigrants since the large majority of immigrants employed in this sector are not registered in the Social Insurance Archive since they don't have a regular contract.

From this evidence we claim that the recent massive inflow of low-skilled immigrants to Italy, enhancing the formal market for long-term care, might have played a role in shaping retirement decisions increasing the opportunity cost of early retirement for natives. Our study detects whether more years of work could be gained for workers with a more flourishing and cheaper market for the formal care, by using the flow of immigrants as the price for care. We disentangle the choices of retirement first modelling retirement choice by using a simple life cycle framework where the care to parents is introduced in the choice set.

Retirement often coincides with parents getting older and requiring assistance. Minimum retirement age in Italy has been very generous until the reforms that took place in the 1990's (Amato, Dini ,and Prodi's reforms), which made more restrictive the retirement rules.The lack of financial sustainability of pension system imposed to increase the retirement age and to decrease the pension benefits. Up to the above-cited reforms, the incentive to remain in work was very little (if not non-existent) as the pension benefit was practically uncorrelated with the amount of contribution paid. In other words, the incentive to remain in work was very little (Fornero and Sestito (2005)). The presence of old parents might exacerbate the disincentive to work as the price to buy care in the market can be a strong deterrent to work. Women, in a traditional country such as the Italian one, are usually the care-givers in the family. Early retirement of females can be associated to the need of care within the family. The price of caring, which immigrants have shaped over time, might play a pivotal role in making the incentive to retire later work. The empirical evidence by using SHIW data reports that both females and males experience a slight increase in expected retirement age over the period of our analysis as shown in Table 1. Females and males postpone their expected age of leaving the labor force by more than two years between 2000 and 2008. Given this evidence, the hypothesis we want to test is whether there has been any role for immigrants in explaining this upward trend and whether this role has been different by gender and by individuals with different degree of family commitments.

3 Optimal Retirement Decision

3.1 An Overview

The strand of literature on the determinants of retirement decisions is particularly fertile. The common denominator of most of these studies is the role played by financial incentives in shaping retirement decisions. Detecting the effectiveness of policies such as those discouraging retirement through the introduction of a DC scheme rather than a DB scheme, is crucial to understand how incentives to postpone retirement are taken successfully into account in the decision process of retiring.

Within this literature, both developed using reduced forms and structural models, among which the work of Stock and Wise (1990) stands out as the seminal work introducing the pension choice according to the Option Value (OV) theory. In a nutshell, the OV considers the different utilities associated to immediate retirement versus postponement, by choosing the best of the alternatives. An alternative to the OV value models is given by Dynamic Programming (French (2005)), which differs from the former only on the way uncertainty (which is captured by a stochastic component relative to health status, for example) is treated. However, results with the two different approaches differ little from each other (such as in Lumsdaine, Stock and Wise (1995)).

Several papers have drawn from the seminal contribution of Stock and Wise. To quote one of the the most relevant for our study, Brugiavini & Peracchi (2003) adopt a reduced form of the option value model and estimate a probit using the administrative data provided by the Social Security archive (INPS). To measure the effectiveness of incentive measures, they use retirement incentives such as the stock of Social Security Wealth (SSW) which they combine with other alternative marginal measures such as the Social Security Accrual, the Peak Value and the Option Value[3]. Their findings show that the SSW has the expected sign and it is strongly significant, as opposed to the marginal incentive measures which are barely significant and with the wrong sign. More recently Brugiavini and Peracchi (2004) estimate a reduced form probit for a sample of workers insured at the Social Security archive (INPS) using the predicted values of the SSW annual earnings and pensionable earnings. In this case, the incentive variables have almost always the right sign, whereas the SSW don't have the right sign in many of the specifications and is often not significant. Different policy scenarios are simulated through the impact of the incentive measures computed according to the legislated formulas, and the results show the accrual rate being the most effective. Brugiavini and Peracchi (2004) represent one of the country studies gathered by Gruber and Wise (2004). They apply the same template to 12 OECD countries by running a reduced form of the Option value model (probit regressions) and simulate different policy scenarios, providing strong support for the significant causal effect of financial incentives on retirement decisions. The effectiveness of financial incentives on retirement postponement is found being robust across all countries [4] regardless of the differences in the cultural and institutional setting of each of them. [5]

In a recent paper Alessie and Belloni (2010) estimate the version of the OV model

[3]The (one year) Accrual for an individual of age a at time t is defined as the difference between the SSW at time t relevant to postponing retirement at age a+1 and SSW at time t relevant to retire at age a. The Option value considers the present discounted value of future income corresponding to any future retirement age and then compute the difference between this value in case of immediate retirement versus this value at the optimal age. The prediction is that a worker will continue working until the Option value is positive. This measure entails two components of compensation from working: discounted utility from future wage and the change in discounted utility of benefits between immediate retirement and retiring at the optimal age. This second component of the Option Value represents the Peak Value, an alternative marginal incentive measure proposed by Coile and Gruber (2000) in order to exclude the individual heterogeneity linked to wage earnings as in the case of the Option Value. Since wage earnings proxy for individual preferences for working, the Peak Value allows to isolate the impact of financial incentive from heterogeneity

[4]with the exception of weak results for the case of Italy

[5]Samwick (1998) represents another relevant study which applies this reduced form version of the Option Value model to the case of U.S.

which accounts for dynamic self-selection on females using administrative data (INPS) providing all information on the contribution history of employees in the private sector. Their results confirm the importance of incentives on retirement decisions and provide evidence that the dynamic self-selection causes the marginal utility of leisure to be underestimated, thus the effect of pension reform to be overestimated.

Miniaci (1998) uses the Bank of Italy's Survey of Household Income and Wealth (SHIW) survey to show that younger workers retire earlier, the better educated and self employed postpone retirement, and that there is no evidence that public workers retire earlier. Bottazzi et al. (2006) use the same dataset as in Miniaci (1998) by extending the analysis to the use of information about retirement expectations. This dataset uniquely contains information on the expected retirement age and expected replacement rate for each (working) respondent. They analyse the effect of perceived financial incentives, such as the SSW, on the wealth accumulation of Italian workers, exploiting the exogenous variation on replacement rate and the change in the eligibility rules introduced with the Dini's pension reform in 1995. They first analyse whether workers revise their expectations about replacement rate and age of retirement as a consequence of the reform. The evidence, gathered using a difference in difference approach, shows that workers revise their expectations in the direction consistent with the reform. In fact, they raise expectations of the retirement age and reduce the expected replacement rates, which, in turn, is reflected into a lower expected pension wealth. They then evaluate the relation between perceived pension wealth and private wealth accumulation accounting for the different degree of workers' information, showing that a crowding-out effect of perceived SSW on individual wealth accumulation is at place for individuals well informed about the pension reforms, whereas, to a much lower extent, for the less informed individuals. The relationship between retirement expectations and financial incentives for retirement in U.S. is investigated, amongst many others, by Chan and Stevens (2002 and 2004). Their findings, based on the Health and Retirement Survey for the US, suggest that job loss affects retirement probabilities. In their subsequent study Chan and Stevens (2004) investigate the relationship between financial incentives and retirement expectation using U.S. data (HRS) and accounting for unobserved heterogeneity. In their studies the inter-temporal framework becomes richer to include possible borrowing and savings in the choice of retirement. They also deal with the problem of the potential endogeneity of financial incentives. The latter is a derived measure of earnings, and earnings are clearly related to tastes for leisure or working, thus not controlling for this correlation may produce biased coefficients since also retirement choices are correlated with these unobservable factors. The financial incentive endogeneity concerns had been already raised by Coile and Gruber (2000) who developed the Peak Value as an alternative measure of retirement incentives, which doesn't directly contain earnings, thus suffering to a lower extent from potential correlation with unobserved individual heterogeneity.

Our paper contributes to the existing literature by inserting the inter-temporal optimization over two dimensions. Firstly, we use an OV type of decisional model, to get the determinants of how incentive measures to postpone retirement successfully work. Allowing for asset accumulation within the model, provides us with testable implications of the effect of wealth (other than social security wealth) on retiring decision. As far as we know, the role of private wealth accumulation has been neglected so far in the analysis (with the exception of Chan and Stevens). We provide testable implications on the role of private wealth on retirement decisions Secondly, we also take into account the role of care during retirement, specifically the care towards the old parents. The need of care requested by old parents, exacerbated by the thinness of the care market, may act as a disincentive to continue work. If increasing life expectancy implies that the elderly will experience more years of disability before their death, then the increase in morbidity resulting from lower mortality will add to care-giving demand. Eligible to retirement workers face the trade-off between continuing working, by increasing their social security wealth, or retire earlier accepting a lower level of pension benefits. Retiring earlier also allows old workers with living parents to care for them and avoid buying long-term care on the formal market. Most of the studies on the role of informal care-giving on labor market outcomes are about U.S. data (Wolf and Soldo (1994), Ettner (1996), Kolodisnky and Shirey (2000)) with fewer cases analysing UK (Carmichael and Charles (1998, 2003), and Heitmuller and Michaud (2006)), a few cross country studies about European countries (Bolin et al (2008), Crespo (2007)) and only one study relevant to Italy (Marenzi and Pagani (2008)). All of these studies are quite consistent in pointing out to a negative impact of informal care provision on different measures of labor market supply, either at the intensive or at the extensive margin. Ettner (1995) was the first to analyse the connection between informal care giving to disabled people and female labor supply in U.S.. He estimates a two part model of the effect of care-giving for non co-resident disable elderly parents on the labor supplied by females at the intensive margin allowing for the endogeneity of the care-giving indicator. Instrumenting the care-giving indicator with number of siblings and parental education the main findings are in favor of a negative impact of care-giving on female hours of work. In a second study Ettner (1996) finds different impact of care-giving responsibilities on the intensive margin of labor supply by care-giver's gender and by type of care-giving recipient. Only giving care to non co-resident parents has a significant negative impact on labor supply of both gender as opposed to a non significant impact in case of demand for care within the household. Women labor supply is found much worse affected than for the men's case. Crespo (2007) shows a strong causal negative impact of elderly care activities on participation in the labor market for over 50 year-old European women with this impact becoming higher once the care-giving decision is considered endogenous as opposed to assuming its exogeneity. As for Italy Pagani and Marenzi (2008) study how the need for elderly care and the help received by relatives in household chores affect simultaneously the probability of Italian women to participate in the labor market. Treating the care for elderly and the help received as endogenous the main findings provide evidence of a negative impact of elderly care on the female labor force participation and a positive impact of the help received by non co-residing relatives. In a U.S. study Dentinger and Clarkberg (2002) use a discrete time analysis to investigate the relationship between informal care-giving responsibilities and retirement timing with a major focus on distinguishing between gender, different types of care recipients and different types of care. The main findings are that caring for a spouse has the strongest impact on shaping retirement decisions amongst all other types of care recipients, with a difference between gender, where women are likely to postpone their retirement whereas men slower the pace to retirement if the spouse is in need for care, suggesting that the breadwinner role assigned to men within the family is reinforced by the presence of care-giving responsibilities. On the other hand Bolin et al. (2008) exploit the European survey SHARE in order to show that care-giving responsibilities are responsible for a reduction in labor market outcomes in terms of labor supply, results shared by all countries in the survey.

The literature on the impact of immigration on the host country has been very fertile, particularly on investigating the impact on labor market outcomes, such as wages an employment. The findings are rather mixed, although there is quite a strong agreement in pointing to a non negative or non significant impact (Card (1990, 2001, 2007, 2009), Ottaviano and Peri (2006, 2008) D'Amuri et al. (2010), Peri (2007), Dustmann et al. (2005), and Gavosto et al. (1999)) with only few exceptions finding a negative impact (Borjas (2003), Borjas et al. (2008)). Low skilled immigration has been found to reduce the prices of immigrant-intensive services in U.S. cities according to a study done by Cortes (2008) who finds this results robust both to reduced form and structural estimates. To the best of our knowledge there are only a few studies to date which have investigated the relationship between immigration and natives' labor: Cortes and Tessada (2009) were the first to analyze this question by using U.S. data. Through a reduced form approach, they provide evidence that low-skilled immigration has increased the labor supply of highly skilled women at the intensive margin augmenting their hours of work. Another example is given by Farrè et al. (2009) who study the impact of female immigration on the labor supply of high-skilled native females in Spain showing that female immigrants have increased the labor supply of highly educated women at the intensive margin, particularly they have helped more women with younger children, or with family care responsibility, like co-resident elderly relatives and retired husband. In addition to that immigration has mainly helped women older than 50 to postpone their retirement decisions by increasing their probability of working. No effect has been found on labor supply of highly educated males. As for Italy Barone and Mocetti (2010) find similar results by showing that the presence of female immigrants specialized in household production increase the labor supply of highly educated Italian women at the intensive margin with no effect on the probability of being employed. To the best of our knowledge there are no existing studies which aim to investigate the relationship between immigration and retirement decisions. Therefore the main contributions of this paper are both theoretical and empirical: from a theoretical point of view we improve upon the existing literature through a dynamic programming approach, and we develop a modified version of the standard life-cycle model extending the analysis of the determinants of retirement to the pivotal role of the formal market for long-term care. In addition to that we contribute to the literature on the impact of immigration on the host country by estimating which is the role played by immigrants in shaping retirement choices of workers. Since we argue that immigration affects retirement decisions due to its contribution to long-term care and household production, we also analyze who are those mostly affected by this contribution. Moreover this is the first study which takes into account wealth and savings as potential determinants of retirement behavior using Italian data, despite the empirical evidence of a positive discretionary savings at all ages (Brugiavini and Padula (2001)).

3.2 Theoretical set-up

We adopt a theoretical model similar in spirit to Chan and Stevens (2004) who follow the Option value approach pioneered by Stock and Wise (1990), enriching the latter model in order to allow for the role of savings across time periods. We improve upon Chan and Stevens (2004) under two main respects: we introduce the nd(the role of the long-term disabilit)Tj53.2801
care costs to aren tal care. As Stock and Wise and Chan and ens our model
is a modified version of standard life-cycle approach a leisure enhancing factor
entering the utility function only retirement. Individuals are assumed to maximize
he following inter-temporal and searable utility function, with a Constant Relative
isk Aversion (CRRA) form:

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cti t .

$$\frac{}{(1+\rho)^{s-t}(1-\gamma)} + \sum^{T}$$

$$\sum_{s=t}^{T} \frac{c_s}{(1+r)^{s-t}} = A_t + \sum_{s=t}^{R} \frac{y_s}{(1+r)^{s-t}} + \sum_{s=R+1}^{T} \frac{B_s}{(1+r)^{s-t}} \qquad (2)$$

y and B are labor income and pension benefits, respectively, A_t the sum of and
financial wealth, and r is the annual terest rate, supposed to be wn constant
over time. Uncertainty is removed from the model by that know
certainty their expected end of life.
maximization problem, assuming $r = \rho$ and equal to zero, yields the following first order conditions:

$$c_t = c_{t-1} = c \qquad if\ t \neq R+1$$
$$c_{R+1} = k^{\frac{1}{\gamma}\gamma} c_R = k^{1-\gamma}$$

Substituting the FOC to the budget constraint gives[6]:

$$c = \frac{\sum_{s=t}^{R} y_s + \sum_{s=R+1}^{T} B_s + A_t}{\left[R - t + 1 + k^{\frac{1-\gamma}{\gamma}}(T-R)\right]}$$

[6] The genealth is described in the Appendix

The value function is the sum of flows of future utility when consumption is chosen at its optimal level:

$$V_t(R, A_t) = \left(\sum_{s=t}^{R} y_s + \sum_{s=R+1}^{T} B_s + A_t \right)^{1-\gamma} \frac{(R - t + 1 + k^{\frac{1-\gamma}{\gamma}}(T - R))^{\gamma}}{(1-\gamma)}$$

For individuals deciding to postpone retirement optimally to $\bar{R} > R$ it must hold that:

$$V_t(\bar{R}, A_t) > V_t(R, A_t) \tag{3}$$

where

$$V_t(\bar{R}, A_t) = \left(\sum_{s=t}^{\bar{R}} y_s + \sum_{s=\bar{R}+1}^{T} \bar{B}_s + A_t \right)^{1-\gamma} \frac{(\bar{R} - t + 1 + k^{\frac{1-\gamma}{\gamma}}(T - \bar{R})^{\gamma}}{(1-\gamma)} \tag{4}$$

with $\bar{B} > B$. Takings logs of (3) follows that for individuals deciding to postpone retirement the following inequality must hold:

$$\log(H_{\bar{R}}) - \log(H_R) > \frac{\gamma}{1-\gamma} \log \left[\frac{R - t + 1 + k^{\frac{1-\gamma}{\gamma}}(T - R)}{\bar{R} - t + 1 + k^{\frac{1-\gamma}{\gamma}}(T - \bar{R})} \right] \tag{5}$$

where $H_{\bar{R}}$ and H_R are the amount of resources under postponed retirement and early retirement, respectively.

$$H_{\bar{R}} = \sum_{s=t}^{\bar{R}} y_s + \sum_{s=\bar{R}+1}^{T} \bar{B}_s + A_t$$

and

$$H_R = \sum_{s=t}^{R} y_s + \sum_{s=R+1}^{T} B_s + A_t$$

We now want to introduce the possibility of taking care of the old parents when the indvidual is entitled to claim retirement, which is after age R. Suppose that the parents are alive until age R_3, which is higher than the early possible retirement age (R) and the latest (R_2). If the care of parents is bought in the market and the agent continues working we have:

$$\max_{c_t} U(c_t, c_{t+1}, ..., c_T) = \max_{c_s} \sum_{s=t}^{R_3} \frac{u(c_s)}{(1+\rho)^{s-t}} + \sum_{s=R_3+1}^{T} \frac{u(kc_s)}{(1+\rho)^{s-t}} \tag{6}$$

subject to the following intertemporal budget constraint

$$\sum_{s=t}^{T} \frac{c_s}{(1+r)^{s-t}} = A_t + \sum_{s=t}^{R_2} \frac{y_s}{(1+r)^{s-t}} + \sum_{s=R_2+1}^{T} \frac{\bar{B}_s}{(1+r)^{s-t}} - \sum_{s=R+1}^{R_2} \frac{y_s^c}{(1+r)^{s-t}} \tag{7}$$

so as individuals start enjoying leisure only after R_3, which corresponds to their parents' death and can still postpone the possible early age of retirement R to $R_2 < R_3$ by paying the market cost of long-term care $y^c = w^c h$, for the time interval $R_2 - R$, where w^c is the hourly salary for elderly care-givers with $y_s > y_s^c$. After some algebra follows that a similar inequality to (5) must hold:

$$\log(H_{\bar{R}}) - \log(H_R) > \frac{\gamma}{1-\gamma} \log \left[\frac{(R - t + 1) + k^{\frac{1-\gamma}{\gamma}}(T - R)}{(R_3 - t + 1) + k^{\frac{1-\gamma}{\gamma}}(T - R_3)} \right] \tag{8}$$

where

$$H_{\bar{R}} = \sum_{s=t}^{R_2} y_s + \sum_{s=R_2+1}^{T} \bar{B}_s + A_R - \sum_{s=R+1}^{R_2} y_s^c$$

and

$$H_R = \sum_{s=t}^{R} y_s + \sum_{s=R+1}^{T} B_s + A_R$$

The main testable implication of (8) is that a reduction in the market cost of long-term care, y^c has a positive effect on postponing retirement since:

$$\frac{\partial \log(H_{\bar{R}}) - \log(H_R)}{\partial y^c} = -\frac{1}{\left(\sum_{s=t}^{R_2} y_s + \sum_{s=R_2+1}^{T} \bar{B}_s + A_R - \sum_{s=R+1}^{R_2} y_s^c\right)} < 0$$

4 Data description & earnings projection

In order to investigate the relationship between age of retirement and the role of immigrants providing household services we rely on two different sources of data. The main source is the Bank of Italy's Survey of Household Income and Wealth (SHIW) which has been run since 1965 on a large random sample representative of the Italian population with latest available wave relevant to 2008. Until 1987 the sample was only cross-sectional, whereas since 1989 up to the latest wave the survey has introduced a sub-sample of panel households. Every two years the survey gathers information on about 8,000 households corresponding to about 24,000 individuals and provides data about income, wealth of family members, and socio-demographic characteristics of family members. Particularly since 1993 a special section has been devoted to collect information about whether individuals have non co-resident living parents. Since our dependent variable is the age of retirement, we use the actual retirement age for those who retire during the period of analysis, whereas for those who have never been observed retiring we impute the retirement age from the expected retirement age[7]. Individuals are asked the following question: "At what age do you expect to retire?". The information on the expected age of retirement is available since year 1989 for all waves up to 2008, but unfortunately this information can't be exploited over this time-span due to the

[7] Those who are observed retiring during the period of analysis represent 551 observations, corresponding to 6.66% of the whole sample (8276). In order to increase the efficiency of our estimates, due to the limited sample size, we consider also these respondents assuming that for them the expected age of retirement coincides with the actual one. However our estimates are robust also to the exclusion of this sub-sample. Results are not shown in order to avoid cluttering up but are available upon request.

fact that, in order to compute the pension benefits for those who never retire, we need to rely on another variable provided by the survey: the expected replacement rate at the time when individuals expect to retire. The survey elicits the information about the expected replacement rate at the time of retirement asking the following question: "Think about when you will retire, and consider only the public pension (that is, exclude private pensions, if you have one). At the time of retirement, what fraction of labor income will your public pension be?". This question is only available for the following years: 1989, 1991, and all years between 2000 and 2008. The second source of data we rely on is provided by ISTAT. We use the resident permits collected yearly by the Home Office and released by ISTAT disaggregated by country of origin in order to compute a measure of the country specific inflow of immigrants to Italy, this information is used to implement the instrument which will be described in the next section. A measure of the immigration rate by regions (the endogenous variable in our empirical analysis) is adopted as a proxy for the average immigrant local market wage in the household services (long-term care) sector. Although the Bank of Italy kindly provided us with the information about the country of origin, the number of immigrants in the survey is very low, corresponding to the 3% of the sample, therefore our measure of immigration rate at the regional level is computed from registry data (*anagrafe*) by taking resident immigrants and overall resident population. The assumption that immigration rate by region can be taken as a proxy for the average local market wage in the long-term care sector rests on the empirical evidence that immigrants represent the largest share of those employed in the long-term care sector and that 30% of immigrant workers are employed in low-skilled occupations. As a consequence, despite not having information on the skill-specific shock of immigration from registry data, we can claim that an increase in the total inflow of immigrants can have a substantial impact in the size of the household services. Moreover recent structural estimates about the impact of immigration on the Italian wage structure show that the immigration occurring in 2000 reduced wages of low-skilled immigrants by 3.5% (Romiti (2010)).
We thus have to limit our analysis only to the period 2000-2008, since for the years 1989, 1991 the information about resident immigrants is not available and moreover we need to consider a sufficient time lag between the period of analysis and the reference year adopted for the instrumental strategy which will be described in the next section. Our final selected sample consists of natives employed or observed retiring during the selected time-span with age between 40 and 70. After excluding all individuals who don't meet the age criteria or who have missing information on the variables included in the analysis our final sample size consists of a cross section of 8276 observations: among which 3235 represent females and 5041 represent males. Table 3 shows the descriptive statistics relevant to the sample used in the analysis.
We use the life tables disaggregated by year, gender, age and geographic location defined by 5 macro-regions and provided by ISTAT to recover the expected length of life for each individual.

In order to compute our pension incentives measures we need to reconstruct the counter-factual earnings for each worker. Different strategies are adopted according to different types of workers. For workers who are never observed retiring in the sample we need to recover the counter-factual earnings corresponding to the year before expected retirement in order to compute the relevant expected pension benefits. Therefore individual earnings are projected forward up to the year previous their expected retirement applying the constant growth rate of real earnings per capita corresponding to the last year they are observed in the sample. The growth rate of real earnings per capita is computed from aggregate earnings and aggregate employment using the national account statistics. In order to compute the earnings in case of immediate retirement we need to recover the predicted replacement rate corresponding to the last year they are observed. We predict the expected replacement rate by using the following regression

$$y_i = \beta z_i + \mathbf{x_i}'\gamma + \epsilon_i \tag{9}$$

where y_i is the expected replacement rate provided by the survey, z_i are the years of contributions expected to be paid before retirement computed from the survey which asks individuals about the number of years of contributions paid at the time of the interview, $\mathbf{x_i}$ is a vector of individual characteristics such as sex, education, type of occupation, civil status and time dummies, and ϵ_i is the standard zero-mean error term. The replacement rate is the predicted value for each individual using the number of year of contributions corresponding to retire in the last year when they are observed. This predicted value is applied to the last observed earnings in order to recover the benefits in case of immediate retirement (B). For workers who retire during the survey years we observe their actual pension benefits (B) and we need to recover the counter-factual earnings relevant to the year they effectively retire in order to compute the pension benefit in case of postponed retirement $\bar{\text{B}}$. Thus we project their last observed earnings using the relevant annual growth rate of per capita earnings to the year corresponding to their actual retirement and we multiply the latter by the predicted replacement rate obtained by using the estimated coefficients from (9). In order to compute $H_{\bar{R}}$ and H_R both B and $\bar{\text{B}}$ are assumed to be constant. All financial values are expressed in real terms, deflated using the CPI based index with base=2000.

5 Empirical strategy

The empirical strategy adopted in order to estimate the determinants of age of retirement follows a reduced form approach implemented, among others, by Peracchi and Brugiavini (2004, 2007), Coile and Gruber (2000), and Chan and Stevens (2002, 2004).
Our basic estimating equation can be expressed as

$$y_{ij} = \beta Im_j + \alpha(\log(\hat{H}_{\bar{R}}) - \log(\hat{H}_R))_{ij} + \mathbf{x_{ij}}'\gamma + \epsilon_{ij} \tag{10}$$

where the dependent variable y_{ij} is the age of retirement of individual i residing in region j, more specifically, y_{ij} is the expected age of retirement for those still working and the actual one for those observed retiring during the sample period. $\mathbf{x_{ij}}$ represents a vector of the following variables at the individual level: sex, education, age, age squared, civil status, real and financial assets, occupation, dummies for the size of the town of residence, dummies for region of residence, an indicator taking the value one for years equal or subsequent to 2004 when a law affecting retirement decisions was put in act in Italy (*Legge Maroni, 2004*)[8] and the immigration rate at regional level, Im_j. Finally

$$OV(\bar{R})_i = (\log(\hat{H}_{\bar{R}}) - \log(\hat{H}_R))_i \tag{11}$$

is our estimated measure of the Option Value of working up to age $\bar{R}$.
One of the possible factors that may weaken an OLS approach in our identification of the impact of immigration in equation (10) is due to the endogeneity of immigrants. Immigrants are not randomly allocated to regions, but they reasonably decide to reside in areas characterized by positive (unobservable) demand shocks, thus more favourable labor market conditions constitute a pull factors for them. At the same time these unobserved factors can affect also the retirement decisions of natives, enter positively the retirement equation and are positively correlated to immigrants' location, as a consequence you might expect the OLS coefficient to be upward biased. In addition to that, our measure of immigration rate is affected by measurement errors, since we only accounts for regular immigrants who are resident, thus discarding the contribution due to those who are regularly present in Italy but are not (yet) resident and to the irregular ones.[9] Since this type of error introduces a downward biased in the OLS coefficient, the direction of the resultant bias is an empirical question and depends on how much the two types of bias offset each others. We deal with both of these issues adopting an IV strategy broadly used in the literature which adopts the spatial correlation approach in order to estimate the impact of immigration on the host country. This strategy is called *supply-push component* and was initiated by Card (2001) in his seminal paper on the impact of immigration on natives' labor outcomes. The rationale behind the instrument rests on exploiting the past local settlement of immigrants from a given source country as an exogenous determinant of the current local country-specific distribution. The current country-specific flow of immigrants to the all country is then distributed according to its past regional distribution. The validity of this strategy relies upon two main requirements: the past local distribution is unrelated to current local pulling factors, simply stated we can claim that local demand shocks ought not to remain constant over time. In addition to that past and current local distribution have to be correlated and this requirement is strongly supported by the broad empirical evidence about the tendency of newly arriving immigrants to cluster in areas highly populated by immigrants from the same country in order to take advantage of the network already established there. The empirical findings suggest that this phenomenon is shared by different countries since Cutler et al. (2008) provide substantive evidence for U.S., whereas Damm (2009) and Aslund (2005) represent two recent example for Europe. Therefore the instrument for the term representing the immigration rate in region j and at time t, Im_j is computed according to the following formula:

$$IV_{jt} = \frac{\Sigma_c \lambda_{cj,t_0} M_{ct}}{Pop_{jt}}$$

[8] The law entails financial incentives for workers who decide to postpone early retirement.

[9] The incidence of regular non-resident immigrants on the resident ones is around 13%, whereas the irregulars represent the 10% (ISMU based on estimates provided by Cesareo and Blangiardo (2009)).

where

$$\lambda_{cj,t_0} = \frac{M_{jct_0}}{M_{ct_0}}$$

represents the ratio of immigrants from country c in region j at time $t = t_0$, where our selected past distribution is that relevant to year $t_0 = 1993$, M_{ct} is the total flow of immigrants to Italy from country c at time t and Pop_{jt} is the population in region j at time t. Pop_{jt} represents the total population when we compute the total immigration rate, whereas it is the female total population in case of female immigrants. As already mentioned in the previous section, due to the low number of immigrants in SHIW we compute the term M_{ct} using the stock of residence permits released and we only use SHIW in order to compute the term λ_{cj,t_0} since the regional distribution of immigrants disaggregated by country of origin is not available in registry data. Immigrants are disaggregated according to two macro-areas of origin: Eastern Europe and a second broad group obtained by polling together Asia, Africa and South America. The implementation of the instrument using this broad aggregation of different ethnic groups represents a drawback of the all strategy, but it's motivated and bound by data limitation, since the Bank of Italy provided us with the information on workers' country of birth only at this broad level due to privacy's constraints.
Another potential concern undermining the identification is due to the fact that individual heterogeneity in the preferences for working can also affect retirement age, some workers may be more work-lovers and prefer working rather than spending their time in leisure, whereas others may be more leisure-lovers. The existence of these preferences can affect in the same way the selection of individuals into the labor market and, ultimately, be responsible for the censoring of the retirement age. As a result we don't observe the expected age of retirement of those less attached to the labor market. Following the standard approach to sample selection we argue that basing our estimates only on the censored sample can potentially produce upward biased estimated parameters, thus this paper accounts for the selection mechanism adopting an Heckman correction approach. In order to deal with the problem of identification we select the variable for the exclusion restriction instead of relying on identification by functional form which is of a weaker type. The variable used for the exclusion restriction is the growth rate of GDP per capita at the time when workers enter the labor market starting their first job. Our preferred variable for the exclusion restriction would have been the growth rate of real earnings at the time of the first job but since this information is computed from national account data and is only available since 1970, we have to rely on the growth rate of GDP per capita[10] at the time of entering the labor force, which is instead available since 1951 and allows us to save much more observations. We follow the empirical strategy adopted by Blundell and Smith (1986) which accounts for selection and endogeneity and then we adopt an Heckman model with included residuals obtained from the first stage. Throughout the analysis the first stage specification includes a set of regional dummies, the regional population and a time trend.

[10] available from the Penn World Tables

6 Estimation results

Our main interest is to provide evidence that individuals with higher family commitments experience a positive impact of immigration in terms of postponing their age of retirement and staying longer in the labor force. Women are undoubtedly those within the household who mostly bear the burden of household chores and long-term care, therefore our main focus is to explore how immigrants affect differently potential care-givers, such as females and males and, among females, those with different degrees of family responsibilities. For this purpose we compare the results obtained by running separated regressions on different samples, contrasting those obtained for females and males and, among the former, we select those more involved in family care activities such as having older parents non co-residing with them[11] since we believe that this represents a stronger burden than living with older parents. Moreover, within the group of daughters with at least one older non co-resident parents, we select those whose parent(s) has a low level of education, where lower educated are considered those with less than secondary school. This choice is motivated by the strong empirical evidence of a positive correlation between health status and socio-economic status, denoted by education, income, or occupation, therefore we expect that daughters with at least an older and lower educated parent bear a bigger burden in terms of care-giving responsibilities provided that we consider education as a good proxy for health status. Our preferred model is the 2SLS method. The endogeneity is accounted for by both the two estimation methods (2SLS and Heckman), and this turns out to be an issue as it is clear from the residuals of the first stage regression always significant throughout the analysis. However the selection mechanism doesn't play a major role with the exception of the whole sample of females whereas in all other sub-samples it doesn't affect the estimation. This is clearly shown by the high p-value obtained from the LR test which never rejects the null hypothesis of absence of correlation between participation and main equation. Apart from the case of the pooled sample of females, the correlation between potential unobserved factors driving both retirement decisions and participation in the labor market doesn't turn out to be an issue. As a consequence hereafter we contrast and comment the results obtained by the IV strategy only, leaving the results of the Heckman method only as a robustness check for the cases where selection is not negligible. Table 4 and 9 report the results obtained separately for females and males, using a measure of immigration rate which includes all immigrants (table 9) and only considering the female component of immigration (table 4). The evidence is strongly in favor of a different impact of immigration by gender: only females are positively affected by immigration, since the coefficient turns out to be not significant for men in any of the specifications, whereas immigrants, especially its female component, help women to postpone retirement decisions, with a coefficient robust throughout the different regressions. If the channel through which immigrants help workers to postpone their retirement decisions is through helping them in the household production, which broadly includes housekeeping and care-giving activities, these results point to the expected direction, since the role played by female immigrants is substantially higher with respect to considering both female and male immigrants. This is consistent with the expectations since it is the former component of immigration to be

[11] We classify parents as older if their age is 75 or higher

mostly employed in the household services sector as reported in Table 2. The adopted instrument doesn't seem to be weak as it is clear from the bottom of tables 4 and 9: the first stage of the endogenous variable clearly shows an F statistics above the conventional value considered a signal of potential weakness. The selection mechanism turns out to be an issue only for the sample of females: in this case the exclusion restriction chosen for the participation equation, the growth rate of GDP per capita occurring at the time of first entering the labor force, supports the identification strategy adopted since it is highly significant and with the expected positive sign, we would expect in fact an higher level of GDP per capita to be a signal of more flourishing labor market conditions, and, as such, to bring about an higher probability of entering the labor force.

The remaining results consider different groups of females characterized by different degree of family commitments. Table 5 reports those with at least one older non co-resident living parent by using the female component of immigration which is our preferred measure of immigration for evaluating its role on care-giving activities. We argue that females having to take care of their non co-resident parents have to bear an higher burden compared to the case of those sharing the house with them, since the time to be spent in reaching their parents' house adds up to the time spent in caring for them. In this case we rule out the results of the Heckman regression since there is no evidence of any role for selection in any of the sub-samples, as it is clear from the p-value of the LR test shown at the bottom of the tables. According to the 2SLS results, the positive impact of immigration on the whole sample of females is certainly driven by its impact on this sub-sample which shows a much higher coefficient than the previous one. As expected this result is driven by the female component of immigration, in fact it holds true only for this case since the coefficient of the immigration rate is not significant and even lower in magnitude if we measure immigration by pooling all men and women, as table 10 reports. Our analysis suggests that females between 40 and 70 year old with at least one non co-resident older parent benefit from immigration in terms of postponing their retirement age, a 5% rise in immigration rate brings about a delay in expected age of retirement of 1.4 year. However, if this is the channel through which immigrants contribute to long-term care, we expect this contribution to be higher for females whose parents' health is worse. Therefore we replicate the analysis by selecting, among females with at least one older non co-resident parent, those whose parental educational level is lower. Table 6 further supports and strengthens the results found in the previous table since, within the daughters of older parents, we select those whose parents are less healthy (educated), the results show that the benefit from female immigrants is higher as it is clear from the bigger coefficient of immigration, according to these latter estimates a 5% increase of female immigration helps women to delay retirement age by one year an a half. Finally, in order to support further our hypothesis about the role of female immigrants in the long-term care, we consider another two sub-samples of potential persons demanding long-term care: females with older single parents and females with older single and lower educated parents. For both these sub-samples immigration represents a strong support in the long-term care since its coefficient is again positive and statistically different from zero, and even higher in magnitude with respect to all the previous cases as reported in tables 7 and 8.

Overall all these findings strongly support the conclusion that immigrants, by contributing to household production and, particularly, to long-term care, help women to stay longer in the labor market by increasing the opportunity cost of early retirement.

The predicted measure of the OV turns out to be highly significant and with the expected positive sign regardless of the specification adopted, confirming the results found in previous studies that financial incentives do matter in driving retirement decisions (Brugiavini and Peracchi (2003, 2004), Gruber and Wise(1999, 2004) Alessie and Belloni (2008, 2010), Chan and Stevens (2002, 2004). As for the other regressors our results show that married people retire earlier, instead better-educated individuals retire later. Workers employed in highly skilled occupations retire later, as it is clear from the positive and statistically significant coefficients of white collars and managers, the exclusion category being represented by blue-collars workers. Results which is in line with expectations given that our definition of low-skilled coincides with blue-collar workers who are those who presumably perform more physically demanding jobs. The coefficient on age is negative and significant throughout the analysis, whereas its square value is positive suggesting that (expected) age of retirement is initially declining with age and begins to increase later, however the magnitude of these coefficients provides a turning point correspondent to age 90, as a consequence the relationship between age and age of retirement turns out to be decreasing due to the sample age being between 40 and 70. Regarding other financial variables included in the analysis the two components of wealth don't seem to play any role in shaping retirement decisions for females since they are never significant. On the contrary wealth significantly affects retirement decisions for males: financial wealth brings about a reduction in the age of retirement whereas real wealth has a positive impact.

All the results point out to a strong support for our testable implications: immigrants, especially their female component, contribute substantially to the household production, and particularly to the long-term care, since they help only females to postpone their retirement decisions, whereas they don't bring about any impact on males. Moreover, female immigrants give a very high support to daughters with living non co-resident old parents, who represent a big burden in terms of family care responsibilities, due to the declining health status associated to ageing.

Overall we find that an inflow of female immigration corresponding to a 5% of the resident population increases the retirement age of Italian women with older living non co-resident parents by almost one year and a half, whereas the gain for women is even higher in case they have to take care of at least one old parent who is single and in bad health, gaining almost 2 years of work as a consequence of the help provided by immigrants care-givers. The impact of the actual flow of immigration occurred during the period of our analysis (corresponding to a 2% increase over the period 2000-2008) has brought about an increase of age of retirement equal to more than half of a year for native females with older non co-resident parents.

7 Conclusions

This paper investigates the determinants of retirement decisions for Italian people, enriching the standard approach of the relevant literature, which mainly looks at the role played by financial incentives, to the pivotal role of the need for long-term care. Italy stands out among other OECD countries with its extremely high dependency ratio, as a consequence the increasing life expectancy and the associated increased morbidity for older people represents an unexplored potential driving factor of retirement decisions for those more involved in family care. We argue that women, and particularly those with higher family commitments such as older non co-resident parents, especially if in bad health, are those mainly affected by the increasing burden of long-term care. At the same time, they are also those who mainly gain from a more florid and cheaper market for household services and long-term care brought about but the massive inflow of low-skilled immigration. Our results confirm the testable implications derived by our theoretical model: a decrease in the market cost of long-term care helps to postpone age of retirement. Assuming the inflow of immigrants as a proxy for the price of care we found that immigration, by increasing the affordability and reducing the market costs of long-term care, helps those responsible for household production to postpone retirement by increasing the opportunity cost of early retirement. The different results found by gender and by different types of potential care-takers within the group of women foster further our hypothesis. We found that the role played by immigration holds only for those who are traditionally involved in household production, in fact we find a dramatic difference between gender: females overall gain from immigration, whereas the latter doesn't have any impact on males. As a consequence we first conclude that immigration helps individuals in household production. In addition to that the contribution provided by immigrants rests on their support to long-term care given that restricting the analysis to daughters with non co-resident parents, those with older parents gain to a much higher extent from immigration. The positive impact of immigration gets even higher for daughters whose older parents are in bad health, signalling that the potential increase in household chores associated to parent's bad health conditions is mitigated by the contribution of immigrants.

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Appendix

Individuals are assumed to face the following inter-temporal maximization problem

$$\max_{c_t} U(c_t, c_{t+1}, ..., c_T) = \max_{c_s} \sum_{s=t}^{R} \frac{u(c_s)}{(1+\rho)^{s-t}} + \sum_{s=R+1}^{T} \frac{u(kc_s)}{(1+\rho)^{s-t}}$$

where the utility function is represented by a CRRA

$$\max_{c_t} U(c_t, c_{t+1}, ..., c_T) = \max_{c_t, c_{t+1}..c_{Tc}} \sum_{s=t}^{R} \frac{(c_s)^{1-\gamma}}{(1+\rho)^{s-t}(1-\gamma)} + \sum_{s=R+1}^{T} \frac{(kc_s)^{1-\gamma}}{(1+\rho)^{s-t}(1-\gamma)}$$

subject to the following budget constraints

$$\begin{aligned} A_{t+1} &= (1+r)(A_t + y_t - c_t) \quad if\ t \in [t, R] \\ A_{t+1} &= (1+r)(A_t - c_t + B_t) \quad if\ t \in [R+1, T] \end{aligned}$$

where A_t is an asset given at the beginning of the observed period, B_t is pension benefit, R is retirement date, T is the expected length of life, $k > 1$ accounts for leisure after retirement. We assume that workers can't leave either debts, nor bequest, i.e. $A_{T+1} = 0$.
The inter-temporal budget constraints is then equal to

$$\sum_{s=t}^{T} \frac{c_s}{(1+r)^{s-t}} = A_t + \sum_{s=t}^{R} \frac{y_s}{(1+r)^{s-t}} + \sum_{s=R+1}^{T} \frac{B_s}{(1+r)^{s-t}} \tag{12}$$

and the first order conditions yield

$$\begin{aligned} c_t &= \left[\lambda \left(\frac{1+\rho}{1+r}\right)^t\right]^{-\frac{1}{\gamma}} && \text{if } t \in [t, R] \\ c_t &= \left[\lambda \left(\frac{1+\rho}{1+r}\right)^t\right]^{-\frac{1}{\gamma}} k^{\frac{1-\gamma}{\gamma}} && \text{if } t \in [R+1, T] \end{aligned}$$

If $\rho = r$, follows that

$$\begin{aligned} c_t &= c && if\ t \in [t, R] \\ c_t &= k^{\frac{1-\gamma}{\gamma}} c && if\ t \in [R+1, T] \end{aligned}$$

Plugging the optimal path of c in (12) follows the optimal consumption

$$c = \frac{\sum_{s=t}^{R} \beta^{s-t} y_s + \sum_{s=R+1}^{T} \beta^{s-t} B_s + A_t}{\left[\frac{\beta^t - \beta^{R+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{R+1} - \beta^{T+1})}{\beta^t(1-\beta)}\right]}$$

The value function is equal to

$$V_t(R, A_t) = \left(\frac{\sum_{s=t}^{R} \beta^{s-t} y_s + \sum_{s=R+1}^{T} \beta^{s-t} B_s + A_t}{\frac{\beta^t - \beta^{R+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{R+1} - \beta^{T+1})}{\beta^t(1-\beta)}}\right)^{1-\gamma} \frac{(\beta^t - \beta^{R+1})}{\beta^t(1-\beta)(1-\gamma)}$$

$$+ \left(\frac{\sum_{s=t}^{R} \beta^{s-t} y_s + \sum_{s=R+1}^{T} \beta^{s-t} B_s + A_t}{\left[\frac{\beta^t - \beta^{R+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{R+1} - \beta^{T+1})}{\beta^t(1-\beta)}\right]}\right)^{1-\gamma} \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{R+1} - \beta^{T+1})}{\beta^t(1-\beta)(1-\gamma)}$$

which simplifies to

$$V_t(R, A_t) = \left(\frac{H_R}{\left[\frac{\beta^t - \beta^{R+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{R+1} - \beta^{T+1})}{\beta^t(1-\beta)} \right]} \right)^{1-\gamma} \left[\frac{(\beta^t - \beta^{R+1}) + k^{\frac{1-\gamma}{\gamma}}(\beta^{R+1} - \beta^{T+1})}{(1-\gamma)\beta^t(1-\beta)} \right]$$

where

$$H_R = \sum_{s=t}^{R} y_s + \sum_{s=R+1}^{T} B_s + A_t$$

Individuals optimally choosing to postpone retirement to $\bar{R}$ face the following maximization problem

$$\max_{c_t} U(c_t, c_{t+1}, ..., c_T) = \max_{c_t, c_{t+1}..c_{Tc}} \sum_{s=t}^{\bar{R}} \frac{(c_s)^{1-\gamma}}{(1+\rho)^{s-t}(1-\gamma)} + \sum_{s=\bar{R}+1}^{T} \frac{(kc_s)^{1-\gamma}}{(1+\rho)^{s-t}(1-\gamma)}$$

subject to the following inter-temporal budget constraint

$$\sum_{s=t}^{T} \frac{c_s}{(1+r)^{s-t}} = A_t + \sum_{s=t}^{\bar{R}} \frac{y_s}{(1+r)^{s-t}} + \sum_{s=\bar{R}+1}^{T} \frac{\bar{B}_s}{(1+r)^{s-t}} \tag{13}$$

The first order conditions yield

$$c_t = \left[\lambda \left(\frac{1+\rho}{1+r} \right)^t \right]^{-\frac{1}{\gamma}} \qquad \text{if } t \in [t, \bar{R}]$$
$$c_t = \left[\lambda \left(\frac{1+\rho}{1+r} \right)^t \right]^{-\frac{1}{\gamma}} k^{\frac{1-\gamma}{\gamma}} \qquad \text{if } t \in [\bar{R}+1, T]$$

If $\rho = r$, follows that

$$c_t = c \qquad if\ t \in [t, \bar{R}]$$
$$c_t = k^{\frac{1-\gamma}{\gamma}} c \qquad if\ t \in [\bar{R}+1, T]$$

Plugging the optimal path of c in (13) follows the optimal consumption

$$c = \frac{\sum_{s=t}^{\bar{R}} \beta^{s-t} y_s + \sum_{s=\bar{R}+1}^{T} \beta^{s-t} \bar{B}_s + A_t}{\left[\frac{\beta^t - \beta^{\bar{R}+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{\bar{R}+1} - \beta^{T+1})}{\beta^t(1-\beta)} \right]}$$

The value function is equal to

$$V_t(\bar{R}, A_t) = \left(\frac{\sum_{s=t}^{\bar{R}} \beta^{s-t} y_s + \sum_{s=\bar{R}+1}^{T} \beta^{s-t} \bar{B}_s + A_t}{\left[\frac{\beta^t - \beta^{\bar{R}+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{\bar{R}+1} - \beta^{T+1})}{\beta^t(1-\beta)} \right]} \right)^{1-\gamma} \frac{(\beta^t - \beta^{\bar{R}+1})}{\beta^t(1-\beta)(1-\gamma)}$$
$$+ \left(\frac{\sum_{s=t}^{\bar{R}} \beta^{s-t} y_s + \sum_{s=\bar{R}+1}^{T} \beta^{s-t} \bar{B}_s + A_t}{\left[\frac{\beta^t - \beta^{\bar{R}+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{\bar{R}+1} - \beta^{T+1})}{\beta^t(1-\beta)} \right]} \right)^{1-\gamma} \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{\bar{R}+1} - \beta^{T+1})}{\beta^t(1-\beta)(1-\gamma)}$$

which simplifies to

$$V_t(\bar{R}, A_t) = \left(\frac{H_{\bar{R}}}{\frac{\beta^t - \beta^{\bar{R}+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{\bar{R}+1} - \beta^{T+1})}{\beta^t(1-\beta)}} \right)^{1-\gamma} \left[\frac{(\beta^t - \beta^{\bar{R}+1}) + k^{\frac{1-\gamma}{\gamma}}(\beta^{\bar{R}+1} - \beta^{T+1})}{(1-\gamma)\beta^t(1-\beta)} \right]$$

where

$$H_{\bar{R}} = \sum_{s=t}^{\bar{R}} y_s + \sum_{s=\bar{R}+1}^{T} \bar{B}_s + A_t$$

Follows that workers postpone retirement if

$$V_t(\bar{R}) > V_t(R)$$

$$\left(\frac{H_{PR}}{H_R}\right) > \left[\frac{\beta^t - \beta^{R+1} + k^{\frac{1-\gamma}{\gamma}}(\beta^{R+1} - \beta^{T+1})}{\beta^t - \beta^{\bar{R}+1} + k^{\frac{1-\gamma}{\gamma}}(\beta^{\bar{R}+1} - \beta^{T+1})}\right]^{\frac{\gamma}{1-\gamma}}$$

Taking logs, follows that workers postpone retirement if

$$(\log H_{\bar{R}} - \log H_R) > \frac{\gamma}{1-\gamma} \log\left[\frac{\beta^t - \beta^{R+1} + k^{\frac{1-\gamma}{\gamma}}(\beta^{R+1} - \beta^{T+1})}{\beta^t - \beta^{\bar{R}+1} + k^{\frac{1-\gamma}{\gamma}}(\beta^{\bar{R}+1} - \beta^{T+1})}\right] \tag{14}$$

Introducing the market cost of long-term care, individuals with elderly living parents face the following modified version of the (13) maximization problem

$$\max_{c_t} U(c_t, c_{t+1}, ..., c_T) = \max_{c_t, c_{t+1}..c_{Tc}} \sum_{s=t}^{R_3} \frac{(c_s)^{1-\gamma}}{(1+\rho)^{s-t}(1-\gamma)} + \sum_{s=R_3+1}^{T} \frac{(kc_s)^{1-\gamma}}{(1+\rho)^{s-t}(1-\gamma)}$$

subject to the following inter-temporal budget constraint

$$\sum_{s=t}^{T} \frac{c_s}{(1+r)^{s-t}} = A_t + \sum_{s=t}^{R_2} \frac{y_s}{(1+r)^{s-t}} + \sum_{s=R_2+1}^{T} \frac{\bar{B}_s}{(1+r)^{s-t}} - \sum_{s=R+1}^{R_2} \frac{y_s^c}{(1+r)^{s-t}} \tag{15}$$

where R_3 is the dead of elderly parents. The first order conditions yield

$$c_t = \left[\lambda\left(\frac{1+\rho}{1+r}\right)^t\right]^{-\frac{1}{\gamma}} \qquad \text{if } t \in [t, R_3]$$
$$c_t = \left[\lambda\left(\frac{1+\rho}{1+r}\right)^t\right]^{-\frac{1}{\gamma}} k^{\frac{1-\gamma}{\gamma}} \quad \text{if } t \in [R_3+1, T]$$

If $\rho = r$, follows that

$$c_t = c \qquad if\ t \in [t, R_3]$$
$$c_t = k^{\frac{1-\gamma}{\gamma}} c \quad if\ t \in [R_3+1, T]$$

Plugging the optimal path of c in (17) follows the optimal consumption

$$c = \frac{\sum_{s=t}^{R_2} \beta^{s-t} y_s + \sum_{s=R_2+1}^{T} \beta^{s-t} \bar{B}_s + A_t - \sum_{s=R+1}^{R_2} \beta^{s-t} y_s^c}{\left[\frac{\beta^t - \beta^{R_3+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{R_3+1} - \beta^{T+1})}{\beta^t(1-\beta)}\right]}$$

The value function is equal to

$$V_t(\bar{R}, A_t) = \left(\frac{\sum_{s=t}^{R_2} \beta^{s-t} y_s + \sum_{s=R_2+1}^{T} \beta^{s-t} \bar{B}_s + A_t - \sum_{s=R+1}^{R_2} \beta^{s-t} y_s^b}{\frac{\beta^t - \beta^{R_3+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{R_3+1} - \beta^{T+1})}{\beta^t(1-\beta)}}\right)^{1-\gamma} \frac{(\beta^t - \beta^{R^3+1})}{\beta^t(1-\beta)(1-\gamma)}$$

$$+ \left(\frac{\sum_{s=t}^{R_2} \beta^{s-t} y_s + \sum_{s=R_2+1}^{T} \beta^{s-t} \bar{B}_s + A_t - \sum_{s=R+1}^{R_2} \beta^{s-t} y_s^c}{\frac{\beta^t - \beta^{R_3+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{R_3+1} - \beta^{T+1})}{\beta^t(1-\beta)}}\right)^{1-\gamma} \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{R_3+1} - \beta^{T+1})}{\beta^t(1-\beta)(1-\gamma)}$$

which simplifies to

$$V_t(\bar{R}, A_t) = \left(\frac{H^*_{\bar{R}}}{\frac{\beta^t - \beta^{R_3+1}}{\beta^t(1-\beta)} + \frac{k^{\frac{1-\gamma}{\gamma}}(\beta^{R_3+1} - \beta^{T+1})}{\beta^t(1-\beta)}} \right)^{1-\gamma} \left[\frac{(\beta^t - \beta^{R_3+1}) + k^{\frac{1-\gamma}{\gamma}}(\beta^{R_3+1} - \beta^{T+1})}{(1-\gamma)\beta^t(1-\beta)} \right]$$

where

$$H^*_{\bar{R}} = \sum_{s=t}^{R_2} y_s + \sum_{s=R_2+1}^{T} \bar{B}_s + A_t - \sum_{s=R+1}^{R_2} y^c_s$$

Follows that workers postpone retirement if

$$V_t(\bar{R}, A_t) > V_t(R, A_t)$$

$$\frac{H_{\bar{R}}}{H_R} > \left[\frac{\beta^t - \beta^{R+1} + k^{\frac{1-\gamma}{\gamma}}(\beta^{R+1} - \beta^{T+1})}{\beta^t - \beta^{R_3+1} + k^{\frac{1-\gamma}{\gamma}}(\beta^{R_3+1} - \beta^{T+1})} \right]^{\frac{\gamma}{1-\gamma}}$$

Taking logs, follows that workers postpone retirement if

$$\log(H_{\bar{R}}) - \log(H_R) > \frac{\gamma}{1-\gamma} \log \left[\frac{\beta^t - \beta^{R+1} + k^{\frac{1-\gamma}{\gamma}}(\beta^{R+1} - \beta^{T+1})}{\beta^t - \beta^{R_3+1} + k^{\frac{1-\gamma}{\gamma}}(\beta^{R_3+1} - \beta^{T+1})} \right] \quad (16)$$

where and

$$H_R = \sum_{s=t}^{R} y_s + \sum_{s=R+1}^{T} B_s + A_t$$

From (16) follows that, increasing the market cost of formal long-term care has a negative impact on postponing retirement age

$$\frac{\partial \log(H^*_{\bar{R}}) - \log(H_R)}{\partial y^c} = -\frac{1}{\left(\sum_{s=t}^{R_2} y_s + \sum_{s=R_2+1}^{T} \bar{B}_s + A_R - \sum_{s=R+1}^{R_2} y^c_s \right)} < 0$$

under our assumption that $y_s > y^c_s$.

Table 3: Summary statistics

Variable	**Mean**	**Std. Dev.**	**N**
Retir age	61.5220	3.9976	8276
OV	0.1755	0.192	8276
Hr	472480.4679	436446.7935	8276
Hpr	554818.9849	460196.5609	8276
Age	49.6806	6.3696	8276
Imrate	0.0403	2.4805	8276
Female Imrate	0.0394	2.4682	8276
Old parents	0.3841	0.4864	7185
Female	0.3909	0.488	8276
Log finan w	8.2479	3.1027	8276
Lor real w	10.8321	2.6766	8276
Married	0.8197	0.3844	8276
Single	0.0755	0.2642	8276
Divorced	0.0808	0.2726	8276
Widowed	0.0239	0.1528	8276
North East	0.2539	0.4352	8276
North West	0.2152	0.411	8276
Centre	0.2158	0.4114	8276
South	0.2148	0.4107	8276
Islands	0.1003	0.3004	8276
Labor earnings	14477.3468	9137.5093	8276
Blue col	0.3809	0.4856	8276
White col	0.51	0.4999	8276
Manager	0.0425	0.2018	8276
Empl	0.9334	0.2493	8276
Retir	0.0666	0.2493	8276
Agric_sec	0.0348	0.1833	8276
Industry	0.2889	0.4533	8276
Publ sec	0.3659	0.4817	8276
Other sec	0.2438	0.4294	8276
No edu	0.0072	0.0848	8276
Compul_sch	0.4323	0.4954	8276
High sch	0.4189	0.4934	8276
Higher edu	0.1415	0.3486	8276
Town 0-20000	0.2594	0.4383	8276
Town 20000-40000	0.1904	0.3927	8276
Town 40000-500000	0.4537	0.4979	8276
Town 500000+	0.0964	0.2952	8276

Source: SHIW (2000-2008)

Table 4: Sample: females and males.

	Females				Males			
	OLS	IV	Heckman	Heckman	OLS	IV	Heckman	Heckman
Female Imrate	0.004	0.178*	0.022	0.256***	0.021	0.035	0.021	0.032
	(0.044)	(0.073)	(0.045)	(0.075)	(0.042)	(0.069)	(0.042)	(0.071)
OV	6.763***	6.598***	6.696***	6.576***	10.300***	10.295***	10.300***	10.294***
	(0.387)	(0.389)	(0.382)	(0.382)	(0.342)	(0.344)	(0.341)	(0.343)
Law	0.175	−0.232	0.184	−0.322	−0.170	−0.204	−0.170	−0.197
	(0.163)	(0.210)	(0.161)	(0.210)	(0.144)	(0.194)	(0.143)	(0.197)
Age	−1.508***	−1.515***	−1.155***	−1.156***	−1.948***	−1.949***	−1.946***	−1.948***
	(0.133)	(0.134)	(0.152)	(0.152)	(0.110)	(0.110)	(0.118)	(0.123)
Age_sq	0.016***	0.016***	0.012***	0.012***	0.020***	0.020***	0.020***	0.020***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
High_skill	0.043	0.028	0.830***	0.811***	0.765***	0.765***	0.766***	0.765***
	(0.146)	(0.146)	(0.221)	(0.220)	(0.124)	(0.124)	(0.125)	(0.125)
Couple	−0.309*	−0.307*	−1.192***	−1.187***	−0.463**	−0.463**	−0.462**	−0.463**
	(0.127)	(0.127)	(0.226)	(0.224)	(0.161)	(0.161)	(0.161)	(0.161)
Log finan w	−0.032	−0.032	0.002	0.002	−0.075***	−0.075***	−0.075***	−0.075***
	(0.022)	(0.022)	(0.024)	(0.023)	(0.018)	(0.018)	(0.019)	(0.020)
logar_mut	0.024	0.019	0.028	0.023	0.067***	0.067***	0.067***	0.067***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.020)	(0.020)	(0.020)	(0.020)
White col	0.551***	0.573***	0.562***	0.602***	0.842***	0.842***	0.841***	0.842***
	(0.147)	(0.147)	(0.145)	(0.145)	(0.125)	(0.125)	(0.125)	(0.125)
Manager	1.521***	1.526***	1.499***	1.526***	2.047***	2.047***	2.047***	2.047***
	(0.408)	(0.409)	(0.409)	(0.408)	(0.244)	(0.244)	(0.243)	(0.243)
Residuals				−0.450***				−0.020
				(0.112)				(0.102)
Selection								
GDPrpc			4.141***	4.282***			0.597	1.006
			(0.833)	(0.836)			(3.217)	(3.300)
Female Imrate			0.024*	0.037**			−0.013	0.009
			(0.010)	(0.013)			(0.041)	(0.048)
Age			0.347***	0.347***			0.359***	0.351**
			(0.034)	(0.034)			(0.108)	(0.109)
Age_sq			−0.004***	−0.004***			−0.004***	−0.004***
			(0.000)	(0.000)			(0.001)	(0.001)
High_skill			0.902***	0.900***			0.177	0.181
			(0.036)	(0.036)			(0.137)	(0.140)
Couple			−1.182***	−1.181***			0.094	0.101
			(0.050)	(0.050)			(0.188)	(0.191)
Log finan w			0.033***	0.033***			0.058**	0.059**
			(0.006)	(0.006)			(0.018)	(0.019)
Log real w			0.013	0.013			−0.012	−0.012
			(0.007)	(0.007)			(0.022)	(0.022)
Residuals				−0.041				−0.069
				(0.023)				(0.075)
Adjusted R^2	0.205	0.206			0.305	0.305		
LogL			−11985.632	−11976.964			−13730.825	−13730.402
ρ=0 (p-value)			0.001	0.001			0.969	0.999
First stage								
F-stats		11.65				11.65		
Observations	3235	3235	8338	8338	5041	5041	5083	5083

Note: All specifications include the following additional regressors: regional dummies, and dummies for the size of the municipalities. The excluded categories are: dummy for blue collar workers, and a dummy for low-skilled workers. Asymptotic standard errors in parenthesis (for the IV model corrected by using the first stage regressors' matrix), where *, **, and *** denote significance at 5%, 1%, and 0.1%, respectively. The first stage regression is obtained using the following regressors: regional dummies, a time trend, and regional population with standard errors clustered at the regional levels.

Table 5: Sample: females with old parents

	OLS	IV	Heckman	Heckman
Female Imrate	0.028	0.277*	0.054	0.363**
	(0.078)	(0.137)	(0.081)	(0.140)
OV	7.511***	7.259***	7.528***	7.295***
	(0.723)	(0.733)	(0.712)	(0.716)
Law	0.149	−0.380	0.163	−0.467
	(0.269)	(0.361)	(0.265)	(0.354)
Age	−1.257***	−1.257***	−1.002**	−0.946**
	(0.298)	(0.299)	(0.380)	(0.337)
Age_sq	0.013***	0.013***	0.010**	0.010**
	(0.003)	(0.003)	(0.004)	(0.003)
High_skill	0.287	0.261	0.929	1.008*
	(0.274)	(0.276)	(0.684)	(0.510)
Couple	−0.406	−0.365	−1.009	−1.076*
	(0.232)	(0.234)	(0.625)	(0.458)
Log finan w	0.008	0.011	0.043	0.052
	(0.040)	(0.041)	(0.054)	(0.048)
Log real w	0.048	0.041	0.051	0.044
	(0.049)	(0.050)	(0.049)	(0.050)
White col	0.229	0.260	0.229	0.294
	(0.278)	(0.279)	(0.272)	(0.271)
Manager	1.299*	1.302*	1.245*	1.295*
	(0.622)	(0.625)	(0.623)	(0.620)
Residuals				−0.515**
				(0.192)
Selection				
GDPrpc			3.655*	3.698*
			(1.577)	(1.574)
Female Imrate			0.050*	0.055*
			(0.022)	(0.028)
Age			0.297***	0.298***
			(0.082)	(0.081)
Age_sq			−0.003***	−0.003***
			(0.001)	(0.001)
High_skill			0.918***	0.914***
			(0.068)	(0.067)
Couple			−1.100***	−1.094***
			(0.099)	(0.099)
Log finan w			0.043***	0.042***
			(0.011)	(0.011)
Log real w			0.018	0.019
			(0.015)	(0.014)
Residuals				−0.016
				(0.042)
Adjusted R^2	0.196	0.200		
LogL			−3730.764	−3727.165
ρ=0 (p-value)			0.527	0.444
Observations	1044	1044	2104	2104

Note: All specifications include the following additional regressors: regional dummies, and dummies for the size of the municipalities. The excluded categories are: dummy for blue collar workers, and a dummy for low-skilled workers. Asymptotic standard errors in parenthesis (for the IV model corrected by using the first stage regressors' matrix), where *, **, and *** denote significance at 5%, 1%, and 0.1%, respectively. The first stage regression is obtained using the following regressors: regional dummies, a time trend, and regional population with standard errors clustered at the regional levels.

Table 6: Sample: females with old and low educated parents.

	OLS	IV	Heckman	Heckman
Female Imrate	0.018	0.309*	0.033	0.377**
	(0.079)	(0.142)	(0.081)	(0.145)
OV	7.163***	6.874***	7.171***	6.887***
	(0.748)	(0.760)	(0.733)	(0.736)
Law	0.300	−0.320	0.299	−0.429
	(0.274)	(0.374)	(0.269)	(0.367)
Age	−1.414***	−1.424***	−1.305***	−1.285***
	(0.304)	(0.306)	(0.341)	(0.349)
Age_sq	0.015***	0.015***	0.014***	0.013***
	(0.003)	(0.003)	(0.003)	(0.004)
High_skill	0.317	0.290	0.604	0.599
	(0.276)	(0.279)	(0.515)	(0.560)
Couple	−0.410	−0.357	−0.697	−0.688
	(0.244)	(0.247)	(0.499)	(0.542)
Log finan w	0.005	0.008	0.019	0.023
	(0.042)	(0.042)	(0.047)	(0.048)
Log real w	0.017	0.009	0.020	0.014
	(0.052)	(0.052)	(0.051)	(0.051)
White col	0.188	0.218	0.185	0.255
	(0.280)	(0.282)	(0.274)	(0.274)
Manager	1.141	1.110	1.130	1.203
	(0.805)	(0.809)	(0.791)	(0.789)
Residuals				−0.561**
				(0.193)
Selection				
GDPrpc			4.442**	4.523**
			(1.672)	(1.671)
Female Imrate			0.061**	0.066*
			(0.022)	(0.028)
Age			0.257**	0.257**
			(0.084)	(0.084)
Age_sq			−0.003***	−0.003***
			(0.001)	(0.001)
High_skill			0.905***	0.903***
			(0.070)	(0.070)
Couple			−1.126***	−1.124***
			(0.104)	(0.104)
Log finan w			0.039***	0.039***
			(0.012)	(0.012)
Log real w			0.018	0.018
			(0.015)	(0.015)
Residuals				−0.014
				(0.043)
Adjusted R^2	0.196	0.201		
LogL			−3328.205	−3323.950
ρ=0 (p-value)			0.511	0.486
Observations	926	926	1946	1946

Note: All specifications include the following additional regressors: regional dummies, and dummies for the size of the municipalities. The excluded categories are: dummy for blue collar workers, and a dummy for low-skilled workers. Asymptotic standard errors in parenthesis (for the IV model corrected by using the first stage regressors' matrix), where *, **, and *** denote significance at 5%, 1%, and 0.1%, respectively. The first stage regression is obtained using the following regressors: regional dummies, a time trend, and regional population with standard errors clustered at the regional levels.

Table 7: Sample: females with old and single parents.

	OLS	IV	Heckman	Heckman
Female Imrate	0.064	0.333+	0.092	0.401*
	(0.101)	(0.182)	(0.101)	(0.182)
OV	7.216*	7.033*	7.238*	7.061*
	(0.859)	(0.870)	(0.834)	(0.836)
Law	0.246	−0.330	0.256	−0.392
	(0.345)	(0.476)	(0.335)	(0.462)
Age	−1.362*	−1.362*	−1.203*	−1.182*
	(0.379)	(0.381)	(0.393)	(0.393)
Age_sq	0.014*	0.014*	0.012*	0.012*
	(0.004)	(0.004)	(0.004)	(0.004)
High_skill	0.062	0.038	0.532	0.498
	(0.357)	(0.359)	(0.531)	(0.534)
Log finan w	0.077	0.079	0.104+	0.106+
	(0.053)	(0.053)	(0.057)	(0.058)
Loga real w	0.010	−0.003	0.018	0.004
	(0.067)	(0.068)	(0.066)	(0.066)
Couple	−0.175	−0.132	−0.619	−0.575
	(0.304)	(0.307)	(0.482)	(0.484)
White col	0.821*	0.862*	0.828*	0.889*
	(0.358)	(0.361)	(0.347)	(0.347)
Manager	0.631	0.621	0.619	0.615
	(0.826)	(0.831)	(0.804)	(0.802)
Residuals				−0.505*
				(0.241)
Selection				
GDPrpc			3.265	3.469+
			(1.994)	(2.000)
Female Imrate			0.065*	0.083*
			(0.027)	(0.034)
Age			0.229*	0.226*
			(0.100)	(0.100)
Age_sq			−0.003*	−0.003*
			(0.001)	(0.001)
High_skill			0.905*	0.899*
			(0.087)	(0.087)
Log finan w			0.050*	0.050*
			(0.015)	(0.015)
Log real w			0.022	0.022
			(0.018)	(0.018)
Couple			−1.055*	−1.047*
			(0.127)	(0.128)
Residuals				−0.045
				(0.052)
Adjusted R^2	0.213	0.217		
LogL			−2148.631	−2146.200
ρ=0 (p-value)			0.258	0.256
Observations	596	596	1270	1270

Note: All specifications include the following additional regressors: regional dummies, and dummies for the size of the municipalities. The excluded categories are: dummy for blue collar workers, and a dummy for low-skilled workers. Asymptotic standard errors in parenthesis (for the IV model corrected by using the first stage regressors' matrix), where $^{+,}$ *, **, and denote significance at 10%, 5%, 1%, respectively. The first stage regression is obtained using the following regressors: regional dummies, a time trend, and regional population with standard errors clustered at the regional levels.

Table 8: Sample: females with old single and low educated parents.

	OLS	IV	Heckman	Heckman
Female Imrate	0.072	0.393*	0.109	0.480*
	(0.103)	(0.187)	(0.104)	(0.186)
OV	6.747*	6.518*	6.795*	6.563*
	(0.879)	(0.894)	(0.852)	(0.853)
Law	0.485	−0.196	0.492	−0.275
	(0.347)	(0.483)	(0.336)	(0.465)
Age	−1.396*	−1.401*	−1.226*	−1.204*
	(0.389)	(0.392)	(0.394)	(0.393)
Age_sq	0.015*	0.015*	0.013*	0.012*
	(0.004)	(0.004)	(0.004)	(0.004)
High_skill	0.104	0.068	0.633	0.592
	(0.359)	(0.363)	(0.486)	(0.484)
Log finan w	0.065	0.067	0.094+	0.096+
	(0.053)	(0.054)	(0.056)	(0.055)
logar_mut	−0.028	−0.041	−0.019	−0.032
	(0.068)	(0.069)	(0.067)	(0.067)
Couple	−0.276	−0.218	−0.805+	−0.758+
	(0.317)	(0.321)	(0.459)	(0.456)
White col	0.753*	0.805*	0.769*	0.848*
	(0.361)	(0.365)	(0.349)	(0.349)
Manager	0.225	0.123	0.271	0.177
	(1.008)	(1.018)	(0.985)	(0.982)
Residuals				−0.598*
				(0.243)
Selection				
GDPrpc			3.993*	4.212*
			(1.980)	(1.987)
Female Imrate			0.070*	0.089*
			(0.027)	(0.035)
Age			0.205*	0.201+
			(0.103)	(0.103)
Age_sq			−0.002*	−0.002*
			(0.001)	(0.001)
High_skill			0.893*	0.887*
			(0.089)	(0.089)
Log finan w			0.043*	0.043*
			(0.015)	(0.015)
Log real w			0.022	0.022
			(0.018)	(0.018)
Couple			−1.081*	−1.073*
			(0.132)	(0.133)
Residuals				−0.047
				(0.052)
Adjusted R^2	0.209	0.215		
LogL			−2010.663	−2007.440
ρ=0 (p-value)			0.147	0.137
Observations	552	552	1234	1234

Note: All specifications include the following additional regressors: regional dummies, and dummies for the size of the municipalities. The excluded categories are: dummy for blue collar workers, and a dummy for low-skilled workers. Asymptotic standard errors in parenthesis (for the IV model corrected by using the first stage regressors' matrix), where $^{+}$, *, **, and denote significance at 10%, 5%, 1%, respectively. The first stage regression is obtained using the following regressors: regional dummies, a time trend, and regional population with standard errors clustered at the regional levels.

Table 9: Sample: females and males.

	Females				Males			
	OLS	IV	Heckman	Heckman	OLS	IV	Heckman	Heckman
Imrate	0.033	0.125*	0.061	0.154**	0.020	0.024	0.021	0.024
	(0.050)	(0.058)	(0.050)	(0.058)	(0.047)	(0.056)	(0.047)	(0.056)
OV	6.723***	6.624***	6.657***	6.603***	10.301***	10.301***	10.301***	10.298***
	(0.387)	(0.387)	(0.383)	(0.382)	(0.343)	(0.343)	(0.342)	(0.342)
Law	0.098	−0.130	0.103	−0.110	−0.172	−0.184	−0.172	−0.183
	(0.178)	(0.190)	(0.176)	(0.188)	(0.155)	(0.176)	(0.155)	(0.176)
Age	−1.510***	−1.513***	−1.175***	−1.174***	−1.948***	−1.948***	−1.944***	−1.944***
	(0.133)	(0.133)	(0.154)	(0.153)	(0.110)	(0.110)	(0.114)	(0.114)
Age_sq	0.016***	0.016***	0.012***	0.012***	0.020***	0.020***	0.020***	0.020***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
High_skill	0.040	0.029	0.781***	0.780***	0.765***	0.765***	0.766***	0.766***
	(0.146)	(0.146)	(0.227)	(0.223)	(0.124)	(0.124)	(0.124)	(0.124)
Couple	−0.309*	−0.308*	−1.143***	−1.153***	−0.463**	−0.463**	−0.462**	−0.462**
	(0.127)	(0.127)	(0.233)	(0.228)	(0.161)	(0.161)	(0.161)	(0.161)
Log finan w	−0.032	−0.032	0.001	0.000	−0.075***	−0.075***	−0.074***	−0.074***
	(0.022)	(0.022)	(0.024)	(0.024)	(0.018)	(0.018)	(0.019)	(0.019)
Log real w	0.023	0.019	0.026	0.023	0.067***	0.067***	0.067***	0.067***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.020)	(0.020)	(0.020)	(0.020)
White col	0.555***	0.572***	0.564***	0.591***	0.841***	0.842***	0.841***	0.841***
	(0.147)	(0.147)	(0.145)	(0.145)	(0.125)	(0.125)	(0.125)	(0.125)
Manager	1.523***	1.524***	1.505***	1.495***	2.050***	2.048***	2.049***	2.049***
	(0.408)	(0.408)	(0.409)	(0.408)	(0.244)	(0.244)	(0.244)	(0.244)
Residuals				−0.342**				−0.012
				(0.112)				(0.100)
Selection								
GDPrpc			4.326***	4.299***			0.904	0.890
			(0.838)	(0.838)			(3.175)	(3.178)
Imrate			0.038***	0.037***			0.007	0.006
			(0.011)	(0.011)			(0.042)	(0.042)
Age			0.346***	0.347***			0.355**	0.355**
			(0.034)	(0.034)			(0.108)	(0.108)
Age_sq			−0.004***	−0.004***			−0.004***	−0.004***
			(0.000)	(0.000)			(0.001)	(0.001)
High_skill			0.899***	0.899***			0.178	0.178
			(0.036)	(0.036)			(0.135)	(0.135)
Couple			−1.182***	−1.182***			0.092	0.091
			(0.050)	(0.050)			(0.185)	(0.185)
Log finan w			0.033***	0.033***			0.058**	0.058**
			(0.006)	(0.006)			(0.018)	(0.018)
Log real w			0.013	0.013			−0.011	−0.011
			(0.007)	(0.007)			(0.021)	(0.021)
Residuals				0.009				0.010
				(0.030)				(0.105)
Adjusted R^2	0.205	0.206			0.305	0.305		
LogL			−11981.544	−11976.402			−13730.888	−13730.876
ρ=0 (p-value)			0.002	0.002			0.910	0.904
First stage								
F-stats		12.24				12.24		
Observations	3235	3235	8338	8338	5041	5041	5083	5083

Note: All specifications include the following additional regressors: regional dummies, and dummies for the size of the municipalities. The excluded categories are: dummy for blue collar workers, and a dummy for low-skilled workers. Asymptotic standard errors in parenthesis (for the IV model corrected by using the first stage regressors' matrix), where *, **, and *** denote significance at 5%, 1%, and 0.1%, respectively. The first stage regression is obtained using the following regressors: regional dummies, a time trend, and regional population with standard errors clustered at the regional levels.

Table 10: Sample: females with old parents.

	OLS	IV	Heckman	Heckman
Imrate	0.051	0.158	0.059	0.171
	(0.094)	(0.109)	(0.096)	(0.117)
OV	7.489***	7.350***	7.489***	7.330***
	(0.724)	(0.729)	(0.712)	(0.715)
Law	0.089	−0.144	0.091	−0.113
	(0.306)	(0.324)	(0.301)	(0.319)
Age	−1.256***	−1.255***	−1.195***	−1.148**
	(0.298)	(0.298)	(0.356)	(0.439)
Age_sq	0.013***	0.013***	0.012***	0.012**
	(0.003)	(0.003)	(0.004)	(0.005)
High_skill	0.282	0.268	0.431	0.522
	(0.274)	(0.274)	(0.564)	(0.858)
Couple	−0.397	−0.379	−0.538	−0.637
	(0.233)	(0.233)	(0.519)	(0.798)
Log finan w	0.009	0.010	0.017	0.019
	(0.040)	(0.040)	(0.048)	(0.060)
Log real w	0.047	0.043	0.048	0.045
	(0.050)	(0.050)	(0.049)	(0.049)
White col	0.234	0.251	0.232	0.263
	(0.278)	(0.278)	(0.273)	(0.273)
Manager	1.307*	1.315*	1.300*	1.330*
	(0.621)	(0.622)	(0.612)	(0.614)
Residuals				−0.386
				(0.205)
Selection				
GDPrpc			3.561*	3.551*
			(1.668)	(1.696)
Imrate			0.071**	0.066**
			(0.023)	(0.025)
Age			0.296***	0.296***
			(0.082)	(0.082)
Age_sq			−0.003***	−0.003***
			(0.001)	(0.001)
High_skill			0.915***	0.915***
			(0.067)	(0.067)
Couple			−1.094***	−1.094***
			(0.099)	(0.099)
Log finan w			0.046***	0.046***
			(0.011)	(0.012)
Log real w			0.014	0.015
			(0.014)	(0.015)
Residuals				0.029
				(0.060)
Adjusted R^2	0.196	0.198		
LogL			−3729.361	−3727.420
ρ=0 (p-value)			0.735	0.648
Observations	1044	1044	2104	2104

Note: All specifications include the following additional regressors: regional dummies, and dummies for the size of the municipalities. The excluded categories are: dummy for blue collar workers, and a dummy for low-skilled workers. Asymptotic standard errors in parenthesis (for the IV model corrected by using the first stage regressors' matrix), where *, **, and *** denote significance at 5%, 1%, and 0.1%, respectively. The first stage regression is obtained using the following regressors: regional dummies, a time trend, and regional population with standard errors clustered at the regional levels.

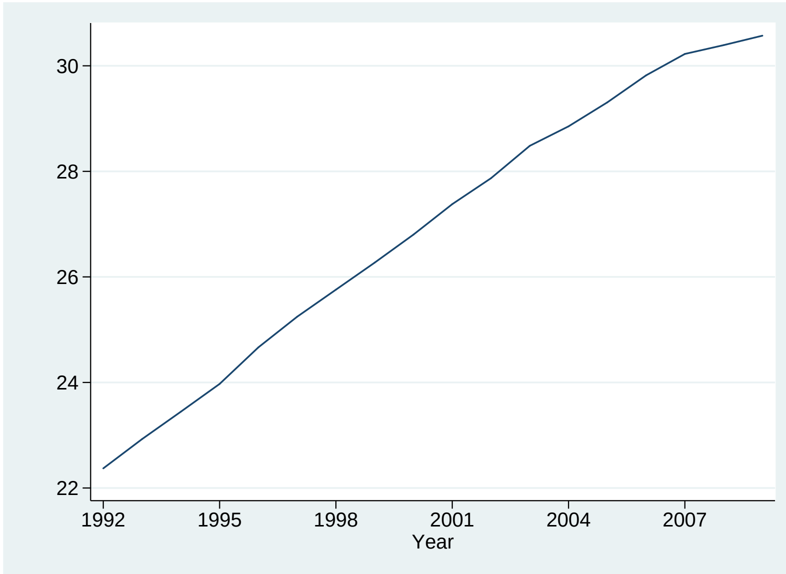

Figure 1: Dependency ratio. Source: elaboration from ISTAT data.

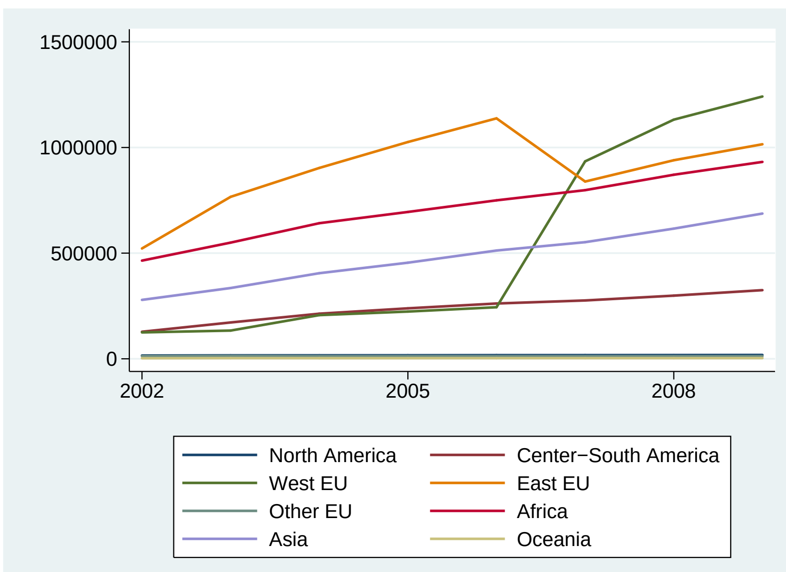

Figure 2: Resident Immigrants. Source: elaboration from ISTAT data

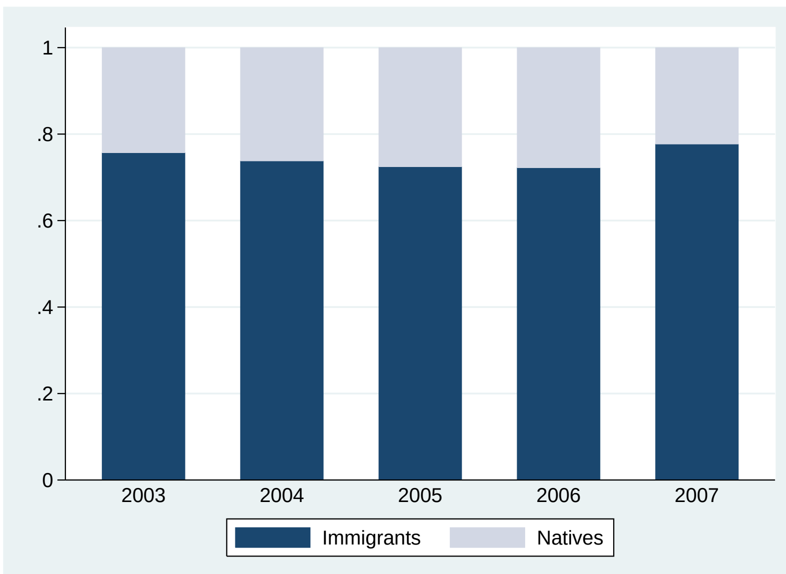

Figure 3: Domestic workers: percentages by nativity status. Source: INPS