Why kids today? Evidence on the old-age security motive from the Italian pension reform *(Incomplete draft prepared for submission to PAA 2008–not to be quoted or cited)*

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1 Introduction

Why do parents decide to have kids? Among the plethora of explanations that have been proposed, in this article we focus on two simple explanations. First, the family economics approach, systematized by Becker and Barro (1988) and Barro and Becker (1989) suggest that parents obtain directly utility from having and raising children. In this approach, therefore, kids resemble a "consumption" good in the utility function of the parents, who will optimally decide to share their resources between their own consumption and the consumption of their kids. Second, several authors who focus on exchange flows between generations have considered children as an "investment" good. In line with early work by Leibenstein (1957), Neher (1971), Caldwell (1978 and 1982) and Cain (1981) argue that parents may decide to have children because they expect to receive back a transfer from them in their old age. This "old-age security" motive would be particularly relevant in societies in which family ties are more binding and where there are no reliable savings instruments.

Several contributions have further elaborated these two alternative – and somewhat opposite – motivations, in an attempt to provide an explanation for the large fall in fertility that has been experienced worldwide during the last decades. For instance, Fernandes-Villaverde (2001) used a calibrated version of Barro and Becker (1989), while Boldrin and Jones (2002) provided a formal model of the old-age security motive, by which it is possible to analyze the effects of a reduction in infant mortality on the fertility rate. The impact of

the introduction of generous social security systems on the fertility trend has also been explored in this literature. The increase in pension spending and the contemporaneous drop in the fertility rate seems suggestive of a causality relation between the two phenomena (see Cigno and Rosati, 1992). The old-age security motive seems more promising to explain this fact and has received more attention. Boldrin, De Nardi and Jones (2005) have calibrated the previous model by Boldrin and Jones (2002) to quantify the effect of the increase in pension spending on the fertility trend. According to their calibrated model around 50% of the drop in fertility in the US is accounted for by the pension system.

For what concerns contemporary rich societies, Kagitcibasi (1982) argue that old-age security is not a reason for fertility in societies such as Germany and the U.S., despite this motive had been cited as "somewhat important" or "very important" by 32 percent of married German women and 27 percent of married U.S. women during interviews. Rendall and Bahchieva (1998) on the other hand, point out to the potentially high relevance of old-age security motives in contemporary developed societies by providing an extensive documentation of the relevance of children for providing support to their elderly parents in contemporary U.S: 11 percent of all unmarried elderly in the U.S. live above poverty because of co-residence with adult children, and observed poverty rates would double in absence of such co-residence. Nevertheless, empirical evidence of the existence of the old-age security motive in contemporary developed societies is lacking up to date.

In this paper, we propose a clear test of the two alternative theories, i.e. children as "consumption" good vs. children as "investment" good providing old-age security based on a natural experiment: the pension reform of the social security system in Italy. In 1995, the Italian public pension system has undergone a mayor reform that has sensibly reduced the future pension benefits (the so-called Dini reform). Interestingly, the magnitude of the reduction in the benefits largely differ across cohort of workers, according to their level of seniority, with a clear discontinuity. While the pension benefits of the individuals with 18 years of contributions or more at the end of 1995 were not modified, despite pension payments being particularly generous when compared to contributions paid, pension entitlements were largely reduced for all other workers (i.e. those with less than 18 years of contribution at the end of 1995) on a pro-quota basis, taking into account their contributory history. A similar discontinuity, affecting exactly the same cohorts and introducing a lower pension levels for those who had less than 15 years of contribution at the end of 1995, had already been introduced in an earlier reform in 1992 (Amato reform). This peculiar discontinuity in the Italian (Amato and Dini) pension reforms has already been exploited to analyze the effect of a reduction in the pension benefits on the savings (see Attanasio and Brugiavini, 2002) and on the retirement decisions (see Bottazzi, Jappelli and Padula, 2007).

This policy natural experiment is particularly well suited to differentiate between the two theories of fertility, which predict opposite effects of a reduction in the future pension benefits on the fertility. The "consumption" motive sug-

gests in fact that a reduction in the future entitlements reduces life-time income and should hence lead to a reduction in the parents' own consumption as well as in their fertility. The "old-age security" motive would instead predict that the reduction in old age resources driven by a lower pension should convince the agents to increase their financial savings and their fertility, in order to be able to effort more old age consumption. All these effects are spelled out in the stylized model presented in Section 2.

The empirical results of our regression discontinuity analysis performed on the Italian pension reforms confirm the relevance of the "old-age security" motive for contemporary fertility. Among the females with less than 42 year old, we find a clear positive effect of the drop in their future public pension entitlements on the probability of having a kid after the reform. This result is robust to different specifications.

2 The Model

To flesh out the old-age security motive and the consumption good motive for having children, we consider a simple two-period overlapping generations nested model that may account for both elements. This model is not meant to be novel, but rather to summarize in a simple environment some of the theoretical results existing in this literature, and to provide a theoretical background for our empirical analysis.

Individuals care about their youth and old age consumption, as well as about the number of kids they have, according to the following utility function:

$$U(C_t^t) + \rho U(f_t) + \beta U(C_{t+1}^t). \tag{1}$$

where superscripts denote the time of birth of the individual, and time subscripts denote time of action. Hence, C_t^t and C_{t+1}^t represent respectively the consumption in youth and in old age for an individual born at time t, and f_t indicates the fertility decision by an individual at time t, i.e., the number of kids. Finally, ρ and β are parameters that measure the relative importance of the number of children in the individual utility function and the subjective discount factor.

During the first period of their life, individuals work, and earn a wage w_t, on which they pay a proportional tax, τ_t, which is used to finance a PAYG social security system. They transfer a proportional share, d, of their wage to their parents. This share d is assumed to be exogenous and independent of the number of siblings that an individual has. As we shall discuss below, this simplifying assumption can be relaxed without modifying the main implications of the model. During the first period of their life, individuals take two decisions: how much to save for future consumption, s_t, and how many kids to have, f_t. Raising kids is costly. This cost is captured by the function $\phi(f_t)$, which clearly depends on the number of kids. In the second period of their life, agents do not work and consume all their income, which comes from three sources: their private savings, the transfer that they receive from their kids and the public

pension. The budget constraints in youth and old age of an agent born at time t are thus the following:

$$C_t^t = w_t(1 - \tau_t - d) - \phi(f_t) - s_t \tag{2}$$

$$C_{t+1}^t = s_t R_{t+1} + dw_{t+1} f_t + P_{t+1} \tag{3}$$

where R_{t+1} is the interest factor on the savings and P_{t+1} represents the pension transfer at time $t+1$.

In the first period of her life, each individual chooses the amount of savings to move into the second period, s_t, and her fertility, f_t. The first order conditions of the optimization problem are respectively:

$$U'(C_t^t) = \beta R_{t+1} U'(C_{t+1}^t) \tag{4}$$

for the saving decision and

$$U'(C_t^t)\Phi'(f_t) = \rho U'(f_t) + \beta d w_{t+1} U'(C_{t+1}^t) \tag{5}$$

for the fertility decision.

Equation 5 helps to identify the two reasons for having kids. The left hand side represents the marginal cost of raising kids in terms of less consumption in youth, while the first term on the right hand side shows that parents may derive direct utility from having kids and the second term suggests that the raise in the parents' utility may be driven by the increase in consumption due to the kids transfer, d. This simple formulation allows to isolate the two motives to have children by just imposing that either ρ or d are equal to zero. For instance, for $\rho = 0$, parents perceive their kids as an investment good that is alternative to private savings. The returns from these two investments should be equalized. Using the two first order conditions above, we would hence obtain: $R'_{t+1}\phi(f_t) = dw_{t+1}$.

In a symmetric equilibrium, all individuals obtain the same solution to the fertility decision. Thus, if we denote with N_t the size of the young generation alive at time t, the size of the future generation will be $N_{t+1} = f_t N_t$.

We assume the PAYG social security system to be budget balanced in every period. Thus, the social security budget constraint at time $t+1$ can be written as

$$P_{t+1} = \tau_{t+1} N_{t+1} w_{t+1} \left(1 - \varepsilon_{t+1}\right) / N_t = \tau_{t+1} f_t w_{t+1} \left(1 - \varepsilon_{t+1}\right)$$

where the parameter ε_{t+1} is meant to capture future changes in the social security transfer, such as those introduced in Italy by the Dini reform in 1995.

To continue this simple representation of the two fertility motives, it is convenient to impose some functional forms. Besides using a logarithmic utility function and a Cobb Douglas production function, $g\left(k_t\right) = k_t^{\alpha}$, we assume that the cost of having and raising kids is $\phi(f_t) = f_t^{\gamma}$, with $\gamma > 1$. By assuming a convex cost function in the number of kids, we make sure that individual decisions on fertility provide an interior solution even in this stylized setting.

With these functional forms, using the first order conditions of the optimization problem (see eq. 4 and 5) and imposing market clearing conditions, we can obtain the law of motion for the stock of capital, which, together with the fertility choice, characterizes this economy. In particular, we have that the stock of capital evolves according to the following function:

$$k_{t+1} = \Lambda k_t^{\frac{\alpha(\gamma-1)}{\gamma}} \tag{6}$$

where

$$\begin{aligned} \Lambda \quad = \quad & \left[\frac{\beta\left(1-\alpha\right)\left(1-\tau_t-d\right)\alpha\left(1+\beta\right)\gamma}{\alpha\left[\gamma\left(1+\beta\right)+\rho\right]+d\left(\rho+\beta+\gamma\right)\left(1-\alpha\right)+\tau_{t+1}\left(\rho+\gamma\right)\left(1-\varepsilon\right)\left(1-\alpha\right)}\right]^{\frac{\gamma-1}{\gamma}} * \\ & \left[\frac{\rho\alpha+d\left(\rho+\beta\right)\left(1-\alpha\right)+\rho\tau_{t+1}\left(1-\varepsilon\right)\left(1-\alpha\right)}{\alpha\beta\gamma}\right]^{-\frac{1}{\gamma}}. \end{aligned} \tag{7}$$

The fertility decision of the individuals living at time t is:

$$f_t = \Theta(\tau_t, \tau_{t+1}) k_t^{\frac{\alpha}{\gamma}} \tag{8}$$

where

$$\Theta = \left[\frac{\beta\left(1-\alpha\right)\left(1-\tau_t-d\right)+\left[\rho\alpha+d\left(\rho+\beta\right)\left(1-\alpha\right)+\rho\tau_{t+1}\left(1-\varepsilon\right)\left(1-\alpha\right)\right]}{\beta\left[\alpha\left[\gamma\left(1+\beta\right)+\rho\right]+d\left(\rho+\beta+\gamma\right)\left(1-\alpha\right)+\tau_{t+1}\left(\rho+\gamma\right)\left(1-\varepsilon\right)\left(1-\alpha\right)\right]}\right]^{\frac{1}{\gamma}}. \tag{9}$$

This economy described by equations 6 and 8 converges to a steady state featuring a stock of capital and a fertility that are respectively:

$$k_{ss} = \Lambda^{\frac{\gamma}{\gamma(1-\alpha)+\alpha}} \text{ and } f_{ss} = \Theta\Lambda^{\frac{\alpha}{\gamma(1-\alpha)+\alpha}} \tag{10}$$

To discriminate between the consumption and the investment motive to raise children, we now consider the impact of a reduction in the future pension benefits on the individual's fertility decision. To resamble the reform implemented in Italy in 1995, we consider that the contribution rates for the current and future generations remain unchanged, but the pension benefits decrease. In our model, this can easily be obtained by increasing the parameter ε. The next proposition characterizes the results.

Proposition 1 *A reduction in the pension benefits, i.e., an increase in ε, leads to an increase in the steady state level of the stock of capital k_{ss}, and to an increase in the steady state fertility rate, f_{ss}, if $(1-\alpha)\,d > \alpha\rho$, and to a reduction if $(1-\alpha)\,d < \alpha\rho$.*

The above proposition suggests that a reduction in the future pension benefits induces a differential change in the fertility decision depending on whether the consumption or the investment motive dominates. A lower pension benefits

reduces the individual life time income and tilts her endowment profile towards the youth. Agents will hence prefer to move some of their resources in youth towards old age consumption. For $d > 0$ and $\rho = 0$, that is, when only the old age security motive is at work, individuals will both increase their savings and have more kids. Instead, for $d = 0$ and $\rho > 0$, that is, when individuals obtain direct utility from having children, but kids do not transfer resource to their parents, agents will still want to increase their savings. However, in this case, they will reduce their fertility – there is, their "consumption" in terms of children – due to the reduction in their life time income. In the empirical part, we will use this differential response to a policy shock to identify the relative importance of these two fertility motives.

Finally, it is important to notice that the stark implications provided by this stilyzed model do not hinge on the semplifying assumptions used in this section. For instance, in a more complete model, in which kids determine the size of the transfers to their parents, Boldrin, De Nardi and Jones (2005) reach a qualitative similar conclusion to the one summarized by proposition 1.

3 Data and analyses (preliminary presentation)

We use data from the Bank of Italy's 2004 SHIW (Survey of Italian Households' Income and Wealth, 2002) . The SHIW provides, besides standard socio-economic and demographic variables, for the main earner in the household a) total number of years of contributions to the pension system; b) age of all co-resident children and number of non co-resident children. More specifically, we select households with a married couple at the time of the survey; given the low divorce rate in Italy, this should not constitute a threat in our analyses. Moreover, fertility histories are built using the date of births of co-resident children, while all non co-resident children are assumed to be born before 1993 (e.g. to be older than 11). Again, this should not constitute a threat to our results given the low divorce rate in Italy. We focus on male respondents, although we also use some data (in particular, age) from their female spouses or co-resident partner.

We have two principal dependent variables: 1. the number of children born starting from the year after each of the reforms (so from 1993 or 1996) and until the survey date; 2. whether an additional child was born during the same period. For what concerns explanatory variables, we focus on a main dychotomous "treatment" factor: whether the individual's pension entitlement were affected by pension reforms. To assess this, we use the total number of years of pension contribution at the date of the survey, and assume continuous work between pension reforms and the survey date. More precisely, household heads are "treated" (e.g. affected by pension reforms) if their total number of years of contribution to the pension system was lower than 27 at the end of 2004 (corresponding to lower than 18 at the end of 1995, or 15 at the end of 1992). In this sense, we are using pension reform as a natural experiment, and

adopting a regression discontinuity design to obtain causal estimates of the drop in expected pension benefits on fertility.

The sharp effect of pension reform is documented by Bottazzi et al. (2006), who estimate for instance that, with a retirement age of 60, the replacement rate (the ratio between pension income and work income before retirement) drops by 1 percent only for older private employess who had more than 27 years of contribution, compared to a drop by 12.4% for younger private employes. Differentials are even more pronounced for public sector employees or self-employed.

Figure 1 shows preliminary descriptive evidence of discontinuity in fertility behavior consistent with the old-age fertility motive. Using two separate linear approximations to the relationship between fertility and years of pension contributions of the household head (husband or cohabiting man), there seems to be evidence for a discontinuity in post-reform fertility (red curve) with a shift of around .1 post-1996 children (only women who were younger than 40 at the time of the reform are considered). Similar evidence is visible when the interval is extended to consider the impact of the Amato reform, and focus on the number of children born 1993-2006 (figure 2).

To test more directly what is the prevailing effect, we use OLS and probit regression models, focusing only on couples in which women were younger than 40 at the time of the reform(s), and in which men had between 20 and 34 years of pension contributions in 2004. That is, we use a regression discontinuity design on the window covering plus or minus seven years of pension contributions around the reform. As control variables, we use age of both partners (more specifically, the year of birth), and the number of children born prior to reforms.

Results for the Amato reform, i.e. on children born after 1993 are reported in figure 3, and they indicate that, coeteris paribus, individuals affected by the pension reform have on average around .12 children more after the reform, with a statistically significant effect. Repeating the same analysis on the Dini reform, i.e. on children born after 1996 indicate a smaller effect, albeit pointing to the same direction (.07 children more for individuals affected by the reform), and statistically significant only at the 10% threshold. The latter result is consistent with the idea that the Amato reform influences fertility also between 1993 and 1995. Additional analyses (not reported here) using a probit specification on the probability to have an additional child and on the probability of having a child for childless individuals show consistent results.Our findings from the natural experiment of the Italian pension reform therefore consistently point to the relevance of the old-age security motive over the consumption good motive for fertility.

Results are of general relevance for the study of fertility motives, and of particular relevance to the study of very-low and "lowest-low" fertility: the introduction of pension reforms might contribute to a rise in fertility; indeed, fertility in Italy had its minimum in 1996 and since then it is slowly rising. More research, however, is needed to understand the contribution of the old-age security motive to total fertility.

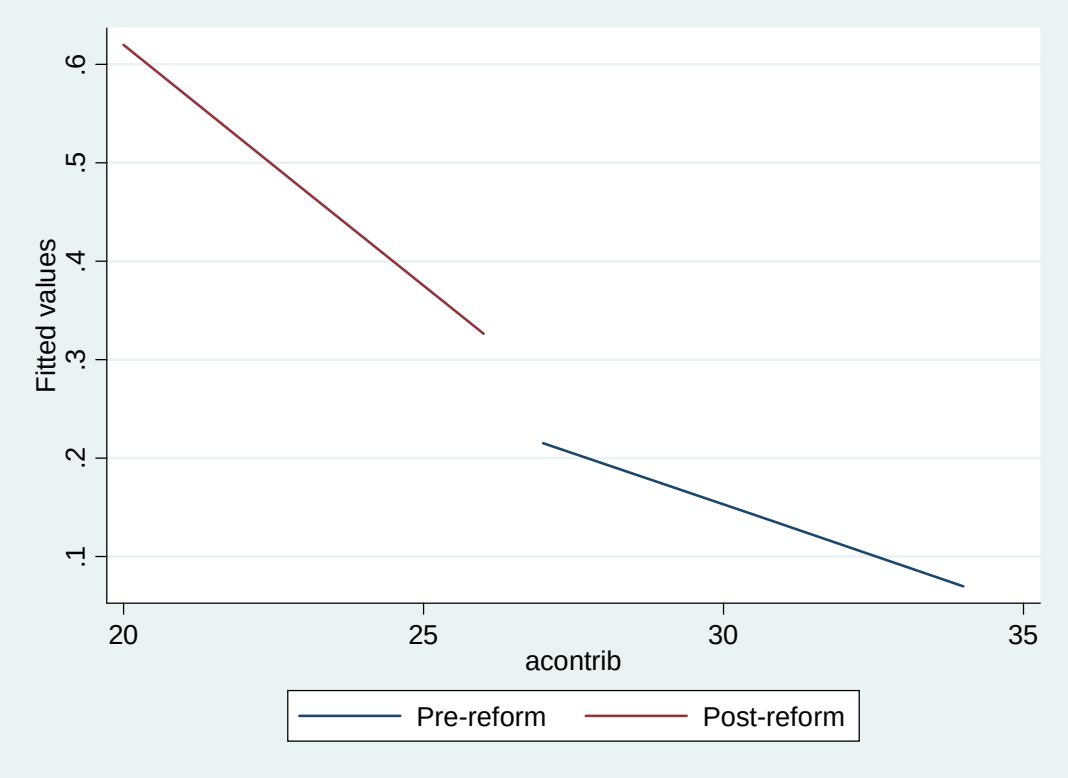

Figure 1: Regression discontinuity: average number of post-reform children by years of contribution (women born 1955 and later).

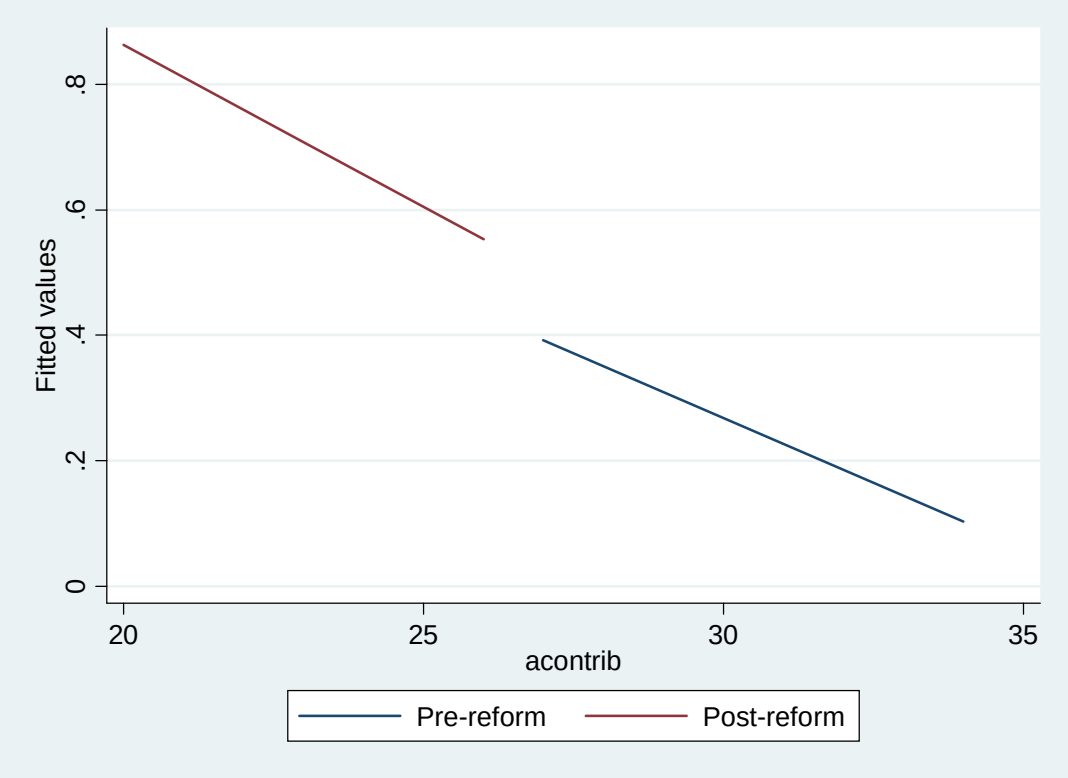

Figure 2: Regression discontinuity: average number of post-reform children by years of contribution (women born 1955 and later).

Figure 3: OLS regression on the total number of children born after 1993. figpre93 indicates previous number of children, anasc the year of birth of the man, anascwi the year of birth of the woman, AMATO the exposure to pension reform. N=1102, R^2=0.2852.

fig93	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
figpre93	-.1754449	.0210405	-8.34	0.000	-.2167291	-.1341607
anasc	.0213492	.0056971	3.75	0.000	.0101708	.0325276
anascwi	.0347461	.0060768	5.72	0.000	.0228227	.0466695
AMATO	.1183353	.0453954	2.61	0.009	.0292636	.207407
_cons	-109.2515	10.58578	-10.32	0.000	-130.0222	-88.48085

Figure 4: OLS regression on the total number of children born after 1996. figpre96 indicates previous number of children, anasc the year of birth of the man, anascwi the year of birth of the woman, AMATO the exposure to pension reform. N=1102, R^2=0.2682.

fig96	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
figpre96	-.1275154	.0169613	-7.52	0.000	-.1607957	-.0942352
anasc	.0140214	.0047488	2.95	0.003	.0047036	.0233392
anascwi	.0372528	.0050856	7.33	0.000	.0272741	.0472315
dini	.0661783	.0380492	1.74	0.082	-.0084792	.1408358
_cons	-100.0186	8.67855	-11.52	0.000	-117.047	-82.99013

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