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What explains fertility? Evidence from Italian pension reforms

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Abstract

Why do people have kids in developed societies? We propose an empirical test of two economic theories of fertility – children as "consumption" or "investment" good. We use as a natural experiment the Italian pension reforms of the 90s, which by decreasing expected pension benefits generated a large negative income effect, with a sharp discontinuity across workers. This policy experiment is particularly well suited, since lower future pensions are expected to have differential effects on fertility under the "consumption" and "investment" theories. Empirical analyses identify a causal, robust positive effect of less generous future pensions on post-reform fertility. These findings are consistent with an "old-age security" motive also for contemporary fertility in advanced societies or with the original Becker-Lewis (1973) version of the "consumption" theory, based on the interaction between quantity and quality of children.

Keywords: old-age security, quantity-quality trade-off, public pension systems, fertility, altruism.

JEL Classification: H55, J13, D64.

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1. Introduction

Why do people have kids? In particular, why do parents decide to have kids in contemporary developed countries? We review the main economic motives for childbearing that exist in the literature, and try to assess their empirical validity using a unique natural experiment. The family economics approach, pioneered by Becker (1960), suggests that individuals obtain direct pleasure from having and raising children, and from their well-being. Kids, and possibly their quality level, thus resemble a "consumption" good in the utility function of their parents. Evidence that genetic endowments influence the propensity to have children (see, e.g., Kohler et al., 1999; Rodgers et al., 2001) are consistent with this view. However, the initial formulation of this theory (Becker, 1960) delivered a positive correlation between fertility and family income, which is not supported in either cross-section or time-series data. The large literature that followed has emphasized two crucial aspects: a quantity-quality trade-off and the role of the cost of parental time (see Jones, Schoonbroodt, and Tertilt, 2008, and Guinnane, 2010, for two comprehensive reviews). Along the former lines, Becker and Lewis (1973) showed that an increase in income may lead to fewer children, but of higher quality. This is because rich parents value kids' quality, but higher quality increases the cost of having (and raising) kids, and may thus lead to lower fertility. The "price of time" consumption theory suggests that, since raising kids requires parental time, fertility is more costly for high income parents, who thus choose to have fewer kids[1]. The "old-age security" motive focuses instead on intergenerational flows within the family and considers children as an "investment" (or "production") good (see Leibenstein, 1957, Neher, 1971, Caldwell, 1978 and 1982, Cain, 1981, and Boldrin and Jones, 2002). Parents may decide to have children because they expect to receive back a (monetary or in-kind) transfer from them in their old age. In this case, altruism runs from the kids towards their parents. This "old-age security" motive should be particularly relevant in societies where family ties are more binding and/or no reliable saving instruments are

[1]Finally, "consumption" theories that postulate heterogeneity in tastes for kids argue that the negative income-fertility correlation is caused by individuals with a strong taste for kids dedicating more time and effort to their family and less to acquire market skills and income.

available.

In this paper, we examine the relevance of these fertility theories in an advanced, post-demographic transition society, characterized by low fertility and strong family ties: Italy. We analyze the effect on fertility choices of a sequence of Italian pension reforms (the so-called "Amato" reform in 1992 and the "Dini" reform in 1995), which largely decreased future pension benefits, while leaving social security contributions virtually unchanged.

Pension reforms are well suited to test these three economic theories of childbearing. A decrease in future pension benefits that is not matched by a corresponding reduction in social security contributions induces a clear, negative income effect. Moreover, to the extent that future pension benefits are linked to current labor income, incentives to work may also be reduced by a decrease in the future pension generosity. This latter effect amounts to a reduction in the opportunity cost of fertility – provided that raising kids requires parental time. Under all these fertility theories, this would lead to an increase in fertility. The former, pure negative income effect associated with a reduction in the pension benefits leads instead to different predictions under different fertility theories. In the most recent version of the "consumption" theories, based on the crucial role of the opportunity cost of parental time for fertility, a pure negative income effect leads to a drop in fertility, as well as in the parents' overall consumption. In the Becker-Lewis (1973) and Becker-Tomes (1976) quantity-quality version of the "consumption" theory, a negative income effect may instead lead to an increase in fertility, and to a contemporaneous reduction in kids' quality. In the "old-age security" motive (see Boldrin, De Nardi, and Jones, 2005), negative income and incentive effects go in the same direction. A reduction in the old-age resources, due to the lower expected pension benefit, induces the agents to increase their financial assets and/or their fertility in order to support their old-age consumption; while, at the same time, a reduction in the cost of raising kids increases the returns from fertility.

We exploit several features of the Italian family structure, labor market and pension reforms to be able to discriminate among these theories and to identify the effects of the reforms on fertility. First, in order to single out the pure negative income effects induced by the Italian pension reforms, we concentrate on the fertility decisions of couples, in which the male is a dependent worker, whose future pension benefits may (or may not) have been affected by the reforms. For these workers, due to institutional constraints in the Italian labor market, no (marginal) incentive effect is at work, since dependent workers are only able to modify their labor supply in discrete jumps, namely by choosing between not working, working part-time or full time. Moreover, the division of labor within Italian families during the 90s was still such that the care of the children was almost entirely provided by the mothers. Hence, if a change of incentives might have emerged from the reform, it would at most have affected the female workers. Second, the design of the reform introduced a clear discontinuity in the size of future pension benefits across workers. Pension benefits of the individuals with 15 years of contributions or more at the end of 1992 were not modified, while pension entitlements were largely reduced for all other workers on a pro-quota basis, which took into account their contributory history. A discontinuity that affected exactly the same cohorts of workers was then introduced by the Dini reform in 1995. The magnitude of the discontinuity is sizeable. Due to the reforms, a one-year difference in the length of contributions in 1992 (14 vs. 15 years) for two individuals with otherwise the same characteristics commanded a difference in the pension replacement rate (measured as the ratio between the pension benefit and the last wage prior to retirement) of around 15 points – that is, a replacement rate of 80% for the individual with 15 years in contributions in 1992 versus 65% for the other individual. This discontinuity may allow to identify a causal effect of income on fertility.

In our empirical analysis, we hence choose to concentrate on the effect of the reforms on the male workers, for whom we can identify a clear, negative income effect, while controlling for the effects on the female workers. We find a strong positive effect of the pension reform on the average number of post-reform children and on the probability of having a kid after the reform. More specifically, affected individuals are estimated to have 10.7% higher fertility after the reforms with respect to the unaffected ones. Sensitivity analyses confirm the robustness of our findings.

This paper contributes to the existing literature in two crucial aspects. In our empirical analysis, we are able to identify a causal, negative effect of a reduction in the (males) income on fertility. Interestingly, this causal link acts via a pure negative income effect. Furthermore, our empirical results have strong implications for the existing fertility theories. The existence of a causal link running from income to fertility is not consistent with "consumption" fertility theories based on heterogeneity in tastes for children (see Jones, Schoonbroodt, and Tertilt, 2008), which suggest the causality running in the opposite direction, that is, from fertility tastes to education decisions and thus income. However, the existence of a negative income effect does not support either the more common versions of the "consumption" theory based on the value of parental time, at least as long as kids are considered a normal good. Perhaps surprisingly, our results for contemporary fertility are consistent with the "old-age security" motive or with the original "consumption" theory proposed by Becker-Lewis (1973), based on the strong interaction between quality and quantity of children.

Our results have relevant implications. First, they constitute a clean causal evidence of a link running from public pension systems to fertility decisions: lower pension benefits increase fertility. Along these lines, our analysis might contribute to explaining, at least in part, recent fertility trends, including the (mild) reversal towards high fertility which has been observed in Italy since the mid-1990s. Moreover, it also suggests that in many developed societies, at least where family ties matter, the strong decreasing trend in fertility may be partially due to the large rise in pension spending. Second, our empirical findings hint to the fact that the old age security motive or the Becker-Lewis (1973) version of the "consumption" theory matter for fertility decisions. This is of interest, since recent versions of the "kids as consumption good" model, based mainly on the value of parental time, have become the workhorse model of fertility choice in a recent literature on demographic transition and economic growth (see for instance de la Croix and Doepke, 2003), and on female labor force participation (see Galor and Weil, 1996) . One should be aware of this shortcoming, in particular when drawing policy implications on how to reverse this demographic trend[2] (e.g., through public intervention aimed

[2] A large debate has developed on this issue, especially since individuals in most of these countries have repeatedly expressed their willingness to have more children than they actually do (Goldstein

at the provision of services, such as publicly funded child-care, or at tax reliefs or other monetary incentives), based on this fertility model, especially for countries that feature a "traditional" family structure.

The paper proceeds as follows. Section 2 discusses the related literature. Section 3 reviews three models, which capture the effects of a pension benefit reduction on the fertility under the two different motivations – kids as "consumption" in the most recent version, and in the original Becker-Lewis formulation, and the kid as "investment" good. Section 4 briefly describes the Italian pension reforms of the 1990s, and the discontinuity embedded in their design. Section 5 discusses our identification strategy, and underlines the salient features of the Italian family structure and of the pension reforms that make this a particularly well suited natural experiment. The empirical results and the sensitivity analysis are in section 6. Section 7 discusses the results and concludes.

2. Related Literature

Since the seminal papers by Becker (1960), a large literature has emerged that analyzes demographic phenomena based on a "consumption" motive for fertility. However, the traditional formulation of this theory has been unable to reproduce the observed negative – cross-section and time series – relation between fertility and income. Later contributions in this "consumption" theory have dealt with this issue in a variety of ways (see Jones, Schoonbroodt, and Tertilt, 2008, and Guinnane, 2010, for two complementary reviews). Becker and Lewis (1973), Willis (1973) and Becker and Tomes (1976) have stressed the role of the interaction between quality and quantity of children[3]. Since high income parents strongly value their kids' quality, high income families choose to spend more in their children education, which in turn increases the cost of having (and raising) kids, and may thus result in lower fertility. Others have contributed to a price of time version of the "consumption" theory (see Jones, Schoonbroodt, and Tertilt, 2008). The idea is that fertility is more costly for high income parents, who have a higher opportunity cost in dedicating parental

et al., 2003).

[3] This issue was also analyzed in a dynamic framework by Becker, Murphy and Tamura (1990).

time to their kids, and thus choose a lower fertility. Other "consumption" theories have instead argued that the negative correlation between fertility and income is driven by agents' heterogeneity in tastes for kids. In particular, individuals with a strong taste for kids dedicate more time and effort to their family, choose to have more kids, but care less about acquiring market skills, and thus have lower income. Recently, versions of the "consumption" motive that combine the quality-quantity trade-off with the importance of parental time in raising kids have become the workhorse model for fertility decisions, particularly in the growing literature on demographic transition and economic growth (see for instance Galor and Weil, 2000, Galor and Moav, 2002, de la Croix and Doepke, 2003, and Greenwood, Seshadri and Vanderbrouche, 2005).

An alternative theory of fertility, based on the "old-age security" motive, which was initially introduced by Leibenstein (1957) and Caldwell (1978 and 1982), has been formalized in a general equilibrium framework by Boldrin and Jones (2002), who analyze the effects of a reduction in infant mortality on fertility. Boldrin, De Nardi and Jones (2005) subsequently used a calibrated version of the Boldrin and Jones (2002) model to quantify the effect of the rise in pension spending on fertility trends. According to their calibrated model, around 50% of the long-term drop in fertility in the US is accounted for by the pension system. A calibrated model of "old age security" is used also by Zhao (2008), who studies how the impact of social security on fertility may depend on the family income, due to the redistributive feature of the US social security system.

A large empirical literature has used cross country, cross individuals and time series data in an attempt to establish a correlation between fertility and income or wages, and possibly a causality link. Becker (1960) initially claimed the existence of a negative correlation between father's occupation or mother's education and fertility in the US. A recent study by Jones and Tertilt (2008) supports these findings: they consider cross-sectional relations between husband's occupation and fertility for women born in the US between 1826 and 1960, and estimate a negative income elasticity of fertility of a magnitude between one half and one fifth. Other studies that rely on historical data to analyze agrarian societies have instead found a positive relation between occupational status and fertility (see Lee, 1987, Weir, 1995, and Clark and Hamilton, 2006), which is coherent with the Malthusian framework. Indeed, a typical ground to test the relevance of the different fertility theories has been to evaluate how well these theories do at accounting for the demographic transition[4] (for a review see Galor, 2005, and Guinnane, 2010). However, testing these theories on historical data has proved difficult.

Cross individual data have also been used to study the – possibly different – correlations between females' income and fertility, and between males' income and fertility. While most findings support a negative correlation between wives' wages and fertility, evidence for the husbands' are more mixed (see for instance Schultz, 1986, and Blau and van der Klaauw, 2007). To able to distinguish between the impact of the income and of the incentive effects embed in an increase in wages (or income, or productivity), recent works have exploited exogenous husbands' income variations. They find that a reduction in the husbands' income (namely, their job displacement) has little impact on their wives' fertility (Amialchuck, 2006), which is only somewhat anticipated (Lindo, 2010). Regarding the other "consumption" theories, empirical analyses (see Angrist and Evans, 1998) provide little support for the theories that use the heterogeneity in tastes for kids to generate the negative income-fertility correlation. Evidence in Rosenzweig and Wolpin (1980) confirm instead the existence of a quality-quantity trade-off (see also the recent critical assessment by Angrist, Lavy and Schlosser, 2005).

Empirical contributions have provided evidence in favor of the old-age security motive in contemporary societies. Kagitcibasi (1982) argued that old-age security was not a reason for fertility in societies such as Germany and the U.S. during the 1970s, despite this motive having 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 the potentially high relevance of old-age security motives in contemporary developed societies. They provide an extensive documentation of the relevance of children

[4]Indeed, a large debate is still ongoing even on the characteristic features of this demographic transition, such as its timing in the different countries and its magnitude (see Jones and Tertilt, 2008, and Guinnane, 2010).

for providing support to their elderly parents in contemporary U.S: 11 percent of all unmarried elderly in the U.S. live above poverty only because of co-residence with adult children, and observed poverty rates would double in absence of such co-residence. Co-residence is therefore a crucial way to transfer income from adult children to their elderly parents also in the US, a country that has almost the same strength of family ties as Italy, according to the measure of Alesina and Giuliano (2007). Recent analyses of comparative data on support for parents show that, in countries with strong family ties, help to parents is more widespread (Kalmijn and Saraceno, 2008). In a 1998 "Eurobarometer" survey, 76 percent of adult Italians state that in the future working adults may have to look after their parents more than they do now, 52 percent that a needy elderly parent should co-reside with a child, 23 percent state that children should have the main economic responsibility when elderly parents are in need (Kalmijn and Saraceno, 2008). Despite its relevance, however, systematic empirical evidence of the existence of the old-age security motive for fertility in contemporary developed societies is lacking up to date.

The link between social security and fertility has been extensively explored in the literature, with several contributions implicitly endorsing the importance of the "old-age security" motive. For instance, Sinn (2004) argues in favor of a public pension system, since this provides insurance against the risk of not having children, or of having ungrateful children, who are unwilling (or unable) to care for their old parents. Yet, as also suggested in Sinn (2004) model, a drawback of public pension systems is that, even in households with grateful children, they tend to reduce kids-to-parents transfers. Parents have an incentive to "free ride" on the social security contributions paid by other people's children. As a result, fertility falls (see Cigno, 1993). Policy suggestions to overcome this free riding problem have been provided for instance by van Groezen, Leers and Meijdam (2003) and Fenge and Meier (2004). Empirical studies on the negative correlation between fertility and various measures of the size or the generosity of the public pension system include Swidler (1983), Cigno and Rosati (1992, 1996) and Galasso, Gatti and Profeta (2009). Gábos, Gál and G. Kézdi (2009), using aggregate time-series data from post-war Hungary, compare the effect of pensions and of child-related benefits on fertility, and estimate that a 1-per-cent increase in pensions would decrease fertility by 0.2 per cent, while a 1-percent increase in child-related benefits would increase it by the same amount.

Finally, a recent empirical literature has exploited the peculiar discontinuity and the related natural experiment created by the Italian (Amato and Dini) pension reforms. These contributions include Attanasio and Brugiavini (2003), who estimate the effect of the reduction in pension benefits on savings, Bottazzi, Jappelli and Padula (2006), who analyze the impact on retirement decisions, Manacorda and Moretti (2006), who concentrate on the decision of young children to leave the parental home, and Battistin et al. (2009), who investigate the size of the consumption drop at retirement.

3. Three Models of Fertility Decisions

In this section, we introduce three overlapping generations models, which characterize the households' fertility decisions under two versions of the "consumption" good motive and under the "old-age security" motive. These models will provide the background for the subsequent empirical analysis.

In our setting, fertility decisions are jointly taken at the household level. For each household, we consider an altruistic couple (where the husband and the wife belong to the same generation), who cares about its youth and old-age (joint) consumption, but also about (i) the well-being of their parents (i.e., of the two couples of parents), in the "old-age security" model; and (ii) the number of kids, and their human capital, in the "kids as consumption good" model.

During the first period of their life, couples work, save, and raise kids. They earn a wage, which may be different for males, w_t^M, and females, w_t^F; they pay contributions, $\tau_t \in [0,1]$, which are used to finance a PAYG pension system, and a proportional income tax, $\sigma_t \in [0,1]$, which provides general revenues. The amount of time dedicated to work depends on the number of kids they choose to have. Raising kids takes time, ϕ, which can be divided between the parents, so that $\phi^M + \phi^F = \phi$, where superscripts refer respectively to males and females. Bringing up a child entails also a fixed monetary cost, γ; providing a level of education e_t to a child has a marginal cost of schooling, $\overline{w}_t$, which represents the average wage in the economy, and may require a fixed cost, θ, independent of the number of kids, which is due for instance to the cost of providing a learning environment at home. Education increases the kid's human capital. The total amount of resources in the first period are hence used to consume, C_t^t, to save, s_t, to raise n_t kids, to provide them with an education, e_t, and – if kids-to-parents altruism is present – to transfer resources to both couples of parents, d_t. In the second period of their life, agents retire, and use the resources obtained from private savings, transfers from their kids and public pensions for old age consumption, C_{t+1}^t.

The budget constraints in youth and old age for a couple born at time t are thus respectively as follows:

$$C_t^t+(\gamma+e_t\overline{w}_t)\,n_t+\theta e_t+s_t+2d_t=(1-\tau_t)(1-\sigma_t)\left[w_t^F\left(1-\phi^F n_t\right)+w_t^M\left(1-\phi^M n_t\right)\right] \tag{3.1}$$

$$C_{t+1}^t=s_tR_{t+1}+d_{t+1}n_t+P_{t+1}^F+P_{t+1}^M \tag{3.2}$$

where superscripts denote the birth cohort of the couple, and time subscripts denote the time of action. Hence, C_t^t and C_{t+1}^t represent respectively the consumption in youth and in old age for a couple born at time t, and n_t indicates fertility for a couple at time t. Moreover, R_{t+1} is the interest factor on the savings, and P_{t+1}^j represents the pension transfer at time $t+1$ to the j-member of the couple, with $j=\{F,M\}$.

Individuals may have different wages, w_t^j, which are distributed according to a cumulative function, $F\left(w_t^j\right)$, with average wage $\overline{w}_t^j$. Each young couple chooses the amount of savings, s_t, fertility, n_t, education, e_t, transfers to parents, d_t, while taking prices, $\left(w_{t,}^j R_{t+1}\right)$, and fiscal variables as given. The time to raise kids, ϕ, is instead assumed to be entirely supplied by the mother, so that $\phi^F=\phi$ and $\phi^M=0$. This complete division of labor within the family would endogenously arise in the model, if the parental time devoted to the kids is perfectly substitutable between mother and father, and fathers enjoy higher wages; or if there exist some indivisibilities in the supply of labor in the market[5].

[5] In section 5, we will assess and justify this assumption empirically in the context of the Italian labor market and family organization of the mid-90s.

Pension benefits depend on an individual's previous wage income:

$$P_{t+1}^{j}\left(w_{t}\right)=\lambda_{t+1}^{j}w_{t}^{j}\left(1-\phi^{j}n_{t}\right) \tag{3.3}$$

where λ_{t+1}^{j} represents the pension benefit replacement rate, i.e., the ratio of pension benefits to the previous wage income, for an individual of gender j. Total pension spending is financed by the social security contributions and, if needed, by a transfer from the general tax revenue. The social security budget constraint is thus

$$\int P_{t+1}^{F}\left(w_{t}^{F}\right)dF\left(w_{t}^{F}\right)+\int P_{t+1}^{M}\left(w_{t}^{M}\right)dF\left(w_{t}^{M}\right)= \tag{3.4}$$

$$\begin{aligned} = \quad & \left(\tau_{t+1}(1-\sigma_{t+1})+\sigma_{t+1}\varepsilon_{t+1}(1-\tau_{t+1})\right)(1+n_{t}) * \\ & \left[\int w_{t+1}^{F}\left(1-\phi n_{t+1}\right)dF\left(w_{t+1}^{F}\right)+\int w_{t+1}^{M}dF\left(w_{t+1}^{M}\right)\right] \end{aligned}$$

where ε_{t+1} denotes the share of total revenue devoted to finance social security. The remaining part, $1-\varepsilon_{t+1}$, of revenues is used to finance wasteful government spending that provides no utility to the individuals.

We now study the effects of a pension reform announced at time t and implemented at time $t+1$, featuring a reduction (at time $t+1$) of the replacement rates, λ_{t+1}^{j}, and a corresponding reduction of ε_{t+1}, which balances the budget at eq. 3.4, given that the tax rates, $(\tau_{t+1},\sigma_{t+1})$, do not change. Moreover, we analyze a small open economy, so that wages and rates of return are not affected by the pension reforms.

3.1. Kids as Consumption Good: Parental Time

We now consider a popular version of the "consumption" model (see for instance de la Croix and Doepke, 2003), which embeds a quantity-quality trade-off, and features the use of parental time to raise kids, but not to improve their quality. This latter element (i.e., the different price of time for the kids' quantity and quality) is crucial to deliver a negative relation between income and fertility, but a positive relation income and kids' quality. Couples care about their youth and old age consumption, the number of kids they have, and their level of human capital according to the following utility function:

$$U(C_t^t) + \rho U(n_t h_{t+1}) + \delta U(C_{t+1}^t). \tag{3.5}$$

where h_{t+1} is the kids' level of human capital, and $\rho \geq 0$ measures the relative importance of the number of children and of their human capital in the couple utility function. The kids' human capital depends upon the education they received according to a production function $h_{t+1} = (1 + e_t)^{\mu} h_t$ where h_t is their parents' average human capital and $\mu \in (0, 1)$.

The optimization problem hence amounts to maximize eq. 3.5 subject to the budget constraints at equations 3.1 and 3.2, with $d_t = d_{t+1} = \theta = 0$, and yields the following first order conditions:

$$U'\left(C_t^t\right) = \delta R_{t+1} U'\left(C_{t+1}^t\right) \tag{3.6}$$

for the saving decision,

$$\rho h_{t+1} U'(n_t h_{t+1}) = \left[\gamma + e_t \overline{w}_t + \phi \widehat{w}_t^F\right] U'\left(C_t^t\right) + \delta \lambda_{t+1} \phi w_t^F U'\left(C_{t+1}^t\right) \tag{3.7}$$

for the fertility decision, where $\widehat{w}_t^j = w_t^j (1 - \tau_t)(1 - \sigma_t)$ and

$$\rho\mu (1 + e_t)^{\mu - 1} h_t U'(n_t h_{t+1}) = \overline{w}_t U'\left(C_t^t\right) \tag{3.8}$$

for the education decision.

The first equation – determining the savings decision – has the usual interpretation, the second and third equations identify the reasons for having kids, and the quality-quantity trade-off. An additional kid directly increases the parents' utility (notice that this increase is weighted by their level of human capital), but reduces the parents' consumption – and thus utility – because kids are costly to raise, both in terms of time and resources. The third equation shows that educating the kids directly increases the parents' utility, but again at a cost, since education requires resources, and thus reduces the parents' consumption and utility.

Using a logarithmic utility function, the individual fertility and education decisions can be summarized as follows

$$n_t = \frac{\rho}{1+\delta+\rho}\left[\frac{\left(\widehat{w}_t^F + \widehat{w}_t^M\right) R_{t+1} + \lambda_{t+1}^F w_t^F + \lambda_{t+1}^M w_t^M}{\left(\overline{w}_t e_t + \gamma + \phi \widehat{w}_t^F\right) R_{t+1} + \lambda_{t+1}^F \phi w_t^F}\right] > 0 \tag{3.9}$$

$$e_t = \max\left\{0, \frac{\mu}{1-\mu}\left[\frac{\gamma}{\overline{w}_t} + \left(\phi \widehat{w}_t^F + \frac{\lambda_{t+1}^F \phi w_t^F}{R_{t+1}}\right)\frac{1}{\overline{w}_t}\right] - \frac{1}{1-\mu}\right\}. \tag{3.10}$$

Hence, all individuals choose to have kids, but only those who are sufficiently rich decide to provide them with some level of education[6]. Not surprisingly, the fertility level is decreasing in the monetary cost, γ, and in the time cost, ϕ. Moreover, fertility is decreasing in the income level of the provider of the time to raise the kids, i.e., the mother, and thus delivers the empirically relevant negative correlation between income and number of kids, if $\gamma - \overline{w}_t - \phi \widehat{w}_t^M - \frac{\phi w_t^M \lambda_{t+1}^M}{R_{t+1}} < 0$, that is, if the fixed cost of raising kids is small relative to the cost of educating them, and to the time cost, measured at the father's income. We assume this condition to hold. An increase in the wage, w_t^M, of the father, who allocates no working time to the kids represents a pure positive income effect, and thus raises fertility. Education is instead decreasing in its cost, $\overline{w}_t$, but increasing in the monetary and time costs, γ and ϕ, and in the income level. Hence, if the above condition holds, this version of the "kids as consumption good" model suggests that high income mothers have fewer, but better educated kids, while low income mothers prefer more kids, but provide them with lower education (see de la Croix and Doepke, 2003).

The next proposition summarizes the effects of our pension reform on the individual fertility decisions at eq. 3.9.

Proposition 3.1. *A reduction in λ_{t+1}^M reduces the fertility rate, n_t; while a reduction in λ_{t+1}^F increases the fertility rate, n_t.*

The proof of the above proposition is in the appendix, but the intuition is straightforward. A reduction in the replacement rate of male workers does not affect their incentive to work, since $\phi^M = 0$, but produces a pure negative income effect on the couple, who reacts by reducing the "consumption" of having kids. A

[6] Notice that if no education is provided to them, kids remain at the same level of human capital as their parents.

drop in replacement rates for female workers is instead accompanied by a reduction in the monetary cost of raising kids, since $\phi^F = \phi > 0$; and hence the pension reform induces an increase in fertility.

3.2. Kids as Consumption Good: the Quality-Quantity Trade-Off

We now discuss the quality-quantity trade off model originally proposed by Becker and Lewis (1973) and Becker and Tomes (1976), in which the negative relation between fertility and income is induced by a strong interaction between quality and quantity. The underlying idea is that high income parents prefer to have high quality kids. This increases the marginal cost of each kid, and may thus reduce fertility. To simplify the notation, we abstract from savings and consider individuals who care about their lifetime consumption, C, the number of kids and their level of human capital (quality), according to the following utility function:

$$U(C) + \rho_n U(n_t) + \rho_h U(h_{t+1}) \tag{3.11}$$

where $\rho_n > 0$ and $\rho_h > 0$ measure respectively the relative importance of the number of children and of their human capital in the parents' utility function. Unlike in the previous version of the "consumption" model, we allow these two parameters to differ ($\rho_n \neq \rho_h$). As before, the kids' human capital depends upon their education according to a production function $h_{t+1} = (1 + e_t)^{\mu} h_t$ where h_t is their parents' average human capital and $\mu \in (0, 1]$. The individual life time budget constraints can be written as follows:

$$C + (\gamma + e_t \overline{w}_t)\, n_t + \theta e_t = (1 - \tau_t)(1 - \sigma_t)\left(w_t^F + w_t^M\right) + \frac{P_{t+1}^F + P_{t+1}^M}{R_{t+1}} \tag{3.12}$$

where the pension benefits P_{t+1}^j with $j = F, M$ are defined at eq. 3.3, and θ is a cost associated with the level of education which is independent of the number of kids living in the family. This cost may thus resemble a family public good, such as the books (or any device allowing access to valuable information) available in the household. We abstract from the parental cost of raising kids, $\phi = 0$.

Using a logarithmic utility function, for interior solutions, the individual fertility and education decisions can be summarized as follows

$$n_t = \frac{\rho_n (1 + e_t) \theta}{\mu \rho_h (\overline{w}_t e_t + \gamma) - \rho_n \overline{w}_t (1 + e_t)} > 0. \tag{3.13}$$

Simple algebra shows that an increase in the kids' quality (or rather in the input for producing quality, that is, e_t) increases the cost of having kids, and thus reduces fertility, n_t, if $\overline{w}_t > \gamma$, that is, if the marginal cost of having kids associated with educating them, $\overline{w}_t$, is larger than the marginal cost of raising them, γ.

We are now in the position to ask how a pension reform consisting of a negative income effect modifies the fertility decisions in this model a la Becker and Lewis. The next proposition summarizes the effect of this pension reform.

Proposition 3.2. *If $\mu\rho_h/\rho_n > \overline{w}_t/\gamma\,(> 1)$, a reduction in λ^j_{t+1} with $j = F, M$ increases the fertility rate, n_t, and reduces the level of education, e_t.*

The proof of the above proposition is in the appendix, but the intuition is clear. If the kids' quality is sufficiently more important to the parents than the quantity of kids (controlling for the efficiency of the education technology, as measured by μ), a reduction in the lifetime income due to lower future pension benefits leads the parents to reduce the level of quality of their kids. This makes the kids cheaper to produce, since the cost of education drops, as the chosen level of quality is reduced. Fertility thus increases. As in the original formulation by Becker and Lewis (1973), it is the substitution between quality and quantity that allows an income effect to have a negative effect on fertility[7].

3.3. Kids as an Investment Good

In "old-age security" models, couples are altruistic towards their parents (see for instance Boldrin and Jones, 2002). Couples care about their youth and old-age consumption and about their parents' old-age consumption, according to the following utility function:

$$U(C^t_t) + 2\eta U(C^{t-1}_t) + \delta U(C^t_{t+1}). \tag{3.14}$$

[7] Notice that incorporating into the model the use of mothers' parental time to raise kids would reinforce the result at proposition 3.2 that a reduction in λ^F_{t+1} increases the fertility rate, n_t.

where C_t^{t-1} represents the old-age consumption for a couple born at time $t-1$, and η is a measure of the kids-to-parents altruism of each couple towards their two couples of parents. The budget constraints in youth and old age for a couple born at time t correspond to the expressions at equations 3.1 and 3.2, with $e_t = 0$, since for simplicity we abstract from education decisions[8].

In the first period of their life, couples choose the amount of savings, s_t, the fertility, n_t, and the amount of transfer to their parents, d_t, while taking prices, $(w_{t,}R_{t+1})$, and fiscal variables as given, but forming expectations on the future transfers, d_{t+1}, that they may receive from their children. We consider that children cooperate in jointly determining how much support to give to the parents[9]. Moreover, we assume that individuals do not directly care about the number of kids or their level of human capital.

The first order conditions of the optimization problem are respectively:

$$U'(C_t^t) = \delta U'(C_{t+1}^t)\frac{\partial C_{t+1}^t}{\partial s_t} \tag{3.15}$$

for the saving decision,

$$\left(\gamma + \phi\widehat{w}_t^F\right) U'(C_t^t) = \delta U'(C_{t+1}^t)\frac{\partial C_{t+1}^t}{\partial n_t} \tag{3.16}$$

for the fertility decision, and

$$U'(C_t^t) = \eta n_{t-1} U'(C_t^{t-1}) \tag{3.17}$$

for the transfer decision.

The last equation describes the trade-off associated with transferring resources to the parents: the lower consumption in youth has to be compensated by the utility provided by the parents' higher consumption, weighted by the degree of altruism and by the number of siblings who are also providing the transfer. The first two equations characterize the couple saving and fertility decisions. It is important to

[8]Parents, who perceive their kids as an investment good, have an incentive to invest in the education of their offsprings, since this increases their kids' future income – and thus the transfer that they may obtain. Introducing this additional investment opportunity would complicate the algebra, but does not modify the qualitative results at proposition 3.3.

[9]Alternatively, children could play a non-cooperative Nash game among each other on how much to give to their parents (see also Boldrin and Jones, 2002).

notice that these decisions may influence the future transfer, d_{t+1}, that a couple may receive from its kids. Couples take this element into account in their optimization problem and thus need to form expectations on this future transfer, d_{t+1}. Using a logarithmic utility function, from eq. 3.17, we have that

$$d_{t+1} = \frac{\eta}{1+\eta}\left(\phi \widehat{w}_t^F - I_{t+1}\right) - \frac{R_{t+1}s_t + P_{t+1}^F + P_{t+1}^M}{n_t\left(1+\eta\right)} \tag{3.18}$$

where $I_{t+1} = n_{t+1}\left(\gamma + \phi \widehat{w}_{t+1}^F\right) + s_{t+1}$ is the total investment in savings and fertility by the young generation at time $t+1$. Clearly, private savings and pension benefits crowd-out the transfers from the kids, which depend also (positively) on their wage, and (negatively) on their investments.

Consider individuals that choose to be both parents and savers ("Parents & Savers" couples). To be willing to transfer resources into the future via both savings and kids, the returns from these two "investment opportunities" have to be equalized. Using equations 3.15, 3.16, and 3.17, it is easy to see that this occurs for

$$R_{t+1} = \frac{\widehat{w}_{t+1}^F + \widehat{w}_{t+1}^M + \lambda_{t+2}^F w_{t+1}^F + \lambda_{t+2}^M w_{t+1}^M - \lambda_{t+1}^F \phi w_t^F}{\gamma + \phi \widehat{w}_t^F} = R_{t+1}^f \tag{3.19}$$

where the right hand side of the expression above describes the return from "investing in kids", which is clearly decreasing in the monetary (γ) and time (ϕ) cost of raising kids, and in the mother's wage, $\widehat{w}_t^F$, while being increasing in the kids' wage, w_{t+1}^F and w_{t+1}^M. Couples for whom this condition does not hold with an equality will choose to use savings only if $R_{t+1} > R_{t+1}^f$, or fertility only if $R_{t+1} < R_{t+1}^f$.

The next proposition shows the effects of the pension reforms on the fertility decisions of these "Parents & Savers" couples.

Proposition 3.3. *A reduction in λ_{t+1}^F or λ_{t+1}^M increases the total investments of the Parents & Savers couples (I_{t+1}); a reduction in λ_{t+1}^F increases the fertility.*

The proof is in the appendix, but the intuition is as follows. A reduction in the replacement rate of the male workers amounts to a (pure) negative income effect that calls for more resources being moved into the future through more kids (for parents only couples), more savings (for savers only couples) or both ("Parents & Savers" couples). A reduction in the replacement rate of the female workers introduces an additional incentive effect that goes in the same direction as the income effect, since the cost of raising kids is effectively reduced – and hence fertility increases.

3.4. Discussion

A pension reform that reduces the workers' future replacement rate, but leaves current contribution rates unaffected, induces a clear negative income effect. However, it may also modify the individual incentives to work, since the drop in the accrual of future pension benefits effectively amounts to a reduction in the overall wage, and may thus induce the affected individuals to supply fewer hours of work.

The pure negative effect, represented in the previous propositions by a reduction in λ_{t+1}^{M}, leads to different fertility responses under the fertility models developed in sections 3.1 to 3.3. In the version of the "kids as consumption good" based on parental time, the prediction is that fertility drops (see proposition 3.1), whereas fertility may increase under the Becker-Lewis quality-quantity model (see proposition 3.2), and under the "old age security" motive (see proposition 3.3). If the incentive effects, identified in the previous propositions by a reduction in λ_{t+1}^{F}, are in place, all models predict a pension reform that reduces future benefits to lead to higher fertility. This is because the cost of having kids, as represented by the (mother) foregone wage income, drops.

The next section describes in details the sequence of Italian pension reforms of the 90s. Our identification strategy to test these fertility theories is presented in section 5.

4. The Pension Reforms

A sequence of major pension reforms took place in Italy in the 90s, after that pension spending had almost reached 15% of GDP, thereby becoming one of the largest in the world. The pension system featured also a large deficit, since yearly contributions were not sufficient to finance yearly benefits, and large transfers from the central government were needed to balance the budget[10]. Faced with the expectations of further aging and financial crisis, the Italian system was hence largely re-designed,[11] mainly through the Amato reform in 1992 and the Dini reform in 1995 (see figure 1 for details).

The Amato reform introduced a gradual tightening, over a ten-year period, of the eligibility requirements. Retirement age was increased to 60 years for women and to 65 years for men, and the minimum contribution period for pension eligibility was extended to 20 years. Moreover, the minimum contribution period for being eligible to an early retirement pension was extended to 35 years for all (private and public) workers. These measures introduced a clear and sizeable negative income effect. The reference wage in the pension benefit formula moved from the average wage over the last five years prior to retirement to the average wage during the entire working carrier, with past earnings capitalized at the cost of living index plus 1% per year. This typically caused a reduction in the reference wage, due to the labor earning profile being increasing in age (see Galasso, 2006). Since pension benefits were calculated as the product between the number of years of contributions, this reference wage, and a rate of return of two per cent per year, the accrual rate associated with one additional year of contribution decreases in those working years in which the wage was below the average wage calculated in the five years prior to retirement. The accrual rates were hence typically reduced in youth[12]. Pension benefit indexation moved from nominal wages to prices. Social security contributions slightly increased, from 24.5% to 27%, although this was mostly due to the relabeling of existing contribution items.

However, most of these reform measures applied only to some cohorts of (young) workers. In fact, the benefit calculations for the workers with at least 15 years of contributions at the end of 1992 were untouched, and access to early retirement remained virtually the same. For workers with fewer years of seniority, instead, the

[10] To assess the magnitude of this deficit, notice that in the early 90s, the overall statutory contribution rate was around 33%. Yet, the equilibrium contribution rate needed to finance the pension benefits was around 38% (see Galasso, 2006).

[11] See Brugiavini and Galasso (2004) for a detailed description of the reform measures.

[12] The changes in the accrual rates introduced by the Dini reform reinforced the effects of the Amato reform.

new rules were applied *pro-quota*. Only to individuals who entered the labor market in 1993 were the new rules entirely applied. Hence, this reform design gave raise to large differences in the reduction of social security wealth across workers with different seniorities, as well as across public and private employees, who initially enjoyed different treatments.

To better understand this discontinuity, consider two male, dependent workers in the private sector with a high-school degree, who entered the labor market at the same age (20), and featured the same labor earning profile. However, they were born one year apart and thus had different years of contributions at the end of 1992. While Mr. Old is one year older – he was born in 1957 – and already had 15 years of contributions, Mr. Middle (born in 1958) only had 14. Suppose that they will both retire at age 60 upon reaching forty years of contributions. Mr. Old will then retire in 2017 and his pension benefits will entirely be calculated according to the pre-reform rules. His replacement rate – that is, the share of his labor income at age 59 replaced by the pension benefit – would be around 80%. Mr. Middle will instead retire a year later, in 2018. His pension benefits will be calculated for almost two thirds (26/40) according to the new rules, and only for the remaining part (14/40) according to the pre-Amato reform scheme. For Mr. Middle, the replacement rate would only be around 70%. This amounts to a large discontinuity: the pension treatment of individuals who at the end of 1992 differed in one year of contribution only was set to be noticeably large. Analogously, Attanasio and Brugiavini (2003) estimated that, in the private sector, the drop in social security wealth due to the Amato reform was equal to 27.6% for workers born after 1957 and to 17% for those born between 1945 and 1957. This reduction was even larger among the public employees: respectively 32.1% for the younger workers and 27.1% for the 1945-1957 generation.

In 1995, the Dini reform completely redesigned the architecture of the Italian social security system, shifting from defined benefit (DB) to notional defined contribution (NDC), in which returns on social security contributions are not fixed (as in the previous DB system), but depend on the growth rate of the economy. Social security contributions were increased to 33%, although this large raise was due to regrouping existing contributions under the social security contribution rate. Eligibility criteria were also largely revised. Seniority pensions, whose eligibility was exclusively based on reaching a minimum contribution period, were abolished. Under the private employees' scheme, the minimum number of years of contribution to be eligible for a pension was reduced to 5 years only; however, only individuals aged between 57 and 65 years are entitled to a pension. Again, these retrenchment measures induced to a negative and sizable income effect.

As for the Amato reform, these measures were introduced along a transition path that left workers with at least 18 years of contributions at the end of 1995 unaffected. The less senior workers were affected pro-quota, while workers entering the labor market in 1996 were completely embedded into the new system. Interestingly, the same workers who escaped the retrenchment of the Dini reform had already slipped through the Amato reform. Returning to our example, while Mr. Old maintained his (expected) replacement rate of 80%, Mr. Middle only had 17 years of contributions in 1995 and thus had to face a further reduction in his (expected) pension benefits. Leaving his retirement age unchanged at 60 years, his replacement rate would in fact drop to around 65%.

Bottazzi et al. (2006) assessed the differential impact of the Amato and Dini reforms on three classes of workers: those with a seniority of 18 years in 1995 (and 15 in 1992), those with a lower seniority and those who entered the labor market after 1995. The differences in the reduction of their replacement rate – as measured by the ratio of pension benefit to the average wage in the last five years prior to retirement – are quite large. Among the private employees retiring at age 60, the replacement rate is reduced by 1 point (from 67.3% to 66.3%) for the senior workers, by 9.1 points (from 67.3% to 58.2%) for the less senior and by 12.4 points for the young. The impact is larger among public sector employees, with a drop of 5.1 points among the senior, of 20.6 among the less senior and of 26.7 among the young.

These major changes did not come unperceived, nor was the differential impact of the reform across generation of workers underplayed. Quite the opposite. Massive strikes broke out in 1992 and 1994, and a large debate took place in the press. Moreover, estimates by Bottazzi et al. (2006) suggest that private employees were well aware of the magnitude of the reform and of the fact that its differential impact depended on the years of contributions. In particular, less senior private employees expecting to retire at age 60 quite accurately forecasted their replacement rate to be reduced by 8.4 points. The relevance of these reforms and their differential effect is also evident in the workers' intention to postpone retirement after the reform. Consistently with this differential effect, Bottazzi et al. (2006) estimate the increase in the expected retirement age to be larger for middle aged (born after 1957) than for more senior workers.

5. Context, Data and Identification Strategy

5.1. Identification Strategy

We will use the sequence of Amato-Dini Italian pension reforms and their impact on the fertility choices of *affected* and unaffected individuals to assess the theories described in section 3. Italy represents a particularly interesting case for the study of fertility choices. Together with Spain, Italy has been the first country to steadily experience fertility levels below a threshold defined of "lowest-low fertility" (a total fertility rate of 1.3 children per woman or below) during the 1990s (Kohler et al., 2002). In order to visualize recent fertility developments, the Italian total fertility rate in the period 1970-2006 is compared those of Germany, Sweden and the United Kingdom in Figure 2. In the figure, one can also see that the period of lowest fertility levels coincided, in particular in Italy, with the period of implementation of the two reforms.

Our first task is to distinguish between the fertility models described in section 3 based on their implications for fertility as a result of a pension reform. To do this, we single out the pure negative income effects induced by the Italian pension reforms. Our strategy is to concentrate on the fertility decisions of couples, in which the female is still in her reproductive age, and the male is a dependent worker, whose future pension benefits have been affected by the reforms. To distinguish between the fertility models, and to identify the effects of the pension reform on fertility decisions, we exploit four characteristic features of the Italian family structure, labor market and pension reforms.

First, we document the existence of a strong intra-household labor specialization, with the time to raise kids being mostly provided by the mothers. Figure 3 uses time use data from ISTAT (the Italian National Statistical Office) on within family time allocation in Italy in 2003. These data show that, among married couples with at least one child, the surveillance of the children, which amounts on average to half of the total time dedicated to the children, is almost exclusively provided by mothers. All other activities are still very unequally split among parents, the only exception being playing with the kids, where fathers do their fair share. In the context of our theoretical framework, this amounts to have $\phi^F = \phi > 0$ and $\phi^M = 0$, as assumed in section 3.

Second, we exploit the fact that in Italy working hour decisions by dependent workers are lumpy, since workers are unable to make small adjustments in the number of hours worked. In fact, virtually all dependent workers may only choose between working full-time, part-time or not working at all. Italian Labor Force data for the 1992-1995 period show that most male dependent workers in the manufacturing sector work full time, and provide 40 hours of work per week or more[13].

The combination of these two elements suggests that no incentive effects can be induced by the pension reform on male dependent workers. In fact, fathers are only marginal provider of time to raise kids, and, in any case, they would be unable to internalize a positive reduction in their cost of raising kids, since their labor supply can only be modified in rather discrete jumps (no work, part-time or full time). A stronger case could instead be made for pension reforms modifying the mothers' incentive to have kids[14].

Third, to identify the effect of the reforms , we exploit the discontinuity discussed

[13] A normal working week for a dependent workers is of 40 hours; however, shorter lengths may be established through sectoral collective agreements between firms representatives and the unions. The incidence of longer working weeks among male workers is instead explained by the common use of extra-hours.

[14] It is worth noticing however that the all (permanent) dependent jobs feature five-months paid maternal leave, during which pension contributions continue to be accrued. Hence, if mothers only take the ordinary maternal leave, a reduction in their future pension benefits would not modify their incentive to have kids. The Italian legislation however allows mothers to take up to two years of additional maternal leave, yet on a lower pay (30% of their wage), with pension contributions being accrued on this lower pay. For mothers expecting to be on this extended leave, a reduction in future pension benefits would hence (marginally) reduce their cost of having kids.

in section 4 between individuals affected by the Amato and Dini reforms (i.e., the treatment group) with those who are unaffected (i.e., the control group). We use self-reported data on years of contribution to separate, through the discontinuity introduced by the reforms, the treatment from the control group. More specifically, the treatment group is composed of households with a male dependent worker (husband) who had (slightly) less than 15 years of contributions in 1992. The control group is composed by households where the husband had 15 years of contributions (or slightly more). The effect of the reforms on wives are controlled for, in order to test the robustness of our findings to incentives affecting females.

Four, we provide evidence that the reforms affected couples in central childbearing ages for Italian standards. Men in married couples who had 15 years of contribution at the end of 1992 had on average about 35 years of age (to be precise, their average age in 1992 was 34.45 years). Their wives were on average 3.8 years younger (the average age of the wife in 1992 was 30.67 years). This age interval is particularly relevant, in contemporary Italy, for fertility choices. Although we later provide specific figures on the dataset we use, it is useful here to recall that fertility at ages 30+ has been increasing ever since the mid 1980s (see Figure 4). Indeed, Italy has become the leading industrialized country in "late" childbearing (Billari et al., 2007). This is a clear consequence of the postponement of childbearing, a phenomenon that accompanies (and partly causes) the emergence of lowest-low fertility, and that is linked to a – at least partial – recuperation of the postponed births at later ages. It is therefore increasingly important, in the explanation of fertility, to understand the motives of childbearing of women aged 30 and over.

5.2. Data

We analyze two specific datasets that we build using data from the Bank of Italy's Survey of Italian Households' Income and Wealth (SHIW from now onwards). This is a biannual survey, with some individuals repeatedly interviewed, which mostly collects, as the title says, data on income and wealth of Italian households. Crucial for our identification strategy is the fact that the SHIW contains data, provided by respondents, on the total number of years each household member has contributed to the pension system (at December 31st of the reference year of the survey). Given the strong attachment of Italian men to the labor market, we assume that the number of years of contributions at December 31st 1992 (or 1995), i.e., the reform reference date, can be derived from the number of years of contributions at December 31st 1992+ζ, where ζ=6,8,10,12,14, depending on the most recent SHIW wave for which a given respondent was interviewed. For example, a person who has at least 27 years of contributions in 2004 (December 31st) is assumed to have had at least 15 years of years of contributions in 1992 (December 31st) – and therefore to be unaffected by the reforms. On the contrary, a person who has 26 years of contributions in 2004 is assumed to have less than 15 years of contributions in 1992 – and thus to be affected by the reforms. $reform^M$ is a therefore a simple dichotomous variable representing the treatment effect in this natural-experiment setting. Recall bias and lack of precision in reporting years of contributions certainly induce measurement error in the identification of the treatment and control group. However, the bias of such measurement error implies an underestimation of the effect of the reform, therefore the subsequent results might be conservative[15]. We use this strategy to identify affected and unaffected men. Consistently with the model, fertility is considered as a household decision. We focus on households with individuals who were married at the time of the surveys, and evaluate the effect of the reform primarily focusing on men as the affected or unaffected individuals. The focus on married couples should not bias our results, given the particularly low extra-marital birth rates and divorce rates during the period covered (see, e.g., Castiglioni and Dalla Zuanna, 2008).

We also build $reform^F$ for the wives of affected individuals, in order to control for incentive effects that might have affected women (although this is not useful to test alternative theories of fertility). Given the low labor force attachment of Italian women during the period we are studying, however, there are very few women who are not affected by the reform during their childbearing ages. Moreover, the indicator is only poorly measured for women, since it is based on the less likely assumption of a continuous labor force attachment between the time of the reform and the time of the survey. We however choose to keep this indicator to test the robustness of our

[15]The lack of more precise data on contributions (e.g. months, or weeks) prevents us from adopting a regression discontinuity design in subsequent analyses.

results concerning the impact on husbands.

We exploit additional data provided by the SHIW, such as the date of births of all household members, including husband, wife, and co-resident children. Moreover, we use data on the number (although not the date of birth) of non-resident children. In our analyses, we also include other control variables, such as educational level of both partners and the area of birth of the husband. We can reconstruct the couple's fertility history by using the date of birth of co-resident children. All non co-resident children are born before the time of the first reform, i.e. up to 1992 (this assumption does not affect subsequent results as we focus on childbirths from 1993 onwards). These assumptions are relatively mild in the case of Italy where children tend to co-reside with parents for a long time (well into their mid 20s). We only use data on household with wives born in 1955 or after (who are therefore not older than 41 in 1996).

5.3. Descriptive Analysis

We perform a series of simple t-tests in order to compare the mean fertility of individuals who are just before (up to a year) and just after (up to a year) the threshold (15 years of contributions at the end of 1992, 18 years of contributions at the end of 1995) using information available or reconstructed at the time of the surveys. Table 1 contains the results of these tests on individuals who are as close to the discontinuity as we could get, performed on a sample of 200 unaffected individuals and 198 affected individuals. Indeed, while the number of children prior to 1993 is not significantly different between the two groups, fertility after the reforms is significantly higher for the treated. More specifically, up to 1993 unaffected individuals have on average 1.39 children, while affected individuals have on average 1.38 children. After 1993, affected individuals have on average 0.49 children, while unaffected individuals have on average 0.31 children during the same period, which includes the effect of both reforms. The average number of children up to 2006 for affected individuals (1.87) is 10.6% higher than the total number of children for unaffected individuals (1.69). Our first evidence is therefore in favor of a significant, and sizable, negative effect of pensions on fertility. This is in accordance with both the quality-quantity trade-off model and the "old-age security" motive, and against the kids as consumption good model based on parental time.

A graphical representation on this effect is shown in Figure 5. In the upper panel, average pre-reform fertility by years of contribution at the end of 1992 is shown. There is a clear increasing trend, which heavily depends on the link between age and years of contributions–an issue that we will address next. In the lower panel there is an equally clear decreasing trend in the average number of post-reform children. At first glance, when looking at simple nonparametric (moving average) trend estimates, there is a discontinuity of about 0.15 children corresponding to the reform. The low number of data points in terms of years of contributions, however, does not allow us to rely on a straightforward regression-discontinuity estimation strategy. We will rather focus on regression models that explicitly control for the effect of age (as well as for other variables) when estimating the effect of the reforms.

Whether a person is affected or not by the reforms depend on the assumption of continuous labor market attachment and on the good measurement of the variable of our interest. Moreover, other covariates may influence the estimation of the reform effect. The results of the simple comparisons using t-tests displayed in Table 1 and of the discontinuity plots in Figure 5 are hence subject to limitations. In particular, given the link between age at entry in the labor market and exposure to the reform, we can expect that unaffected individuals are, on average, older than affected individuals. If we take, as in Table 1, a one-year window around the reforms' threshold, we find that affected individuals (husbands) have an average age of 35.45 years, against an average age of 36.62 years for unaffected individuals. An average difference of one year in age translates almost equally into an average difference of one year in contributions. The same is true for the wives, as the average age of the wives of affected individuals is 31.67 years, against 32.91 years for the unaffected. Figures 6 and 7 show, however, that, despite the average one-year age difference between affected and unaffected individuals, there is a substantial amount of variability, with common support and an important overlap in the age distributions of affected and unaffected individuals, which allows us to identify the effect of reform, while controlling for the age of individuals (both husbands and wives). Therefore, in what follows we choose to develop a series of regression models that control for the different age distribution, as well as for other potentially influential factors. As we shall see, these models confirm the findings of the previous approach.

We therefore extend our analyses with the inclusion of a series of control variables which are likely to affect both inclusion into the treatment or control group and fertility outcomes. In particular, we control for age (and education) of the husband, age (and education) of the wife, geographical area (using the area of birth of the husband). In order to have a more robust sample size, we also extend our sample to include individuals who are more distant from the discontinuity induced by the reform. In the next section, we will also carry some additional sensitivity analyses for the robustness of our results.

Most analyses are conducted using a dataset where we compare individuals who are up to 7 years below the threshold number of years of contributions (and thus affected by the reform) with individuals who are up to 7 above the threshold (unaffected). The sample size is 2,675, with 59.65 percent of husbands being affected by the reform (92.89 percent of wives). Table 2 presents descriptive statistics on this extended dataset (all variables, with the exception of fertility and reform refer to the time of the survey). We estimate simple OLS models of the type

$$f_i = \beta_0^0 + \beta_1^0 \cdot reform_i^M + \beta_2^0 \cdot x_i + \epsilon_i \tag{5.1}$$

where f_i is post-reform fertility for the i-th individual, $reform_i^M$ is a dichotomous indicator (=1 if the i-th husband is affected, =0 otherwise), x_i is a vector of control variables, ϵ_i is white noise. The estimated coefficient $\hat{\beta_1^0}$ is therefore the average effect of the reform on treated individuals on the number of post-reform children.

In order to assess whether our findings are robust with respect to incentive effects on wives, we also estimate parallel models with the effect of reforms on both husbands and wives in the same household:

$$f_i = \beta_0^0 + \beta_1^{0M} \cdot reform_i^M + \beta_1^{0F} \cdot reform_i^F + \beta_2^0 \cdot x_i + \epsilon_i \tag{5.2}$$

Here the estimated coefficient $\hat{\beta_1^{0M}}$ is therefore the average effect of the reform on treated husbands net of the effect on wives, which is estimated by $\hat{\beta_1^{0F}}$.

In a second series of models we focuses on the probability that at least one post-reform child is born, with a probit specification:

$$\Phi^{-1}\left(\Pr(f_i > 0)\right) = \beta_0^1 + \beta_1^1 \cdot \mathit{reform}_i^M + \beta_2^1 \cdot x_i \tag{5.3}$$

where Φ^{-1} is the inverse standard-normal distribution, and the estimated coefficient $\hat{\beta}_1^1$ is the average effect (via inverse Mill's ratio) of the reform on the probability of having at least one post-reform child for treated individuals. Analogously, we estimate probit models which include the potential effect of the reform on women, similar to eq. 5.2.

The data, however, contain more information than just the number of post-reform children. More specifically, we can also exploit information on the timing of births, as is usually done in empirical analysis of fertility choices. Moreover, we can exploit the fact that some of the factors we focus on vary over the observation time (this is the case of husband's and wife's ages, or calendar year). To this purpose, we build a second dataset that contains observations in terms of persons-years, i.e., an entry for each individual i in each given year of observation j, from 1993 onwards. In this second dataset, the age of husbands and wives is updated every year. The appropriate method to analyze persons-years datasets is discrete-time event history analysis (see, e.g., Jenkins, 1995) with the adoption of a hazard rate approach to the timing of births (see, e.g., Newman and McCulloch, 1984). Each household contributes to the sample as long as they are observed, and they leave the sample either when they are interviewed (in this case information is right-censored) or when they have another child. As the number of post-reform children is low on average, we only consider the progression to the first birth after the reform. Therefore, with the second dataset, we use a discrete-time probit specification, where the left-hand-side variable is the hazard rate, i.e., the annual probability of having an additional birth for the individual i during the year j, given that the same individual has not yet had an additional birth in earlier years of observation:

$$\Phi^{-1}\left(Pr(B_i = j | B_i \geq j)\right) = \beta_0^2 + \beta_1^2 \cdot \mathit{Reform}_i^M + \beta_2^2 \cdot x_i + \beta_3^2 \cdot v_{ij} \tag{5.4}$$

In eq. 5.4, B_i denotes the time of first post-reform birth, j is the year of observation, potentially between 1993 (j=1) and 2006 (j=14), ($j = 1, ..., J_i$, where $J_i < 14$ is the last year of observation for the i-th individual), x_i is a vector of time-constant control variables, v_{ij} is a vector of variables that vary across years. $\hat{\beta}_1^2$ is the estimated average effect (via inverse Mill's ratio) of the reform on the hazard of a post-reform birth for treated individuals. Also in this case, we will control for wives' potential reform effect.

6. Results

We now examine the results of our analyses (complete results of regressions and scripts are available upon request from the authors), starting from our first dataset. Table 3 displays the results on the effect of the reform on the: a) number of children born starting from the year after each of the reforms and until the date of the survey (column (1), OLS as in eq. 5.1; column (2), OLS as in eq. 5.2); b) probability of having an additional child during the same period (columns (3) Probit, as in eq. 5.3; column (4) controlling for wives' reform). The estimated effects of the reforms on husbands are displayed in the "Reform" line (in terms of marginal effects for the Probit). The estimated effects of the reforms on wives are displayed in the "Wife's reform" line. In these regressions, we control for several elements that may affect the number of years of contributions individuals had up to the end of 1992 and their fertility behavior. In particular, we control for: age of husbands and wives (using age fixed-effects), level of education of husbands and of wives, geographical area, and the number of kids that they already had prior to the reforms. As might be expected, some of these controls have a significant effect. For instance, more educated women – who presumably decided to postpone fertility – are more likely to have kids after the reform. Individuals in the South are more likely to have children, whereas individuals who had more kids prior to the reform are less likely to have additional children afterwards. According to these estimates, after controlling for all these covariates, the average number of children for treated couples is 0.0542 higher (significant at the 10% level). This effect only slightly diminishes when controlling for the effect of the reform on wives. Interestingly, the effect on wives is positive, in accordance with theory, albeit not statistically significant, perhaps due to the small sample of unaffected wives. The magnitude of the first effect (on husbands) should be compared to an average of 0.5089 post-reform children (i.e., it amounts to 10.7% higher fertility for affected individuals). Results of regression models on the larger sample of individuals therefore confirm the findings obtained with the smaller time window around the reform displayed in Table 2.

Coupled with the estimates of Attanasio and Brugiavini (2003) on the effect of pension wealth of the reforms, our estimates suggest that a 1 per cent decrease in pension wealth increases fertility by 0.26 per cent. This is therefore slightly higher than the effect obtained by Gábos, Gál and Kézdi (2009) using time-series, who estimate that a 1 per cent decrease in pensions increases fertility by 0.2 per cent, with a magnitude similar to a 1 per cent increase in child-related benefits.

Results on the Probit model on the probability of having an additional post-reform child also point towards the same direction: individuals who are affected by the reform have a 7.1% higher probability of having post-1992 reform children. Also the effect of the reform due to the change in the wives' future pension benefits is positive, as predicted by all fertility theories, and statistically significant.

Therefore, the findings from this set of regression models confirm the direction of the effect found in Table 1, pointing towards the prevalence of a quality-quantity trade-off consumption good model or a old-age security motive for childbearing. The joint effects of the two reforms (post-1992) is statistically significant, and strong.

From now onwards, our results refer to the second dataset, i.e., the one with discrete-time data on persons years, and to estimates based on eq. 5.4. We specify a model in which we estimate the joint effect of the reforms, i.e., the post-1992 effect. Table 4 displays the results of a first probit hazard model, in which age of the husband and age of the wife (using fixed-effects) are time-varying covariates, and in which we control for fixed period effects using dummy variables for each year. The marginal effect of the reform on the annual probability of having an additional birth is 0.67%. This effect can be compared to the observed (average) annual probability, which is above 5%. The reform is estimated to raise the annual probability of having a(nother) child by 12.9% in relative terms. The effect is statistically significant at the 5% level. This analysis, which makes use of additional information contained in the data and controls for time-varying effects, thus confirms the results obtained with the first dataset.

We now run two types of robustness checks for the reform effect using the second dataset (similar robustness checks have been run on the first dataset giving analogous results). A first robustness check regards the size of the time window around the reform that we use. Our standard models use a +/-7 year-wide window. The fact that age (controlled via fixed effects) is not behind the estimated effect is reassuring, but we conduct a robustness check by using shorter time windows around the reform. Table 5 contains the output of such checks, compared to the reform effect displayed in Table 4. The effect is stable with a +/- 3 year window. It is much higher, still significantly positive, but estimated with lower precision, as the window becomes the smallest one (+/- 1 year). The stability of the estimates with the variation of the time window is a sign of robustness of the positive effect of the reform on fertility, while the fact that the effect becomes higher with the shorter window is consistent with the effect of reform being captured in a cleaner way with the shorter window.

A second robustness check of our identification strategy is a "placebo" test, which is often used in studies on natural experiment, like ours, which exploit discontinuities. More specifically, we estimate the effect of two discontinuities that we expect not to matter, as they are in fact not related to the reform. A first discontinuity ("Younger" placebo) is placed around 10 years of contributions in 1992, with a window of +/- 1 years around the discontinuity. A second discontinuity ("Older" placebo) is placed around 20 years of contributions in 1992, with a window of +/- 1 years around the discontinuity. The estimates of placebo effects are compared with the estimates of the reform effect with a +/-1 years time window in Table 6. Indeed, placebo effects are not statistically significant, which is what we expect if our identification strategy through a discontinuity in years of contributions picks the reform effect: only the discontinuity around the actual reform matters.

7. Discussion

In a contemporary low fertility society, characterized by strong family ties – Italy, we have exploited the discontinuity induced by two parallel pension reforms held in 1992 and 1995 to test the effect of a change in future family income on fertility. These reforms have in fact generated a natural experiment that has exogenously reduced the pension income prospects of individuals with years of contribution below specific thresholds, while leaving others unaffected. Our results show that individuals who have lower pension income prospects, because they are affected by the reform, have significantly higher fertility. The relative increase of the realized fertility or of the probability of having a child is above 10%. The strong impact is entirely due to a negative income effect on the husbands' future pension benefits. We are thus able to establish the existence of a causal, negative effect of husbands' income on wives' fertility.

Interestingly, these findings are not in line with the "consumption" theories of fertility based on parental time. Perhaps surprisingly, they are in line either with the original Becker-Lewis version of the "consumption theory" based on the interaction between quality and quantity or with the old-age security motive for fertility. The latter case would also be consistent with the existence of strong family ties in the Italian (see Reher, 1998; Dalla Zuanna, 2001; Giuliano, 2007), as well as in several other contemporary developed societies.[16] In this environment of family culture, parents may reasonably expect their kids to give them old-age support, for instance as in-kind, monetary transfers or co-residence.

We believe that our results are of general relevance for the study of fertility motives in developed societies, as they contribute to identify a clear negative impact of pension policy on fertility decisions. This is of particular relevance to the study of very-low and "lowest-low" fertility. If part of the fertility decline can be attributed to the diffusion of pension systems, the introduction of pension reforms that decrease the income prospects after retirement might contribute to a rise in fertility. Indeed, fertility in Italy had its minimum in 1996 and since then it is slowly rising. Further empirical evidence is needed on the contribution of the old-age security motive to total fertility in contemporary societies.

[16] According to a measure of the strength of family ties constructed by Alesina and Giuliano (2007), Italy ranks third among the OECD countries, after Mexico and Poland and followed closely by the US and Spain, while Germany and the Scandinavian countries have the weakest family ties.

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Appendix

Proof of Proposition 3.1

From equations 3.9 and 3.10, it follows that

$$n_t = \begin{cases} \frac{\rho}{1+\delta+\rho}\left[\frac{\left(\widehat{w}_t^F+\widehat{w}_t^M\right)R_{t+1}+\lambda_{t+1}^F w_t^F+\lambda_{t+1}^M w_t^M}{\left(\gamma+\phi\widehat{w}_t^F\right)R_{t+1}+\lambda_{t+1}^F\phi w_t^F}\right] & \text{if } e_t=0 \\ \frac{\rho(1+\mu)}{1+\delta+\rho}\left[\frac{\left(\widehat{w}_t^F+\widehat{w}_t^M\right)R_{t+1}+\lambda_{t+1}^F w_t^F+\lambda_{t+1}^M w_t^M}{\left(\gamma-\overline{w}_t+\phi\widehat{w}_t^F\right)R_{t+1}+\lambda_{t+1}^F\phi w_t^F}\right] & \text{if } e_t>0 \end{cases}$$

Notice from eq. 3.10 that $e_t > 0$ for $\overline{w}_t < \mu\left[\gamma+\phi\left(\widehat{w}_t^F+\frac{\lambda_{t+1}w_t^F}{R_{t+1}}\right)\right]$. First, it is straightforward to see that $\partial n_t/\partial\lambda_{t+1}^M > 0$. Moreover, simple algebra shows that

$$\frac{\partial n_t}{\partial\lambda_{t+1}^F} = \begin{cases} \frac{\rho}{1+\delta+\rho}\frac{w_t^F\left[\left(\gamma-\phi\widehat{w}_t^M\right)R_{t+1}-\phi\lambda_{t+1}^M w_t^F\right]}{\left[\left(\gamma+\phi\widehat{w}_t^F\right)R_{t+1}+\lambda_{t+1}^F\phi w_t^F\right]^2} & \text{if } e_t=0 \\ \frac{\rho(1+\mu)}{1+\delta+\rho}\frac{w_t^F\left[\left(\gamma-\overline{w}_t-\phi\widehat{w}_t^M\right)R_{t+1}-\phi\lambda_{t+1}^M w_t^F\right]}{\left[\left(\gamma-\overline{w}_t+\phi\widehat{w}_t^F\right)R_{t+1}+\lambda_{t+1}^F\phi w_t^F\right]^2} & \text{if } e_t>0 \end{cases}$$

Hence, $\frac{\partial n_t}{\partial\lambda_{t+1}^F} < 0$ for $\gamma-\phi\widehat{w}_t^M-\frac{\phi w_t^M\lambda_{t+1}^M}{R_{t+1}} < 0$ if $e_t=0$, and for $\gamma-\overline{w}_t-\phi\widehat{w}_t^M-\frac{\phi w_t^M\lambda_{t+1}^M}{R_{t+1}} < 0$ if $e_t > 0$.

Proof of Proposition 3.2

The maximization of the utility function at eq. 3.11 with respect to n_t and e_t, subject to the budget constraint at eq. 3.12, yields the following first order conditions

$$\begin{aligned} \frac{\rho_n}{n_t} &= \frac{\gamma+\overline{w}_t e_t}{C} \\ \frac{\mu\rho_h}{1+e_t} &= \frac{\theta+\overline{w}_t n_t}{C} \end{aligned}$$

which in an interior solution ($n_t > 0$ and $e_t > 0$) deliver the expression at eq. 3.13. Notice that $n_t > 0$ for $\theta > 0$ and $\mu\rho_h\left(\overline{w}_t e_t+\gamma\right) > \rho_n\overline{w}_t\left(1+e_t\right)$. Simple algebra shows that $\partial n_t/\partial e_t < 0$ if $\overline{w}_t > \gamma$. Using eq. 3.13, the former above FOC and the budget constraint at eq. 3.12, we have that

$$\frac{1+\rho_n}{\rho_n}\left(\gamma+e_t\overline{w}_t\right)\frac{\rho_n\theta\left(1+e_t\right)}{\mu\rho_h\left(\overline{w}_t e_t+\gamma\right)-\rho_n\overline{w}_t\left(1+e_t\right)}+\theta e_t =$$

$$=(1-\tau_t)(1-\sigma_t)\left[w_t^F+w_t^M\right]+\frac{\left[\lambda_{t+1}^F w_t^F+\lambda_{t+1}^M w_t^M\right]}{R}.$$

Differenciating the above expression for e_t and λ_{t+1}^{j}, with $j = F, M$, after some tedious algebra we have that a sufficient condition for $de_t/d\lambda_{t+1}^{j} > 0$ is that $\frac{\mu\rho_h}{\rho_n} > \frac{\overline{w}_t}{\gamma}$.

Proof of Proposition 3.3

For "Parents and Savers" couples, the arbitrage condition at eq.3.19 holds with equality. Using this equation and the first order conditions as equations 3.15, 3.16, and 3.17, we have that

$$I_t = n_t\left(\gamma + \phi\widehat{w}_t\right) + s_t = \frac{\rho\left(1+\mu\right)}{1+\delta+\rho}\left(\widehat{w}_t + \frac{s_{t-1}R_t + P_t^F + P_t^M}{n_{t-1}}\right) - \frac{\left(1+\mu\right)\left(\lambda_{t+1}^{M}w_t^M + \lambda_{t+1}^{F}w_t^F\right)}{1+\delta+\rho}.$$

From the equation above and from eq.3.19, it is straightforward to see that (i) $\frac{\partial I_t}{\partial\lambda_{t+1}^{F}} < 0$ and $\frac{\partial I_t}{\partial\lambda_{t+1}^{M}} < 0$, so that a reduction in λ_{t+1}^{j} increases the total investment, I_t, (ii) $\frac{\partial R_{t+1}^{f}}{\partial\lambda_{t+1}^{F}} < 0$, so that a reduction in λ_{t+1}^{F} increases fertility, but $\frac{\partial R_{t+1}^{f}}{\partial\lambda_{t+1}^{M}} = 0$

Figure 1. Main changes in the Italian pension system during the reforms.

	Pre-1993 regime	1992 reform	1995 reform
Normal retirement age	60 (men) 55(women)	65 (men) 60(women)	Any age after 56 (for both men and women)
Transitional period		Until about 2032	Until about 2035
Pensionable earnings	Average of last 5 years real earnings (converted to real values through price index)	Career average earnings (converted to real values through price index + 1%)	Career contributions (capitalized using a 5-year moving average of GDP growth rate)
Pension benefit	2%*(pensionable earnings)*(t), where t is years of tax payments (at most 40)	2%*(pensionable earnings)*(t), where t is years of tax payments (at most 40)	Proportional to capitalized value of career contributions, the proportionality factor increasing with age at retirement (from .04720 at age 57 to .06136 at age 65)
Pension indexation	Cost of living plus real earnings growth	Cost of living	Cost of living
Pension to survivor	60% to spouse 20% to each child 40% to each child (if no spouse)	Same	Same
Years of contributions for eligibility	15	20	5
Early retirement provision	Any age if contributed to SS for 35 years or more, no actuarial adjustment	Any age if contributed to SS for 35 years or more, no actuarial adjustment	No early retirement provision
Total Payroll tax	24.5% of gross earnings	27.17% of gross earnings	32.7% of gross earnings

Figure 2. Total fertility rates (average number of children) in four European countries: 1970-2006. Source: Eurostat.

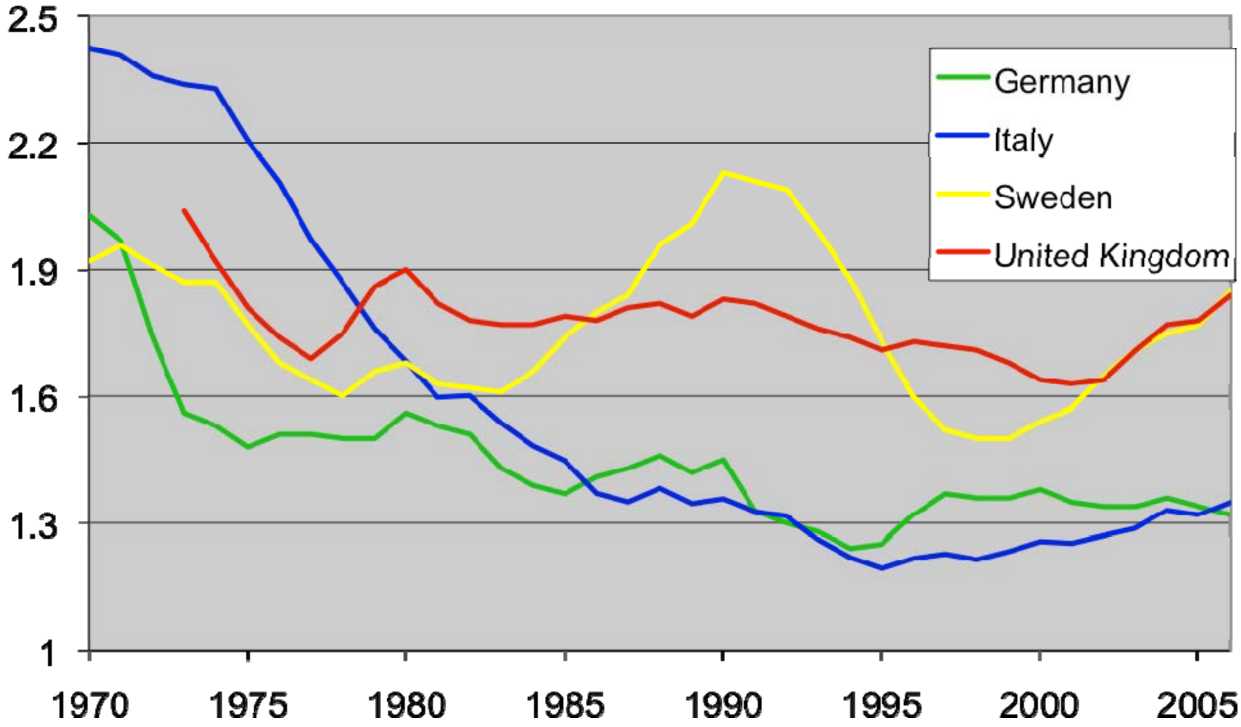


Figure 3. Time dedicated to the surveillance of children. Kernel density estimate of the distribution of the ratio between wives' and husbands' time. Source: own estimation on 2003 ISTAT time use survey.

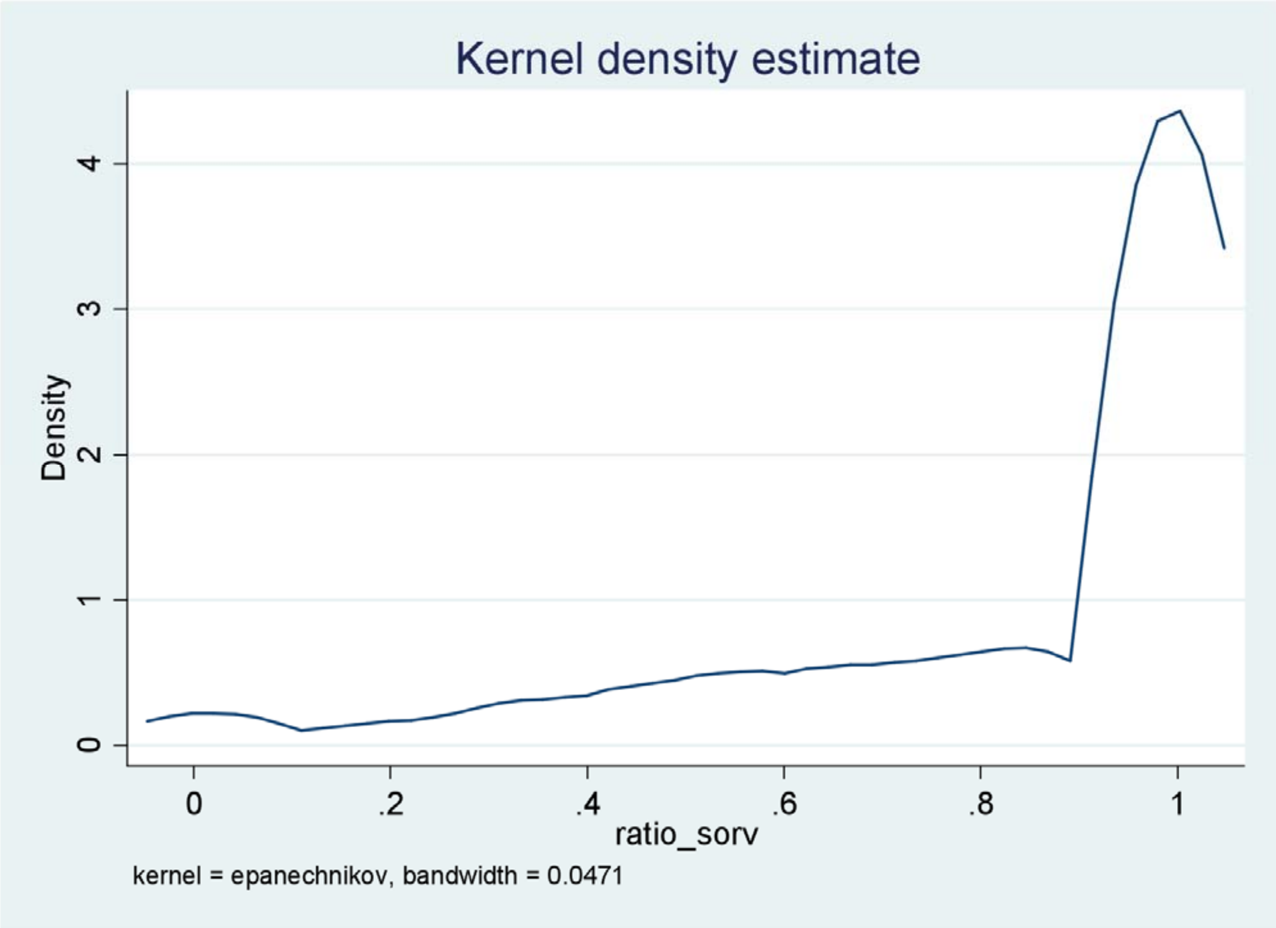


Figure 4. Total fertility rates (average number of children) at ages 30 and above in four European countries: 1970-2006. Source: Eurostat.

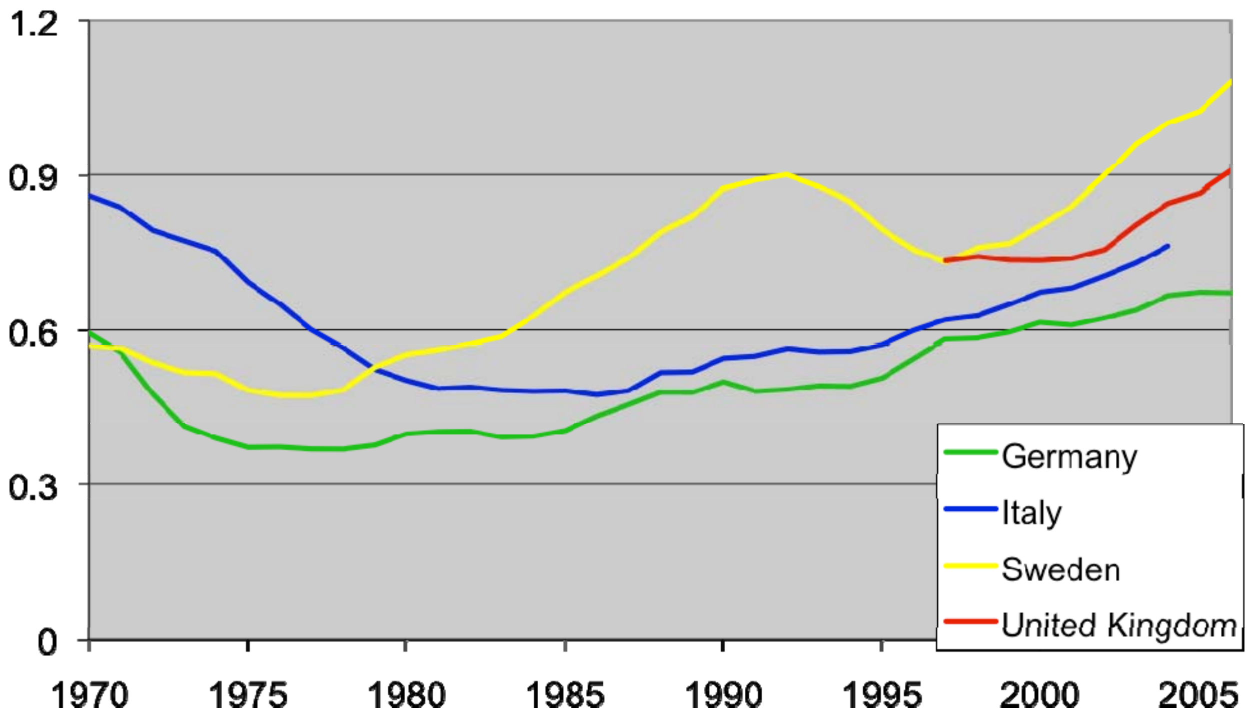


Figure 5. Mean number of children before 1993 (upper panel) and 1993 onwards (lower panel) by years of contribution at the end of 1992. Husbands affected by the reform to the left (up to 14 years), individuals unaffected by the reform to the right (15 years and over). Marks are empirical means, lines represent nonparametric smoothed values (3-values moving average up to the discontinuity point.

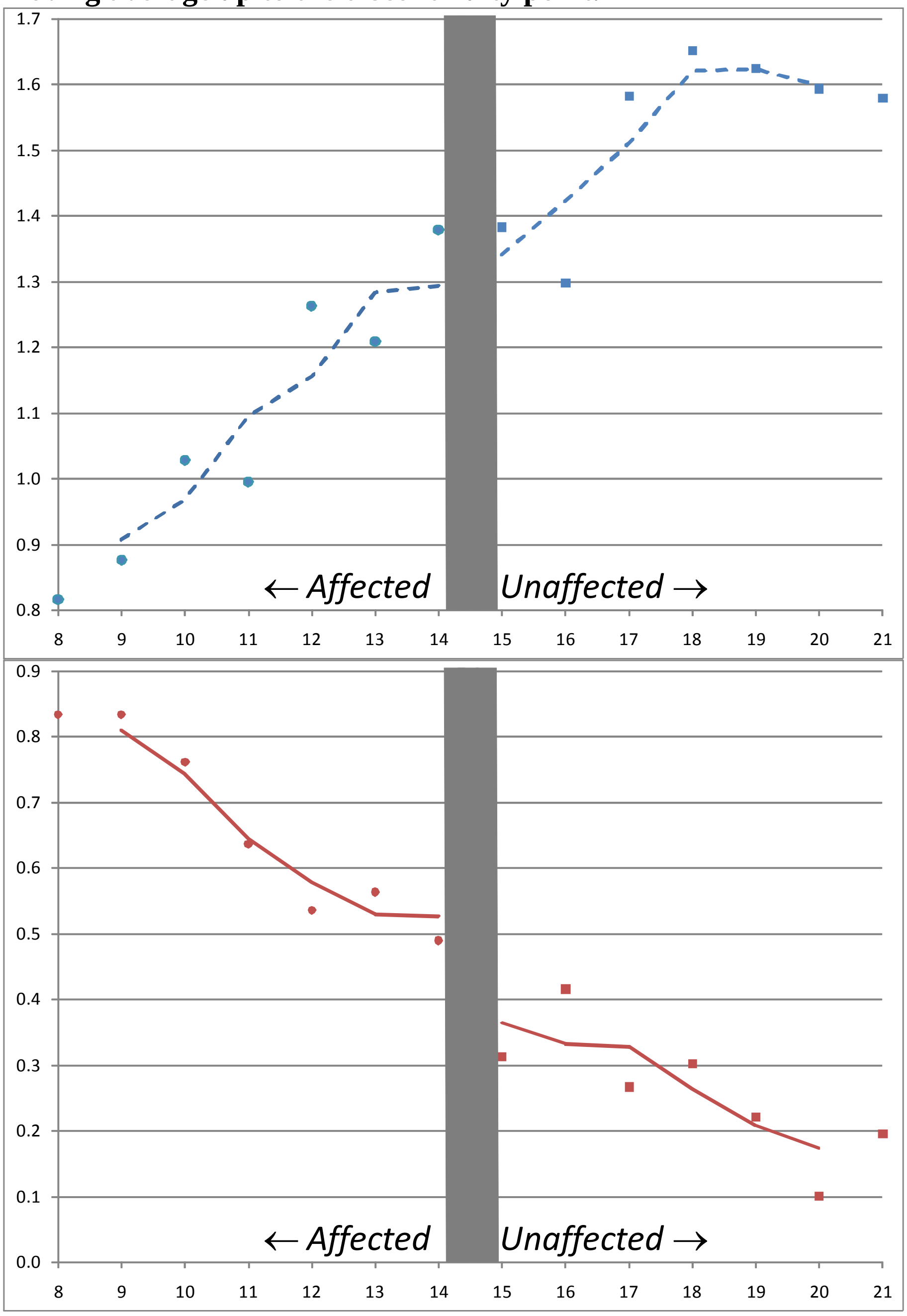
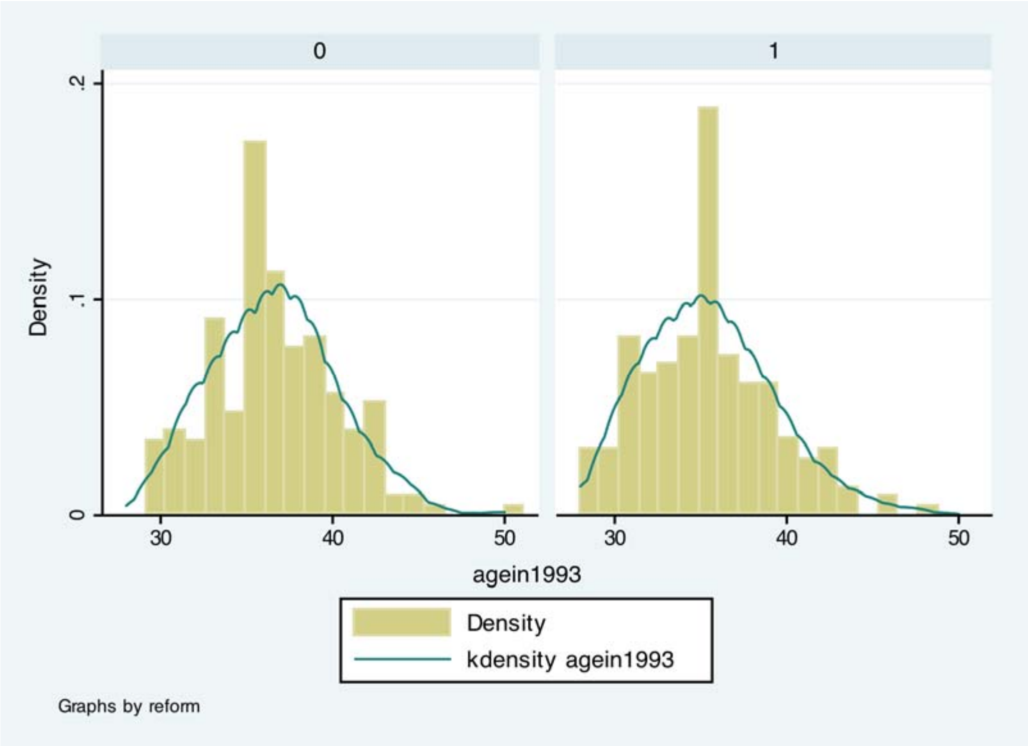
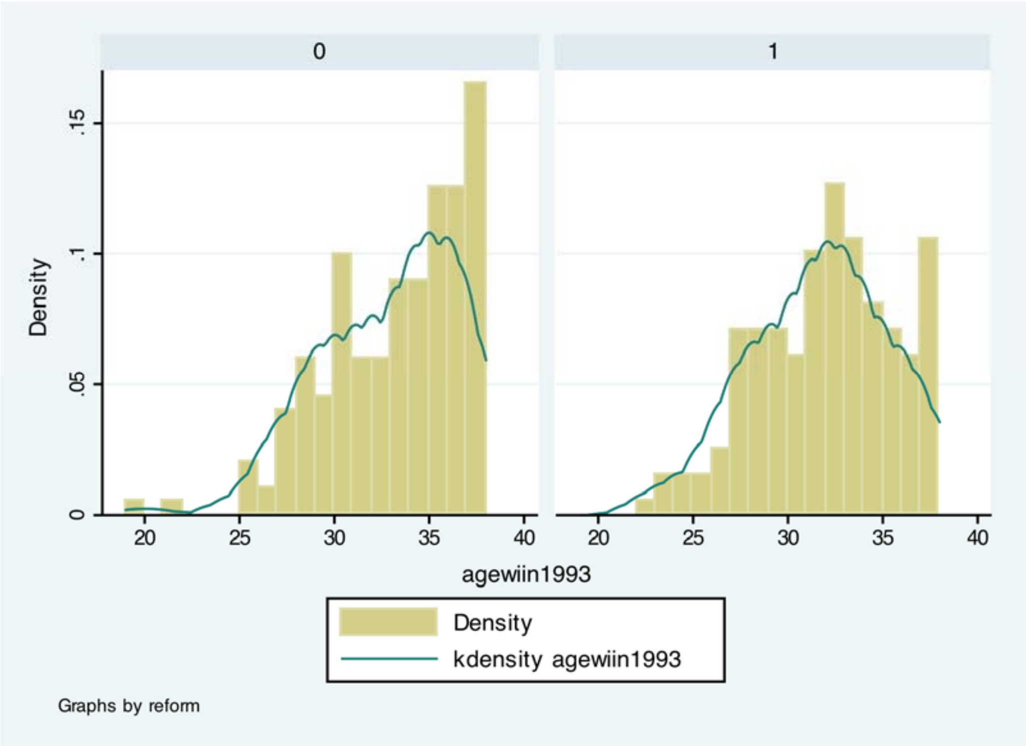


Figure 6. Age distribution in 1993 for husbands unaffected and affected by the reforms. Window: +/- 1 year of contributions around the reforms' thresholds. Wives born 1955 or after.



Mean age in 1993 for N=200 unaffected husbands is 36.62 years, for N=198 affected husbands is 35.45 years. The difference is statistically significant at the 1% level (t-test).

Figure 7. Age distribution in 1993 for wives whose husbands have been unaffected and affected by the reforms. Window: +/- 1 year of contributions around the reforms' thresholds for husbands. Wives born 1955 or after.



Mean wife's age in 1993 for N=200 with unaffected husbands is 32.91 years, for N=198 with affected husbands is 31.67 years. The difference is statistically significant at the 1% level (t-test).

Table 1. Differences between husbands who are affected and unaffected by the reforms. +/- 1 year-window around the reforms' thresholds.

	Unaffected (up to - 1 year)	Affected (up to +1 year)
Number of children (up to 1993)	1.3850	1.3788
	(0.0746)	(0.0802)
Number of children (after 1993)	0.3050	0.4899***
	(0.0414)	(0.0468)
Total number of children (up to 2006)	1.6900	1.8687*
	(0.0670)	(0.0772)
N	*200*	*198*

Standard errors in parentheses.
*Significance levels on the 2-tail t-test on the hypothesis of difference between the affected and the unaffected: * significant at 10%; ** significant at 5%; *** significant at 1%*
Source: own analyses on Bank of Italy's Survey on Household Income and Wealth (joint dataset waves 1998, 2000, 2002, 2004, 2006).

Table 2. Descriptive statistics for variables used in subsequent analyses. Window: +/- 7 years of contributions around the reforms' thresholds for husbands. Wives born 1955 or after.

	Mean	s.d.
Reform (dummy)	0.5965	
Wife's reform (dummy)	0.9289	
Number of children (up to 1993)	1.2522	1.0260
Number of children (after 1993)	0.5089	0.7338
Education (husband, years)	10.4411	3.4473
Education (wife, years)	10.6971	3.4377
Age at interview (husband)	45.6997	5.4437
Age at interview (wife)	41.6651	5.1768
Center as area of birth (dummy)	.1803	
South as area of birth (dummy)	.3882	
Survey year 1998 (dummy)	.0384	
Survey year 2000 (dummy)	.2086	
Survey year 2002 (dummy)	.2198	
Survey year 2004 (dummy)	.1907	
N	2675	

Source: own analyses on Bank of Italy's Survey on Household Income and Wealth (joint dataset waves 1998, 2000, 2002, 2004, 2006).

Table 3. Effect of pension reforms on post-reform fertility (total number of children or probability of having at least an additional child). Window: +/- 7 years of contributions around the reforms' thresholds for husbands. Wives born 1955 or after.

	(1)	(2)	(3)	(4)
	OLS Model 1	OLS Model 2	Probit Model 1 (marginal effect)	Probit Model 2 (marginal effect)
Reform	0.0542*	0.0487*	0.0714***	0.0646***
	(0.0287)	(0.0289)	(0.0248)	(0.0250)
Wife's reform		0.0749		0.0966**
		(0.0496)		(0.0442)
Education (husband)	0.00413	0.00432	0.00472	0.00497
	(0.00437)	(0.00437)	(0.00391)	(0.00391)
Education (wife)	0.0169***	0.0165***	0.0161***	0.0155***
	(0.00428)	(0.00429)	(0.00378)	(0.00378)
Center	-0.00391	-0.00660	0.0286	0.0262
	(0.0339)	(0.0340)	(0.0300)	(0.0300)
South	0.105***	0.100***	0.0833***	0.0776***
	(0.0287)	(0.0289)	(0.0254)	(0.0255)
Year 1998	-0.736***	-0.728***	-0.342***	-0.340***
	(0.0730)	(0.0731)	(0.0168)	(0.0172)
Year 2000	-0.457***	-0.450***	-0.292***	-0.287***
	(0.0413)	(0.0415)	(0.0251)	(0.0255)
Year 2002	-0.321***	-0.317***	-0.215***	-0.211***
	(0.0369)	(0.0370)	(0.0259)	(0.0261)
Year 2004	-0.147***	-0.145***	-0.101***	-0.0992***
	(0.0361)	(0.0361)	(0.0284)	(0.0284)
Number of children (up to 1993)	-0.175***	-0.176***	-0.131***	-0.132***
	(0.0141)	(0.0141)	(0.0127)	(0.0127)
Age fixed effects (husband)	YES	YES	YES	YES
Age fixed effects (wife)	YES	YES	YES	YES
N	2675	2675	2652	2652
R-squared	0.321	0.321		
Observed P			0.3839	0.3839

*Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 4. Marginal effect of pension reforms on the annual probability of having an additional child (discrete-time probit event-history model on persons-years). Window: +/- 7 years of contributions around the reforms' thresholds for husbands. Wives born 1955 or after.

	Person-period Probit Model 1	Person-period Probit Model 2
Reform	0.00672**	0.00618**
	(0.00286)	(0.00288)
Wife's reform		0.00790
		(0.00518)
Education (husband)	0.000513	0.000526
	(0.000428)	(0.000427)
Education (wife)	0.00155***	0.00151***
	(0.000402)	(0.000402)
Center	0.00980***	0.00941***
	(0.00285)	(0.00285)
South	0.00264	0.00244
	(0.00326)	(0.00325)
Number of children (up to 1993)	-0.0144***	-0.0145***
	(0.00147)	(0.00147)
Age fixed effects (husband, time-varying)	YES	YES
Age fixed effects (wife, time-varying)	YES	YES
Year fixed effects (husband, time-varying)	YES	YES
Year fixed effects (wife, time-varying)	YES	YES
N (persons-years)	19708	19708
Observed P	0.0521	0.0521

*Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 5. Marginal effect of pension reforms on the annual probability of having an additional child (discrete-time probit event-history model on persons-years) (varying window around the reforms' thresholds for husbands, wives born 1955 or after).

	(1) window: +/- 7 years	(2) window: +/- 3 years	(3) window: +/- 1 year
Reform	0.00672**	0.00662*	0.0170**
	(0.00286)	(0.00341)	(0.00726)
N (persons-years)	19708	9150	2447
Observed P	0.0521	0.0483	0.0527

*Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%*
Source: own analyses on Bank of Italy's Survey on Household Income and Wealth (joint dataset waves 1998, 2000, 2002, 2004, 2006, persons-years reconstruction).
Same control variables as for the models in Table 4.

Table 6. Marginal effect of pension reforms on the annual probability of having an additional child (discrete-time probit event-history model on persons-years). Placebo test (one-year window around different contribution thresholds for husbands, wives born 1955 or after).

	(1) "Younger" placebo (window: +/- 1 year)	(2) Real reform (window: +/- 1 year)	(3) "Older" placebo (window: +/- 1 year)
Reform	-0.0096 (0.0118)	0.0170** (0.00726)	0.0043 (0.0049)
N (persons-years)	2197	2447	1137
Observed P	0.0992	0.0527	0.0237

Standard errors in parentheses
** significant at 10%; ** significant at 5%; *** significant at 1%*
Source: own analyses on Bank of Italy's Survey on Household Income and Wealth (joint dataset waves 1998, 2000, 2002, 2004, persons-years reconstruction).
Same control variables as for the models in Table 4. The "Younger" placebo model estimates the effect of a discontinuity around 10 years of contributions in 1992, with a window of +/- 1 year around the discontinuity. The "Older" placebo model estimates the effect of a discontinuity around 20 years of contributions in 1992, with a window of +/- 1 year around the discontinuity.