What explains fertility? Evidence from Italian pension reforms

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Why kids today?

We simply consider two *economic* motives for childbearing

- **Old-age security** Have kids because you expect them to take care of you in your old age. Usually confined to pre-transitional societies, in absence of capital markets, and public pension systems (Leibenstein, 1957; Caldwell, 1978; Boldrin and Jones, 2002).

- **Children as consumption goods.** Have kids, cause you like them. Seminal paper Becker and Barro, 1988. Standard assumption for developed countries today; also embedded in family policy thinking.

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Aim of the paper

To test these two alternative theories of fertility

Use the different implications of social security on fertility provided by these two theories:

- **Old-age security** Higher pension benefits induce lower fertility
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Take advantage of a natural experiment: the Amato and Dini social security reforms, which introduced a discontinuity in the effect of the reform

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Related Literature


### Amato and Dini Pension Reforms: Details 1

<table>
<thead>
<tr>
<th></th>
<th>Pre-1993 regime</th>
<th>1992 reform</th>
<th>1995 reform</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal retirement age</strong></td>
<td>60 (men)</td>
<td>65 (men)</td>
<td>Any age after 56 (for both men and women)</td>
</tr>
<tr>
<td></td>
<td>55 (women)</td>
<td>60 (women)</td>
<td></td>
</tr>
<tr>
<td><strong>Transitional period</strong></td>
<td></td>
<td>Until about 2032</td>
<td>Until about 2035</td>
</tr>
<tr>
<td><strong>Pensionable earnings</strong></td>
<td>Average of last 5 years</td>
<td>Career average earnings</td>
<td>Career contributions (capitalized using a 5-year moving average of GDP growth rate)</td>
</tr>
<tr>
<td></td>
<td>real earnings (converted to real values through price index)</td>
<td>(converted to real values through price index + 1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Pension benefit</strong></td>
<td>2%<em>(pensionable earnings)</em>(t), where t is years of tax payments (at most 40)</td>
<td>2%<em>(pensionable earnings)</em>(t), where t is years of tax payments (at most 40)</td>
<td>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)</td>
</tr>
</tbody>
</table>

Amato and Dini Pension Reforms: Details 2

<table>
<thead>
<tr>
<th>Pension indexation</th>
<th>Cost of living plus real earnings growth</th>
<th>Cost of living</th>
<th>Cost of living</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pension to survivor</td>
<td>60% to spouse</td>
<td>Same</td>
<td>Same</td>
</tr>
<tr>
<td></td>
<td>20% to each child</td>
<td>20% to each child</td>
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</tr>
<tr>
<td></td>
<td>40% to each child (if no spouse)</td>
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<tr>
<td>Years of contributions</td>
<td>15</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>for eligibility</td>
<td>Any age if contributed to SS for 35 years or more, no actuarial adjustment</td>
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<td>No early retirement provision</td>
</tr>
<tr>
<td>Early retirement provision</td>
<td>24.5% of gross earnings</td>
<td>27.17% of gross earnings</td>
<td>32.7% of gross earnings</td>
</tr>
</tbody>
</table>

Reforms: Differential Impact

Attanasio Brugiavini (2002): Reduction in social security wealth
- Private Employees. Born 1957-: -27.6, 1945-57: -17

Bottazzi et al. (2006): Reduction in replacement rate (ratio of pension to average wage) for employees retiring at 60 years old:
- Private Sector. 67.3 to Senior: 66.3, Middle: 58.2, Young: 54.9
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Pension Reforms: An example of the differential effect

Consider two workers in the private sector with high school degree entering the labor market at age 20 with the same labor earning profile.

Mr Old born in 1957 has 15 years of contribution in 1992

Mr Young born in 1958 has 14 years of contribution in 1992

Both retire at age 60 with 40 years of contributions.

Mr Old retires in 2017 with pension benefits calculated according to the old rules. Replacement rate around 80.

Mr Young retires in 2018 with pension benefits calculated for 1/3 (14/40) according to the old rules and 2/3 (26/40) to the new rules. After both reforms, the replacement rate would drop to around 65.

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Pension Reforms: Crucial Aspects

Although people were expecting some reform measures, the threshold was clearly not known before.

Both reforms introduced a clear and sizable discontinuity in the social security wealth reduction.

We exploit this discontinuity as a natural experiment for the study of childbearing motives.

People in the treated and control groups are well into their fertility decision period, particularly in Italy.
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Two Models of Fertility

Simple two-period OLG model in small open economy.

Individuals care about their youth and old age consumption, and about

- (i) the wellbeing of their parents; or
- (ii) the utility of their kids

Budget Constraints

\[ C_t^t + \gamma f_t + s_t + d_t = w_t (1 - \tau_t)(1 - \sigma_t) + b_t = y_t + b_t \]
\[ C_{t+1}^t + b_{t+1} f_t = s_t R_{t+1} + d_{t+1} f_t + P_{t+1} \]

- Economic decisions in youth: savings, \( s_t \), fertility, \( f_t \), and transfers \( d_t \).
- Economic decisions in old age: parents-to-kids bequest \( b_t \).

Two groups of agents. Up to \( t \) identical, at \( t \) affected and unaffected individuals with \( P_{t+1}^A < P_{t+1}^U \).

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Kids as consumption good: the model

Individuals care about their own consumption, and about their kids utility:

\[(N_t)^\mu [U(c_t^t) + \beta U(c_{t+1}^t)] + (N_{t+1})^\mu [U(c_{t+1}^{t+1}) + \beta U(c_{t+2}^{t+1})] + ... \tag{1}\]

\[\sum_{t=0}^{\infty} \beta^t (N_t)^\mu [U(c_t^t) + \beta U(c_{t+1}^t)] \tag{2}\]

where \(N_{t+1} = N_t f_t\) and the instant utility is \(U(C_t^t) = (C_t^t)^\rho / \rho\).

Optimization problem compatible with two parametrizations:
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Savings:

\[(C_{t+1})^{\rho-1} = \beta R_{t+1} (C_t)^{\rho-1}\]

Fertility:

\[(\mu - \rho) (N_{t+1})^{\mu} \frac{(C_{t+1})^{\rho} + \beta (C_{t+2})^{\rho}}{\rho f_t} = (\gamma R_{t+1} + b_{t+1}) (N_t)^{\mu} (C_{t+1})^{\rho-1}\]

Bequest:

\[(N_{t+1})^{\mu} (C_{t+1})^{\rho-1} = f_t (N_t)^{\mu} (C_{t+1})^{\rho-1}\]

Predictions

- An expected reduction in \(P_{t+1}\) will reduce the fertility rate.
- Same predictions from models where number of kids enters directly the their parents utility function.

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Individuals care about their own consumption, and about their parents old age consumption:

\[ U(C_t^t) + \eta U(C_t^{t-1}) + \beta U(C_{t+1}^t). \]  

the instant utility is logarithmic

They choose savings, fertility and transfers in youth and form expectations about the transfer that they will receive from their kids in old age

Kids play cooperatively among themselves

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\[ U'(C_t) = \beta U'(C_{t+1}) \frac{\partial C_{t+1}}{\partial s_t} \]

Fertility:

\[ \gamma U'(C_t) = \beta U'(C_{t+1}) \frac{\partial C_{t+1}}{\partial f_t} \]

Transfers:

\[ U'(C_t) = \eta f_{t-1} U'(C_t^{-1}) \]

Expectations on transfers are crucial (for \( s \geq 0 \)):

\[ d_{t+1} = \frac{\eta}{1 + \eta} \left( y_{t+1} + \frac{P_{t+2}}{R_{t+2}} \right) - \frac{1 + \delta}{1 + \eta + \delta} \frac{R_{t+1} s_t + P_{t+1}}{f_t} \]

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Expectations on transfers are crucial (for \( s_i > 0 \)):

\[ d_{t+1} = \frac{\eta}{1 + \eta} \left( y_{t+1} + \frac{P_{t+2}}{R_{t+2}} \right) - \frac{1 + \delta}{1 + \eta + \delta} \frac{R_{t+1}s_t + P_{t+1}}{f_t} \]

Kids as investment good: the equilibrium

Arbitrage Condition:

\[ R_{t+1} = \frac{\eta}{\gamma \delta} \left( y_{t+1} + \frac{P_{t+2}}{R_{t+2}} \right) \]

Predictions

- A reduction in the expected pension benefits does not affect the arbitrage condition due to the kids adjusting their transfers according to their parents' wealth.

- If individuals were using both savings and fertility before learning about the reforms, they will continue to do so.

- But they will increase both fertility and asset holdings.

Kids as investment good: the equilibrium

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If empirical analyses suggest a reduction in the fertility of the affected, this is consistent with kids as consumption good (downward altruism as in Becker and Barro, 1988)

If empirical analyses suggest an increase in the fertility of the affected, this is consistent with kids as investment good (upward altruism as in Boldrin and Jones, 2002)
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If empirical analyses suggest an increase in the fertility of the affected, this is consistent with kids as investment good (upward altruism as in Boldrin and Jones, 2002).

Data Description


- Only couples married at surveys, wife born 1955+
- Date of birth of co-resident children (children live with parents who are not splitting up to age 14)
- Number of children ever born before 1993 available
- Numbers of years of contribution at survey, as a measure of exposure to reform (assuming continuous contributions; only men)

Late Fertility

Figure 3: Total fertility rates (only women aged 30+) in four European countries: 1970-2006

Empirical Strategy

- Description-analysis at the threshold

  - Regression (children ever born, probability of parity progression after the reform +1 year) dummy for discontinuity controls (previous number of children, educational attainment of husband and wife, survey year, geographical area of birth, age of husband and age of wife (both fixed effects))

  - Discrete-time event-history model on the progression to next parity with the same design age of husband and age of wife, period (year) as time-varying covariates, fixed effects

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

<table>
<thead>
<tr>
<th></th>
<th>Unaffected (up to -1 year)</th>
<th>Affected (up to +1 year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of children (up to 1993)</td>
<td>1.3831 (0.0742)</td>
<td>1.3788 (0.0802)</td>
</tr>
<tr>
<td>Number of children (after 1993)</td>
<td>0.3134 (0.0421)</td>
<td>0.4899*** (0.0468)</td>
</tr>
<tr>
<td>Number of children (up to 1996)</td>
<td>1.4627 (0.0730)</td>
<td>1.5101 (0.0800)</td>
</tr>
<tr>
<td>Number of children (after 1996)</td>
<td>0.2338 (0.0360)</td>
<td>0.3586** (0.0410)</td>
</tr>
<tr>
<td>Total number of children (up to 2006)</td>
<td>1.6965 (0.0699)</td>
<td>1.8687* (0.0772)</td>
</tr>
</tbody>
</table>

N 201 198

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%
Husbands by age

Age of husbands in 1993 for unaffected (mean=32.88 years) and affected (mean=31.67 years) by the reform (+/- 1 year window)***
Wives by age

Age of wives in 1993 for unaffected (mean=36.57 years) and affected (mean=35.45 years) by the reform (+/- 1 year window)***

## Results

<table>
<thead>
<tr>
<th></th>
<th>(1) OLS Amato+Dini Reform</th>
<th>(2) OLS Dini Reform only</th>
<th>(3) Probit Amato+Dini Reform (marginal effect)</th>
<th>(4) Probit Dini Reform only (marginal effect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reform</td>
<td>0.0529*</td>
<td>0.0329</td>
<td>0.0717***</td>
<td>0.0312</td>
</tr>
<tr>
<td></td>
<td>(0.0287)</td>
<td>(0.0253)</td>
<td>(0.0247)</td>
<td>(0.0227)</td>
</tr>
<tr>
<td>Education (husband)</td>
<td>0.00465</td>
<td>0.00392</td>
<td>0.00521</td>
<td>0.00365</td>
</tr>
<tr>
<td></td>
<td>(0.00437)</td>
<td>(0.00386)</td>
<td>(0.00391)</td>
<td>(0.00350)</td>
</tr>
<tr>
<td>Education (wife)</td>
<td>0.0166***</td>
<td>0.0158***</td>
<td>0.0159***</td>
<td>0.0173***</td>
</tr>
<tr>
<td></td>
<td>(0.00428)</td>
<td>(0.00377)</td>
<td>(0.00377)</td>
<td>(0.00332)</td>
</tr>
<tr>
<td>Center</td>
<td>-0.00184</td>
<td>0.00762</td>
<td>0.0318</td>
<td>0.0199</td>
</tr>
<tr>
<td></td>
<td>(0.0339)</td>
<td>(0.0299)</td>
<td>(0.0300)</td>
<td>(0.0267)</td>
</tr>
<tr>
<td>South</td>
<td>0.108***</td>
<td>0.0848***</td>
<td>0.0865***</td>
<td>0.0736***</td>
</tr>
<tr>
<td></td>
<td>(0.0286)</td>
<td>(0.0253)</td>
<td>(0.0253)</td>
<td>(0.0227)</td>
</tr>
<tr>
<td>Year 1998</td>
<td>-0.728***</td>
<td>-0.652***</td>
<td>-0.340***</td>
<td>-0.254***</td>
</tr>
<tr>
<td></td>
<td>(0.0726)</td>
<td>(0.0636)</td>
<td>(0.0174)</td>
<td>(0.0113)</td>
</tr>
<tr>
<td>Year 2000</td>
<td>-0.457***</td>
<td>-0.451***</td>
<td>-0.291***</td>
<td>-0.269***</td>
</tr>
<tr>
<td></td>
<td>(0.0412)</td>
<td>(0.0362)</td>
<td>(0.0251)</td>
<td>(0.0176)</td>
</tr>
<tr>
<td>Year 2002</td>
<td>-0.320***</td>
<td>-0.295***</td>
<td>-0.215***</td>
<td>-0.202***</td>
</tr>
<tr>
<td></td>
<td>(0.0369)</td>
<td>(0.0325)</td>
<td>(0.0259)</td>
<td>(0.0193)</td>
</tr>
<tr>
<td>Year 2004</td>
<td>-0.149***</td>
<td>-0.115***</td>
<td>-0.103***</td>
<td>-0.0825***</td>
</tr>
<tr>
<td></td>
<td>(0.0360)</td>
<td>(0.0317)</td>
<td>(0.0283)</td>
<td>(0.0233)</td>
</tr>
<tr>
<td>Number of children</td>
<td>-0.175***</td>
<td>-0.132***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(up to 1993)</td>
<td>(0.0141)</td>
<td>(0.0126)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of children</td>
<td></td>
<td>-0.134***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(up to 1996)</td>
<td></td>
<td>(0.0121)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.105</td>
<td>0.146</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.678)</td>
<td>(0.598)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age fixed effects</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>(husband)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age fixed effects</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>(wife)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>2684</td>
<td>2684</td>
<td>2661</td>
<td>2661</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.320</td>
<td>0.299</td>
<td>0.261</td>
<td>0.261</td>
</tr>
<tr>
<td>Observed P</td>
<td>0.3856</td>
<td>0.2996</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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, women born 1955 or after.**

## Event-History Results

<table>
<thead>
<tr>
<th>Person-period Probit Amato+Dini</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reform</strong></td>
</tr>
<tr>
<td>0.00664**</td>
</tr>
<tr>
<td>(0.00286)</td>
</tr>
<tr>
<td><strong>Education (husband)</strong></td>
</tr>
<tr>
<td>0.000583</td>
</tr>
<tr>
<td>(0.000427)</td>
</tr>
<tr>
<td><strong>Education (wife)</strong></td>
</tr>
<tr>
<td>0.00152***</td>
</tr>
<tr>
<td>(0.000402)</td>
</tr>
<tr>
<td><strong>Center</strong></td>
</tr>
<tr>
<td>0.0100***</td>
</tr>
<tr>
<td>(0.00285)</td>
</tr>
<tr>
<td><strong>South</strong></td>
</tr>
<tr>
<td>0.00291</td>
</tr>
<tr>
<td>(0.00328)</td>
</tr>
<tr>
<td><strong>Number of children (up to 1993)</strong></td>
</tr>
<tr>
<td>-0.0145***</td>
</tr>
<tr>
<td>(0.00147)</td>
</tr>
<tr>
<td><strong>Age fixed effects (husband, time-varying)</strong></td>
</tr>
<tr>
<td>YES</td>
</tr>
<tr>
<td><strong>Age fixed effects (wife, time-varying)</strong></td>
</tr>
<tr>
<td>YES</td>
</tr>
<tr>
<td><strong>Year fixed effects (husband, time-varying)</strong></td>
</tr>
<tr>
<td>YES</td>
</tr>
<tr>
<td><strong>Year fixed effects (wife, time-varying)</strong></td>
</tr>
<tr>
<td>YES</td>
</tr>
<tr>
<td><strong>N (persons-years)</strong></td>
</tr>
<tr>
<td>19760</td>
</tr>
<tr>
<td><strong>Observed P</strong></td>
</tr>
<tr>
<td>0.0522</td>
</tr>
</tbody>
</table>

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, women born 1955 or after.

### Results: robustness

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, women born 1955 or after).

<table>
<thead>
<tr>
<th></th>
<th>(1) window: +/- 7 years</th>
<th>(2) window: +/- 3 years</th>
<th>(3) window: +/- 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reform</td>
<td>0.00664** (0.00286)</td>
<td>0.00662* (0.00341)</td>
<td>0.0169** (0.00727)</td>
</tr>
<tr>
<td>N (persons-years)</td>
<td>19760</td>
<td>9153</td>
<td>2450</td>
</tr>
<tr>
<td>Observed P</td>
<td>0.0522</td>
<td>0.0485</td>
<td>0.0535</td>
</tr>
</tbody>
</table>

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Same control variables as for the models in Table 4.

Results: Placebo

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 (three-year window around the reforms’ thresholds, women born 1955 or after).

<table>
<thead>
<tr>
<th></th>
<th>(1) “Younger” placebo (window: +/- 1 year)</th>
<th>(2) Real reform (window: +/- 1 year)</th>
<th>(3) “Older” placebo (window: +/- 1 year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reform</td>
<td>-0.00850 (0.0118)</td>
<td>0.0169** (0.00727)</td>
<td>0.00426 (0.00482)</td>
</tr>
<tr>
<td>N (persons-years)</td>
<td>2198</td>
<td>2450</td>
<td>1147</td>
</tr>
<tr>
<td>Observed P</td>
<td>0.0996</td>
<td>0.0535</td>
<td>0.0235</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%
Conclusions

- Clear evidence of the prevalence of the old-age security motive
- Potential role in recent fertility increase/recuperation?
- Specific to strong ties societies (with high co-residence between parents and children?);
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